INVESTIGATING THE ADOPTION OF ENTERPRISE APPLICATION INTEGRATION IN HEALTHCARE ORGANISATIONS USING AN ACTOR-ORIENTED APPROACH

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PhD Abstract

This dissertation focuses on Enterprise Application Integration (EAI) adoption in healthcare organisations. EAI has emerged to support organisations overcoming their integration problems and it has been adopted by many organisations in various sectors. Despite its importance, the healthcare domain develops EAI solutions at a slower pace and it can be characterised as a laggard comparing to other sectors. The small number of EAI applications in healthcare has resulted in limited research in this area with many issues, like its adoption requiring further investigation. The normative literature analyses the factors that influence EAI adoption in healthcare (MAESTRO model) but it has not yet explored the role of actors during the adoption process. This dissertation makes a step forward and contributes to the body of knowledge as it: (a) highlights the role of healthcare actors and attitudes towards EAI adoption, (b) introduces an actor-oriented approach, (c) derives and proposes a structured method, named Individual, Group, Organisational, Human, Controllers, Acceptors, Providers, Supporters (IGOHcaps), to model how actors might be identified (structured because such a rationale is explicable and such a method is more readily usable when transferred to others), (d) identifies those actors involved in this process, by using the proposed IGOHcaps method and (e) combines the actor-oriented approach with the factors influencing EAI adoption. The author claims that such an approach is significant and novel as: (a) it extends established norms for EAI adoption, by incorporating an actor-oriented analysis and (b) the actors' differing views emerging could enable decision making bodies to produce more robust proposals for EAI adoption. The author discusses the application of this approach by using a qualitative, interpretive, multiple case study research strategy. Empirical data collected from two case organisations show that such an approach contributes towards more robust decisions for EAI adoption and indicates that it is acceptable by the organisations and the interviewees (actors), participated in this research. Despite these results can not be generalised, they can allow others to relate their views with the ones reported in this dissertation. This dissertation introduces tests and presents a novel approach and model for EAI adoption in healthcare and contributes to the body of knowledge by extending the literature.

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Research activity is collaborative in nature. The research presented in this dissertation is no exception and the support of a number of individuals is gratefully acknowledged. My thanks can be expressed in terms of supervision, financial, empirical, and emotional support.

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Στην οικογενειά μου

για την αμέριστη συμπαρασταση,

τη δύναμη και την αγάπη

που μου έδωσε και μου δίνει...

Declaration

This dissertation gives an account of the research undertaken by Vasiliki Mantzana. Some of the material displayed herein has already been published or is under review in the form of the following publications:

Journal Papers **Published or Accepted for Publication**

[3] **Mantzana, V.**, Themistocleous, M., Irani, Z. and Morabito, V. 2007. *'Identifying Healthcare Actors Involved in the Adoption of Information Systems'*, European Journal of Information Systems, **16**(1): In press.

[2] Themistocleous, M., **Mantzana, V.** and Morabito, V. 2006. *'Achieving Knowledge Management Integration through EAI: A Case Study from Healthcare Sector'*, International Journal of Technology Management, In Press.

[1] **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): 265-278.

Journal Papers **Under Review**

[2] **Mantzana, V.**, Themistocleous, M., Irani, Z. and Khoumbati, K. 2006. *'Factors and Actors Affecting the EAI Adoption in Healthcare Organisations'*, Communications of the Association for Information Systems, **Resubmission**.

[1] Khoumbati, K., Themistocleous, M., Irani, Z. and **Mantzana, V.** 2006. *'Factors Affecting the EAI Adoption in Healthcare Organisations'*, Communications of the Association for Information Systems, **Resubmission**.

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[4] **Mantzana, V.** and Themistocleous, M. 2006. *'Method for the Identification of Actors Involved in the Adoption of Innovations in Healthcare Organizations'*, In Sprague, R. J. (Eds), Proceedings of Thirty-Nineth Annual Hawaii International Conference on System Sciences, (Hicss 39), Kauai, Hawaii, USA, IEEE Computer Society, Los Alamitos, California, USA., [CD-Proceedings], January 4-7.

[3] **Mantzana, V.** and Themistocleous, M. 2005. *'Conceptualizing an Actor-Oriented Approach for Healthcare Systems Integration'* Proceedings of Eleventh American Conference on Information Systems (AMCIS), Omaha Nebraska, USA, [CD Proceedings], August 11-14.

[2] **Mantzana, V.** and Themistocleous, M. 2005. *'Towards A Conceptual Framework of Actors and Factors Affecting the EAI Adoption In Healthcare Organisations'*, Proceedings of 13th European Conference on Information Systems, Regensburg, Germany. [CD Proceedings], May 26-28.

[1] **Mantzana, V.** 2005. *'Investigating and evaluating the integration of health information systems using an actor-oriented approach'*, 13th European Conference on Information Systems, Doctoral Consortium, Regensburg, Germany. May 23-26.

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CHAPTER 1

INTRODUCTION

Summary

The efforts undertaken by healthcare organisations to improve their services through Information Technology (IT) have resulted in the development of disparate and incompatible Healthcare Information Systems (HIS) (Howcroft and Mitev, 2000; Tai *et al.*, 2000). HIS heterogeneity is associated with medical errors that often cause problems to the delivery of health services. For instance, the medical errors that occur through the non-integrated nature of HIS are estimated to have resulted in the loss of 64 persons per day in United Kingdom (UK) (Khoumbati, 2005). In addition, due to the non-integrated nature of HIS, the information held within different care providers (e.g. acute hospitals, social care) can not be shared and made accessible to different healthcare organisations. In seeking to overcome such problems, healthcare organisations have realised that the integration of HIS can enhance the quality of care and services provided.

The need for integrating the disparate HIS has existed for long time now and one suitable solution to bridge them together is Enterprise Application Integration (EAI). EAI has emerged to support organisations overcoming their integration problems at both enterprise and cross-enterprise level and it has been adopted by many private and public organisations (Themistocleous and Irani, 2002). Despite its importance, the healthcare sector develops EAI solutions at a slower pace and it can be characterised as a laggard comparing to other sectors. The small number of EAI applications in healthcare has resulted in limited research in this area with many issues, such as the EAI adoption and actors' involvement, requiring further investigation. The research that has been published in this area has mainly focused on those factors that influence the decision making process associated with EAI adoption in healthcare (Khoumbati *et al.*, 2006). Nevertheless, the implications of HIS integration have yet to be assessed, leaving scope for timeliness and novel research.

In this dissertation, an actor-oriented approach is introduced as an extension to the normative literature on EAI adoption, which has focused on factors' identification. In doing so, the author seeks to: (a) highlight the role of healthcare actors and their attitudes towards EAI adoption, (b) identify healthcare actors involved in this process (adoption), (c) combine the suggested actor-oriented approach with the factors influencing EAI adoption and (d) highlight the factors that are important for each one of the different actors' identified. The proposed approach is significant and novel as it: (a) adds a new dimension to existing EAI adoption models by incorporating an actor-oriented analysis and (b) facilitates healthcare organisations in making robust decisions for EAI adoption.

This dissertation analyses the adoption of EAI in healthcare organisations, with this chapter introducing the research presented hereunder. The chapter begins by reporting the adoption of EAI by healthcare organisations, their increasing needs for awareness, the medical errors that occur and the healthcare actors' resistance to change. Section 1.1 briefly introduces the problem area and highlights the importance of EAI implementation and adoption in healthcare organisations, whereas Section 1.2 introduces Enterprise Application Integration. The aims and the objectives of the dissertation are defined in Section 1.3, with Section 1.4 providing an overview of the research methodology adopted in this research, and Section 1.5 presenting the outline of the dissertation.

1.1 Background to the Research Problem: Healthcare Information Systems and the need for Integration

Heeks *et al.*, (1999) and Westrup, (1998) reported that many healthcare information systems do not succeed, in terms of complete implementation; actual use; or cost effectiveness. Another criterion for HIS success is the quality of healthcare systems. According to Johnston *et al.*, (2003) the quality of HIS is affected by the amount of medical errors that are caused, due to the limitations of HIS.

Medical errors occur for many reasons, including the non-integrated nature of HIS and have been recognised as significant contributors to patient harm. The limitations of the healthcare systems are related to the loss of 64 persons per day in UK (Khoumbati, 2005). Based on the findings of other major studies, medical errors, are related to the loss of up to 98,000 human lives each year in USA (Kohn and Corrigan, 2000). To this end, it is

worth noting that the loss of human lives from medical errors is higher than the annual mortality from motor vehicle accidents (43,458), breast cancer (42,297), or AIDS (16,516) in USA.

Sutherland and Willem (2002) classified the medical errors into preventable and non-preventable and reported that they are the fourth leading cause of death in USA! According to Kohn and Corrigan (2000), the most common types of preventable errors are technical errors (44%), diagnosis (17%), failure to prevent injury (12%) and errors in the use of a drug (10%). The percentage of the technical errors is high, especially in technical surgical specialties such as vascular surgery, cardiac surgery, and neurosurgery. Leape *et al.*, (1995) illustrated that three out of four preventable errors in hospitals are caused by IS failure. In the same research it has been stated that the preventable errors could be reduced by the development and use of sophisticated and integrated applications. Medical records are basically paper-based and they can neither be accessed easily nor combined into an integrated form to present a clear and complete picture of patient care. *Therefore, there is a need for an integrated IT infrastructure that will support the information management and the provision of care.*

An important finding reported by Sutherland and Willem (2002) indicates that minimum levels of automation would reduce the percentage of human life loss by 50-80% in USA. As reported in the same study, the use of automated systems can reduce the deaths related to medication errors from 106,000 to less than 25,000. It has also been stated that by moving from a paper-based system to a digital system, which will be coordinated and integrated, the cost in administrative tasks will be dramatically decreased from $90 billion to $5 billion or less. The development and use of automated, integrated HIS will contribute to the improvement of the care provided, decrease administrative costs and reduce the percentages of human life loss (Sutherland and Willem, 2002).

Multiple researchers suggested that the development of a secure, flexible integrated healthcare IT infrastructure is of high importance (Lapointe *et al.*, 2002; Mass and Suomi, 2004; Wanless *et al.*, 2002). Moreover, it has been estimated that in UK the most frequently cited priorities for healthcare organisations is the implementation of integrated systems that will: (a) reduce medical errors and (b) increase patient's safety (HIMSS, 2004). An integrated IT infrastructure will provide effective links and enhanced communications between different parts of the service and beyond. In support of this,

Anyanwu *et al.*, (2002) suggested that *there is a need to integrate the disparate, heterogeneous HIS to improve the collaboration between different healthcare departments.*

In an attempt to integrate these systems many healthcare organisations have adopted integrated approaches, which are characterised either as integration standards, as integration projects or as internally integrated systems. In the field of integration standards are included the following: (a) Health Level 7 (HL7), (b) Electronic Data Interchange (EDI), (c) CEN/TC251 and (d) Digital Imaging Communications in Medicine and Common Object Broker Architecture in Medicine (DICOM). Although the integration efforts undertaken have provided significant benefits, they have not resulted in the development of an integrated IT infrastructure that efficiently automates and integrates healthcare processes and services (Bernd and Holena, 1997; Carr and Moore, 2003). The limitations of the heterogeneous and incompatible Healthcare Information Systems have motivated healthcare organisations to seek for more advanced integration technologies, such as Enterprise Application Integration (Khoumbati, 2005).

1.2 Enterprise Application Integration (EAI)

Enterprise Application Integration has emerged to piece together inter- and intra-organisational systems and combines a variety of integration technologies such as web services, message and process brokers (Linthicum, 1999). It aims at building an integration infrastructure by bridging existing heterogeneous and incompatible applications. Linthicum (2000) defined EAI as:

> "*Unrestricted sharing of information between two or more enterprise applications. A set of technologies that allow the movement and exchange of information between different application and business process within and between organisations*"
>
> Linthicum (2000, p.354)

Lam (2005b) reported that EAI adoption and implementations differ from the traditional IS projects, as EAI: (a) refers to the integration of existing IS rather than the development of new, (b) affects multiple IS and users in organisations, (c) involves different actors'

groups and (d) lacks of established development methodologies. Thus, it is important to understand and analyse these issues before adopting an EAI solution.

Regarding the last issue, a software engineering methodology was published by Themistocleous and Irani, (2006) that explains the main stages of EAI implementation. Themistocleous' and Irani, (2006) methodology describes the development of EAI solutions to be a lengthy procedure that consists of eight descriptive stages, namely: (a) Planning, (b) Scenarios Building and Evaluation, (c) Business Process Reengineering, (d) Systems Restructuring, (e) Requirements Analysis, (f) Filling the Gap with New Systems Development, (g) Integration and Testing and (h) Operation and Maintenance (Themistocleous and Irani, 2006). This dissertation focuses on the first stage (Planning), which is related to the EAI adoption. During this stage, organisations measure the possible impact of EAI solutions and make decisions regarding the adoption and implementation of the EAI project. Also, the study of this stage will contribute in understanding the issues mentioned above, such as: (a) EAI adoption affects multiple systems and users and (b) EAI adoption involves different actors' groups that have different views and reactions.

1.3 Research Aim and Objectives

1.3.1 Research Aim

The adoption of Enterprise Application Integration in healthcare organisations is a critical process, and different issues (factors, actors etc) need to be considered. Themistocleous (2004) has studied the adoption of EAI in multinational organisations, proposed and validated a model that explains influential factors such as: (a) costs, (b) barriers and (c) benefits. The model proposed by Themistocleous (2002), has been extended and adapted in the area of healthcare by Khoumbati *et al., (2006)*. The latter suggested that other factors like medical should be considered during the decision-making for EAI adoption in healthcare and proposed a model, namely MAESTRO.

It appears that MAESTRO model is based on a factor-oriented approach, which has difficulties to support the IS adoption (Kautz and Henriksen, 2002), as underestimates the significant role of the various actors influencing this process. Moreover, it has been

reported that multiple barriers, such as: (a) culture, (b) politics, (c) lack of knowledge or awareness and (d) resistance to change, increase the risk and hold back the adoption of EAI (Themistocleous, 2004). Thus, these barriers and limitations of MAESTRO model should be considered and addressed when deploying EAI solutions.

In doing so, the author suggests that *a better awareness and communication between the various actors and management will reduce the risk caused by these barriers (e.g. level of resistance to change) and therefore it will contribute towards the adoption of EAI.* Among others, attention should be given to the factors' realisation since the various healthcare actors can better understand them and thus resist less to the EAI adoption.

Hence, the aim of this dissertation is to:

> *Investigate the adoption of Enterprise Application Integration in healthcare organisations, by extending the established norms, using an actor-oriented approach. In doing so, resulting in the development of an emergent model that can be used to support decision-making.*

1.3.2 Research Objectives

To reflect upon this aim of this project, a number of specific objectives, which will be analysed hereunder, should be achieved:

Objective 1: To conduct a literature review in the area of HIS integration and the issues related to the adoption of Enterprise Application Integration in healthcare organisations.

Objective 2: To critically evaluate literature that is relevant to EAI adoption in healthcare organisations. In doing so, it will identify issues for research regarding the EAI adoption for further investigation.

Objective 3: To study relevant models of the EAI adoption in healthcare organisations. Therefore, it will develop a conceptual model for the EAI

adoption. The latter might be used as a decision-making tool by healthcare organisations.

Objective 4: To test and evaluate the proposed conceptual model, within a case-based setting.

Objective 5: To extrapolate conclusions and provide a novel contribution to the domain of healthcare organisations and EAI.

1.4 Introduction to Research Methodology

To understand the multiple actors involved in EAI adoption, the author justified the selection of a qualitative research methodology. As the adoption of EAI is a relatively new research area, qualitative research appears to be more appropriate to support a deeper understanding of this phenomenon. Moreover, the underlying research epistemology of this research is interpretive. This is appropriate for the research context under investigation, due to the complex and interrelated nature of the proposed issues under the research of EAI adoption in healthcare organisations. It appears that the EAI adoption in healthcare organisations can not be distinguished from its organisational, technical and social context. Therefore, an interpretive approach for the analysis of the research findings was considered as more appropriate (Walsham, 1995).

Moreover, a multiple case study research strategy was deployed for this dissertation, as it can offer a 'holistic' view of the processes involved, as well as a realisation of the topic under research (Zmud *et al.,* 1989). Case studies are gaining importance in IS research, and have a dominant part in the research methods used in the IS field (Orlikowski and Baroudi, 1991). More details regarding the research methodology and design are provided in Chapter 4.

1.5 Dissertation Outline

The structure of this dissertation is based on the methodology described by Philips and Pugh (1994). This methodology consists of four elements, namely: (a) background theory, (b) focal theory, (c) data theory and (d) novel contribution. The background theory refers to the literature review, which is conducted to support the identification of the problem domain (Chapter 2). The focal theory is related to the generation of the conceptual model and the research issues (Chapter 3). The third element (data theory) consists of the research design, the data collection methods, the description of the data analysis process and the revised conceptual method and model (Chapters 4, 5 and 6). The fourth element, which is the novel contribution of the dissertation, is presented with conclusions of this research in Chapter 7.

In the following paragraphs, the structure of the dissertation is displayed (Figure 1.1) and the content of each chapter is summarised.

Chapter 1: Introduction

Chapter 1 introduces the research presented in this dissertation and explains the research problem. As a result, the need for integration in the healthcare sector is analysed and Enterprise Application Integration is presented as an appropriate technology to integrate HIS. Moreover, the research aims and objectives of this research are presented in Section 1.3 and the dissertation's outline is explained and displayed diagrammatically.

Chapter 2: Literature Review – Background Theory

In the second chapter, a review of the normative literature is provided. More specifically, the issues related to the Healthcare Information Systems and the prerequisite for integration in the healthcare sector are explained. Moreover, the established norms for the adoption of EAI (MAESTRO model) is presented in Figure 2.5, analysed and discussed. Furthermore, the main limitation of the existing model is identified and highlighted and propositions are made. Chapter 2, addresses the Objectives 1 and 2, reported in Section 1.3.2

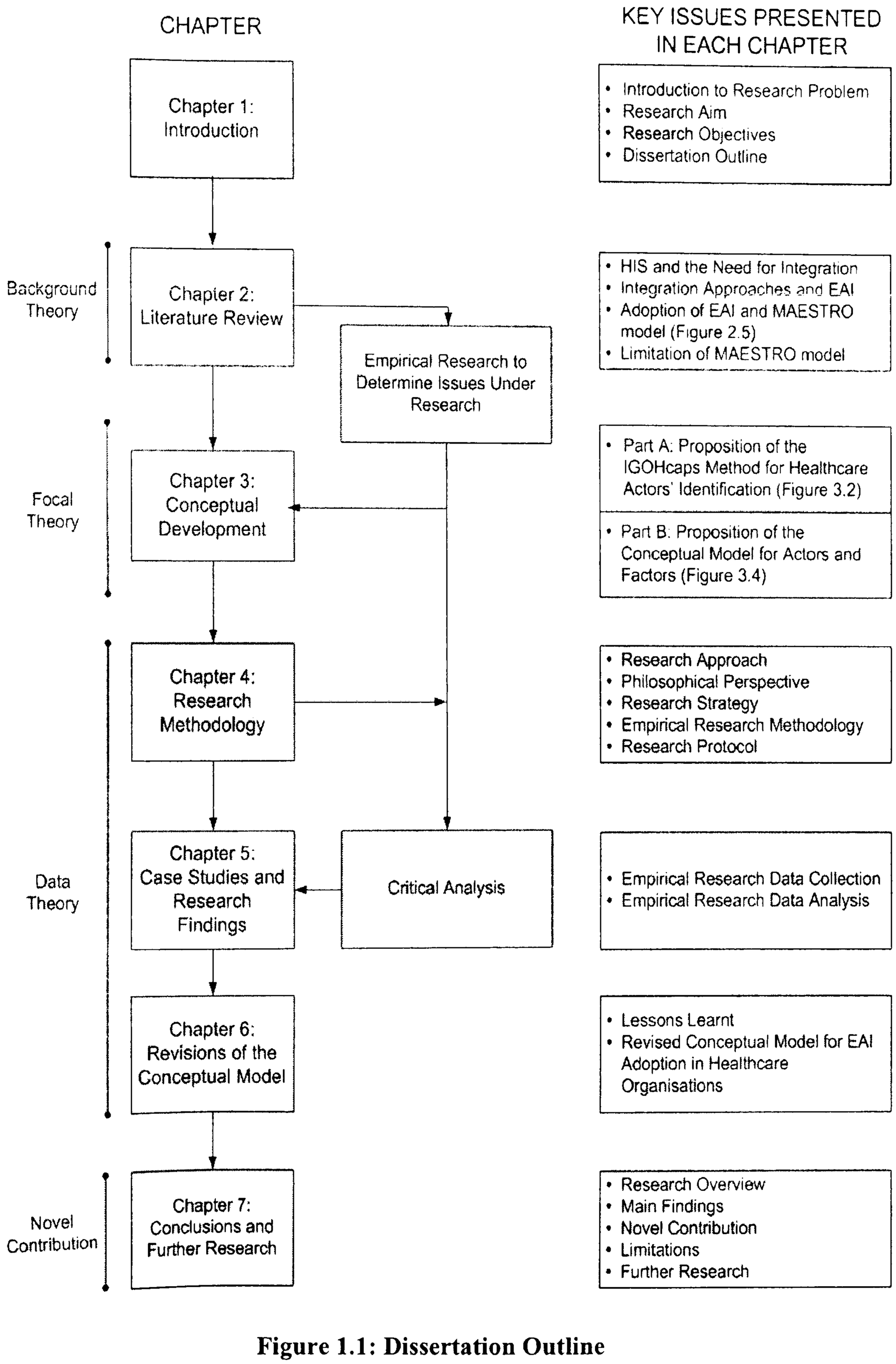

Figure 1.1: Dissertation Outline

Chapter 3: Conceptual Development – Focal Theory

In achieving the objective 3 of this dissertation, the author divides Chapter 3 in the following interconnected sections:

In Section 3.2, the author analyses the role of healthcare actors during the EAI adoption, based on the main limitation of MAESTRO model (Khoumbati, 2005) identified and discussed in Chapter 2.

In Section 3.3 (Part A of the conceptual development), the author introduces an actor-oriented approach, defines healthcare actors and proposes a method for their (healthcare actors) identification that should be considered during the EAI adoption in healthcare organisations. The proposed method, named IGOHcaps *(Individual, Group, Organisational, Human, Controllers, Acceptors, Providers, Supporters)*, increases the level of the analysis and contributes towards a more detailed and systematic study of the adoption of IS in healthcare sector.

In Section 3.4, the author presents Part B of the conceptual development combines the IGOHcaps method (proposed in Section 3.3) with the factors influencing EAI adoption. The author suggests that such an approach is significant and novel as it: (a) enhances existing EAI adoption models by incorporating an actor-oriented analysis and (b) facilitates healthcare organisations in making robust decisions for EAI adoption.

Chapter 4: Methodology and Research Strategy – Data Theory

Based on the aim of this research, Chapter 4 develops an argument for the selection of a suitable research methodology and the data collection methods that are going to be used. Moreover, the author reviews the literature and this leads to the justification for the selection of the interpretivism qualitative epistemological research stance for the purpose of theory testing. Moreover, justification for the selection and use of the multiple case studies research strategy is provided in Chapter 4. The reasons for the selection of these methods, their limitations and the way that these limitations are overcome, are explained.

Chapter 5: Empirical Research Data Collection and Analysis – Data Theory

In Chapter 5, the author provides a detailed description of the case studies (HOSPITAL_UK and HOSPITAL_GR) carried out to test the conceptual model. In doing this, the following information for each case study is presented: (a) the background to the healthcare system and healthcare organisation, (b) healthcare organisation's integration problems, (c) the EAI adoption process of the healthcare organisation, (d) interviewees' perceptions regarding the issues under research (research findings), and (e) analysis of the research findings. Chapter 5 addresses the Objective 4, as this was presented in Section 1.3.2.

Chapter 6: Revisions to Conceptual Method and Model for EAI Adoption in Healthcare Organisations - Data Theory

In this chapter, the research findings presented in Chapter 5 are further analysed and explained. Such an analysis leads to the revision of the conceptual method and model for EAI adoption in healthcare organisations. The revised model for the adoption of EAI adoption in healthcare organisations is presented in Figure 6.2 can support the decision-making process in healthcare organisations. Chapter 6 contributes in addressing the Objective 4.

Chapter 7: Conclusions and Further Work – Novel Contribution

A summary of the research conducted in this dissertation is presented in the last chapter. The novel contribution of this dissertation, as well as the conclusions derived from the findings are also analysed and reported. Furthermore, the chapter highlights possible limitations of this work, describes potential areas of further research, and makes some recommendations for further investigation. Chapter 7 addresses the Objective 5, as this was presented in Section 1.3.2.

The author has presented the structure of this dissertation in Figure 1.1. To better explain the structure, the author in Figure 1.2 presents the story of this dissertation, which is based on the use of the main figures and tables presented herein.

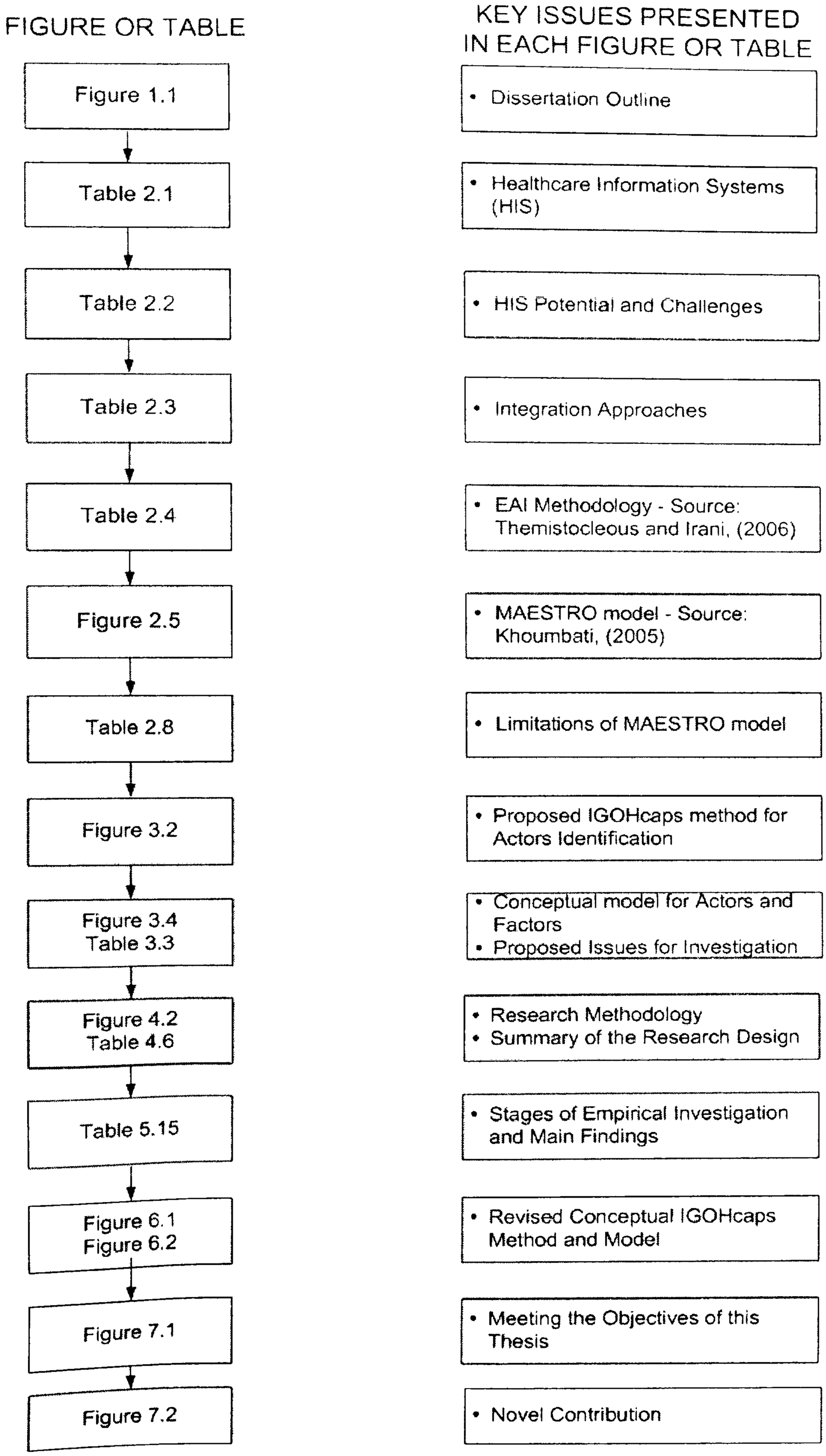

Figure 1.2: Dissertation Story

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CHAPTER 2

LITERATURE REVIEW

Summary

Chapter 1 introduced the research presented in this dissertation, explained the research problem and presented the research aim and objectives. In achieving the aim of this dissertation, Chapter 2 reviews the normative literature to identify research areas for further investigation. Thus, Healthcare Information Systems (HIS) and the need for integration are presented. Moreover, the various integration approaches are discussed, as they do not provide the expected level and quality of integration. In addition, the use of an advanced integration technology, like Enterprise Application Integration (EAI), is highlighted. The author reviews and analyses the technical and business aspects of EAI technology, since this dissertation focuses on EAI adoption in healthcare organisations, the MAESTRO model proposed by Khoumbati (2005), is described and critically discussed. In doing so, a limitation of the MAESTRO model is highlighted for further investigation. In addressing this limitation, the author suggests that the role of healthcare actors' should be examined during the EAI adoption process.

2.1 Introduction

As reported in Chapter 1, Healthcare Information Systems are disparate, heterogeneous and function in an independent manner. This HIS heterogeneity affects the quality of services provided to patients and citizens (Anyanwu *et al.*, 2002). To overcome this problem, various integration technologies have been implemented in the healthcare sector. Yet, these technologies have not provided the expected level and quality of integration that is required by the healthcare sector.

Hence, the need for a more advanced integration technology, like Enterprise Application Integration, has been highlighted in the normative literature. However, limited research has been conducted in the area of EAI in healthcare organisations, with the majority of this research focusing on the adoption of EAI. As mentioned in the first chapter, this dissertation deals with the EAI adoption in healthcare organisations and highlights the important role of healthcare actors during the adoption process. This issue has not been considered or investigated by the research conducted in this field. Thus, there is scope for timeliness and novel research in this area.

Chapter 2 critically reviews and analyses the normative literature and it is structured as follows: Section 2.1 presents the literature related to Healthcare Information Systems. The HIS integration and the various integration approaches that have been used, are analysed in Section 2.2. Although, these approaches have been proved to provide significant benefits, they do not achieve the expected level and quality of integration that is required by the healthcare sector. The need for the implementation of a more advanced integration technology, like EAI, is highlighted, with the author reviewing and analysing the normative literature in this area. In Section 2.3, various adoption approaches are presented and described. As this dissertation focuses on EAI adoption in healthcare organisations, the MAESTRO model proposed by Khoumbati, (2005), is described and critically discussed. In doing this, the need to consider and involve healthcare actors' during the EAI adoption is identified, highlighted and discussed.

2.2 Healthcare Information Systems

Information Systems (IS) play an increasingly crucial role in the healthcare sector, by providing an infrastructure to integrate people, processes and technologies (Ragupathi, 1997; Wanless *et al.*, 2002). Information Technology (IT) applications such as Internet-based telemedicine (Menachemi *et al.*, 2004), personal health records (Lafky *et al.*, 2006), asynchronous healthcare communication systems (Wilson, 2003), and picture archiving communication systems (Menachemi *et al.*, 2004) have been applied in healthcare to improve the capabilities of physicians and clinical staff and provided increased services to patients, caregivers, and citizens in general.

According to Rodrigues *et al.*, (1999) Healthcare Information Systems are defined as:

> *"Computerized systems designed to facilitate the management and operation of all technical (biomedical) and administrative data for the entire healthcare system, for a number of its functional units, for a single healthcare institution, or even for an institutional department or unit"*
>
> Rodrigues *et al.*, (1999, p.2)

HIS are a key enabler, as they have the potential to improve healthcare services, by providing rapid and widespread access to information at the point of care (Lenz and Kuhn, 2004).

2.2.1 Healthcare Information Systems: Evolution

In the early stages of implementing IT in the healthcare sector (e.g. 1960's), Information Systems were dealing with simple transaction processing tasks (Siau *et al.*, 2002). In the 1970's Healthcare Information Systems that support the management processes began to evolve and in 1980's, the traditional decision support systems started being developed and used. Network applications (e.g. internet, intranet and extranet) and information warehousing integrated with data mining tools to support the identification of customer needs and hidden business challenges had been implemented in the healthcare sector in the 1990's.

Recently, the need for implementing Electronic Patient Records (EPR) and to integrate medical systems became apparent, as healthcare organisations have the vision to develop a patient centric integrated system. Therefore, Information Technology is not perceived as a supporting tool, but a strategic necessity for the development of an integrated healthcare IT infrastructure that will significantly improve services and reduce medical errors.

A plethora of IS, ranging from order entry and administrative HIS to laboratory and operation theatre HIS, have been implemented in the healthcare sector. Based on the processes that HIS support, Anyanwu *et al.*, (2002) categorised them into: (a) clinical, (b) non-clinical (administrative and financial), (c) pharmaceutical and (d) laboratory. The author adopts this classification and extends it, by proposing that the non-clinical IS (administrative and financial) can be further broken down into: (a) administrative, (b) financial and (c) support systems. Using the normative literature, the author identifies and classifies the most common Information Systems deployed in the healthcare sector, based on the proposed classification.

In doing this, the author classifies HIS as follows: (a) clinical, (b) non-clinical - support systems (c) non-clinical – administrative, (d) non-clinical – financial, (e) pharmaceutical and (f) laboratory. In Table 2.1, Healthcare Information Systems are classified and described.

Process Supported		Healthcare IS	Description	References
Clinical		Picture Archiving and Communication Systems (PACS)	Store, transmit, acquire and display radiological images. Digital images are accessible and available at any time and place and can be viewed simultaneously in multiple locations if needed.	Strickland, (2000)
		Telemedicine	Provide customized care to patients (in their homes or in remote areas), through the use of technologies as Web TV, smart phones, and wireless devices. Supports information and knowledge exchange and transfer between doctors, specialists and patients.	Siau, (2003)
		Patient records	Store, capture, manipulate, retrieve, and transmit data about patients' information for clinical, biological and administrative purposes	Grimson *et al.*, (2000a)
Pharmaceutical		Pharmacy IS	Keep records about drugs' ordering, stocking and distribution	Austin and Boxerman,(2002)
Laboratory		Laboratory IS (LIS)	Physicians or nurses use devices at the point of-care to provide lab results (blood gasses, glucose), thus assisting physicians in ordering medications right at the point of care.	Chung *et al.*, (2003)
Non-Clinical	Support Systems	Human resources management IS	Store information about personnel management, pay rolls, manpower training and employment law.	Austin and Boxerman, (2002)
		Order entry IS	Allow clinical personnel to enter orders for medications, x-rays etc. into a computer.	Davidson and Chismar,(1999)
		E-learning and research IS	Support and open up new research and learning dimensions (e.g. research of diseases diagnoses).	Grimson *et al.*, (2000a)
		Web-based IS	Provide on-line access such as to patients, physicians, suppliers for required information and facilitate communication between them.	Raghupathi and Josph, (2002)
		Clinical Decision Support Systems (CDSSs)	Improve clinical decision making, by providing advice for further treatments and disease diagnosis. They can be used to send alerts and reminders to patients about preventive care.	Garg *et al.*, (2005) Siau, (2003)
	Administrative	Administrative IS	Deal with patients' admissions, discharge, booking appointments and financial transactions and support the communication with suppliers and insurance companies.	Blobel and Roger-France, (2001)
	Financial	Financial and accounting IS	Support financial transactions with patients, employees, suppliers, insurance companies etc and accounting processes.	Siau, (2003)

Table 2.1: Healthcare Information Systems

2.2.2 Healthcare Information Systems: Potential and Current Challenges

Information Systems implementations have been reported to provide significant benefits to healthcare organisations, such as better data quality, availability, accessibility, connectivity, exchange and sharing (Stefanou and Revanoglou, 2006; Trimmer et al., 2002). Moreover, it has been reported that through minimum levels of automation, the percentage of human life loss would reduce by 50-80% in USA (Sutherland and Willem, 2002).

Despite the potential benefits of HIS, it has been reported that healthcare systems have a low success rate (Heeks *et al.*, 1999; Westrup, 1998). In UK, hundreds of millions of pounds and countless hours of peoples' time have been spent on Information Systems implementations. However, the quality of the healthcare systems suffers as a result of medical errors, clinical employees' resistance to change and fragmented care (Leape *et al.*, 1995; Stefanou and Revanoglou, 2006). It appears that healthcare actors have a significant role in introduction and use of IT and should be involved in the decision-making process (Chau and Hu, 2002). This literature finding emphasises the need to consider healthcare actors during the EAI adoption process.

The author reviews the normative literature, identifies the potential of Healthcare Information Systems, as well as the challenges faced by healthcare organisations. The potential and current challenges are categorised in four main thematic areas, namely: (a) Information Quality, (b) Information Availability, (c) Medical Errors and (d) HIS Integration. In addition, the HIS potential and current challenges are summarised according to the thematic area, presented (Table 2.2) and discussed in the following paragraphs.

Thematic Area 1: Information Quality

Stefanou and Revanoglou, (2006) reported that HIS have the potential to improve the visibility and quality of health data, information and knowledge. However, health data, information and knowledge are delayed, as a result of the weak communication infrastructure. Thus, health information is randomly exchanged and accessed (Mundy and Chadwick, 2004). Moreover, it has been reported that HIS improve the availability, accessibility, connectivity, exchange and sharing of information, data and knowledge (Neri *et al.*, 1998; Trimmer *et al.*, 2002).

Thematic Areas		HIS Potential	HIS Current Challenges
1.	Information Quality	Improve quality of information - Wanless *et al.*, (2002)	The weak communication infrastructure delays the exchange and transfer of health information - Mundy and Chadwick, (2004)
2.	Information Availability	Improve availability of information – Trimmer et al., (2002), Neri et al., (1998)	Health information is partially available – Leonard, (2004) Clinical employees resist to the adoption and use of HIS - Stefanou and Revanoglou, (2006) Privacy, security and confidentiality of data – Mundy and Chadwick, (2004)
3.	Medical Errors	Reduce medical errors – Sutherland and Willem, (2002)	Three out of four preventable errors in care hospitals are caused by systems failure - Leape et al., (1995) The healthcare system still suffers, as a result of medical errors occurring - Khoumbati, (2005), Stefanou and Revanoglou, (2006)
4.	HIS Integration	Improve integration of health information – Donlon, (2003)	HIS are fragmented – Lee et al., (2003) High integration cost – Khoumbati, (2005)

Table 2.2: Healthcare Information Systems Potential and Challenges

Thematic Area 2: Information Availability

Despite the technological advancement, healthcare information is partially available, with poor quality and is displayed in non correct/standardized format (Leonard, 2004). The clinical employees' resistance to adopt Healthcare Information Systems has been reported to affect the quality of information provided (Stefanou and Revanoglou, 2006). In addition, the privacy, security and confidentiality of data is a major concern in the field of HIS (Mundy and Chadwick, 2004).

Thematic Area 3: Medical Errors

Sutherland and Willem, (2002) pointed out that Healthcare Information Systems have the potential to reduce the medical errors that occur and increase patient's safety. However, the medical errors that occur through the non-integrated nature of HIS are estimated to have resulted in the loss of 64 persons per day in United Kingdom (Khoumbati, 2005).

Thematic Area 4: HIS Integration

Despite the potential of the HIS to improve the integration of health information (Donlon, 2003), the systems are still heterogeneous and the care provided is fragmented (Lee *et al.*, 2003). It appears that the requirement for integration has been raised as: (a) effective

information sharing among systems is vital for the management of organisations (Khoumbati *et al.*, 2004a), (b) data is mainly electronically transferred between the HIS (Spyrou *et al.*, 2002) and (c) the healthcare system is becoming a "virtual system" as a result of connectivity and tele-health projects (Mercer, 2001). Nonetheless, the need for the development of an information integrated infrastructure that will be cost effective, flexible and adaptive has become apparent.

2.3 Healthcare Information Systems: Need for Integration

Pink (1996) reported that the integration of healthcare IS and the acceptance by the multiple actors are important requirements that can support timely, accurate and comprehensive information sharing (e.g. information related to health status, costs, quality, utilisation, workload outcomes and satisfaction). However, the implementation of a fully integrated system is a complex process that needs to be carefully planned and the actors involved have to be carefully coordinated (Rodrigues *et al.*, 1999).

2.3.1 Healthcare Information Systems: Integration Approaches

Various integration approaches have been adopted by healthcare organisations to overcome the fragmentation of HIS. The efforts to integrate the heterogeneous HIS have been discussed by Nhampossa, (2005) along a continuum from 'loose' to 'tight' integration approaches, relating to the degree of intervention (Figure 2.1). To this end, it is worth noting that the same approaches (loose and tight) are used in the area of EAI as well (Puschmann and Alt, 2005).

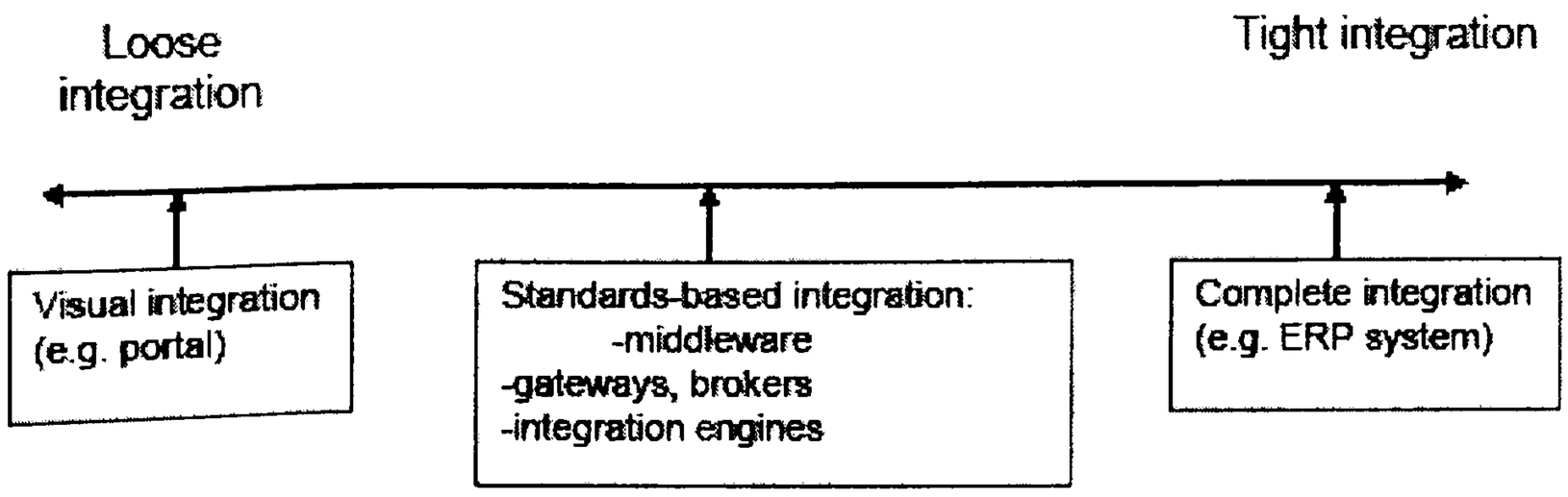


Figure 2.1: Integration Approaches Continuum- Source: Nhampossa, (2005)

The 'loose integration' approaches have been characterised as conservative efforts made that do not fully integrate the various Healthcare Information Systems, e.g. web-enabled portals. On the contrary, the 'tight' integration aims at eliminating fragmentation, by providing fully integrated systems. This is achieved through the implementation of Enterprise Resource Planning (ERP) or EAI solutions. In between the 'loose' and 'tight' integration, there exist different integration approaches that are based on standards, e.g. CEN/TC 251.

The multiple integration approaches are characterised either as integration standards, as integration projects or as internally integrated systems. In the field of integration standards are included the following: (a) Health Level 7 (HL7), (b) Electronic Data Interchange (EDI), (c) CEN/TC251 and (d) Digital Imaging Communications in Medicine and Common Object Broker Architecture in Medicine (DICOM). Some integration projects that have been developed include the following: (a) Synergy Extranet (SynEx), (b) Synapses and (c) Healthcare Advanced Networked System Architecture Project (Hansa). Moreover, internally integrated systems like Enterprise Recourse Planning Systems have been used in the healthcare sector. These integration approaches are presented and described in Table 2.3.

	Integration Approach	Description	Reference
INTEGRATION STANDARDS	EDI	Used in healthcare internally for admissions, clinical and financial purpose.	Spyrou *et al.*, (2002)
		Used in healthcare externally with other stakeholder such as suppliers and insurance providers.	Spyrou *et al.*, (2002)
		Evolved as an electronically data carrier replacing paper documents.	Khoumbati, (2005)
	DICOM	Allows the exchange of medical images and related information between systems from different manufacturers.	Neri *et al.*, (1998)
		Allows the communication between equipment and software from different manufacturers.	Khoumbati, (2005)
		Based on middleware technology.	
	HL7	Provides the facility for electronic data exchange.	Khoumbati, (2005)
		Provides a solution to the basic communication problems between systems.	Ferdinand and Syed, (2000)
		Provides data integration through application-to-application interfaces.	Ferdinand and Syed, (2000)
	CEN/TC 251	Established by the European Standardisation Committee, Technical Committee 251 for Medical Informatics.	Khoumbati, (2005)
		Dealing specifically with issues such as terminology, knowledge base and semantics in healthcare informatics.	Ferrara, (1998)
		Based on three co-operative layers, such as application, middleware and bit ways.	Bemmel and Musen, (1997)
		Provides definition of the information that is shared.	
INTEGRATION PROJECTS	SynEx	Enables authorised persons to share and present medical records from any system in any place.	Ferrara, (2000)
		Assists authorised persons in understanding their clinical significance.	
	Synapses	Funded by the 4th EU framework for health telemetric.	Khoumbati, (2005)
		Enables healthcare professionals to share electronic patient records and related medical data wherever and in whatever system they are held.	Wilson, (1998)
		The aim is to permit client applications to request parts of or complete electronic healthcare record from different IS.	Grimson *et al.*, (1997)
	Hansa	Identified an evolutionary strategy to move toward integrated legacy systems.	Blobel, (2001)
		Uses an open, modular architecture based on the common Distributed Hospital Environment middleware.	Ferrara, (1998)
INTEGRATED SYSTEMS	ERP	Allow a company to produce and access information in a real-time environment.	Siau, (2003)
		Provides an integrated database.	Grimson *et al.*, (2000b)
		Reduces administrative costs.	Trimmer *et al.*, (2002)
		Deployed to manage the data and processes of the hospital.	Stefanou and Revanoglou, (2006)
		Workloads can be better estimated and understood.	
		Allow a company to share common data and practices across the enterprise.	

Table 2.3: Integration Approaches Adopted by Healthcare Sector

The implementation of these approaches has provided significant benefits to healthcare organisations. However, there are still many problems relating to their adoption (Khoumbati *et al.*, 2004a). Among other problems the cost of the development of healthcare integration approaches is high and the level of interoperability remains low (Carr and Moore, 2003).

Khoumbati *et al.*, (2004a) has recognized, analysed and identified the benefits and barriers of these integration technologies and these are presented and analysed in Appendix A. The evaluation of the integration approaches supports the healthcare managers and researchers to overcome the confusion that exists regarding the adoption of the integration approaches. Thus, the selection of a suitable integration approach will become an easier task and less time will be spent on this. According to Khoumbati (2005), through the adoption of integration approaches, the healthcare organisations will gain numerous advantages such as: (a) operational, (b) managerial, (c) strategic, (d) IT Infrastructure and (e) organisational.

From the evaluation of the barriers and the benefits of the integration approaches (Appendix A), it appears that each approach has been developed to provide specific solutions and there is a need for the use of more than one approach to get satisfactory integration outcomes (Khoumbati, 2005). Nonetheless, EAI is a relatively new integration technology that is used to incorporate custom applications, packaged systems and e-business solutions into a flexible and manageable business infrastructure (Themistocleous *et al.*, 2004).

Private and public sector has implemented and evaluated EAI solutions, which has been proved to provide satisfactory integration solutions (Themistocleous, 2004). According to Themistocleous and Irani, (2001) EAI offers multiple benefits to organisations such as: (a) reduced operational costs, (b) increased productivity, (c) improved planning in supply chain management and (d) increased collaboration among trading partners. Despite the significant benefits that EAI has provided to other sectors, healthcare organisations remain laggards in EAI implementations, thus, leaving scope for timeliness and novel research. Khoumbati (2005) was among the first that studied the EAI adoption by healthcare organisations and among others, identified and analysed the factors that motivate the adoption process. According to this classification, these factors include: (a)

technical, (b) cost, (c) medical errors, (d) decision support system, (e) collaboration, (f) access of patients' data, and (g) confidentiality of patients' data.

2.4 Enterprise Application Integration (EAI)

Enterprise Application Integration has emerged to piece together inter- and intra-organisational systems and combines a variety of integration technologies such as web services, message and process brokers (Linthicum, 2001). It aims at building an integration infrastructure by bridging existing heterogeneous and incompatible applications. EAI combines a variety of integration technologies such as message brokers, and application servers, to build a centralised integration infrastructure (Lam, 2005a; Linthicum, 2000). In the following paragraphs, the author attempts to enhance the understanding regarding EAI, by reviewing both the technical and business perspectives related to it.

2.4.1 A Technical Perspective: Integration Levels and Layers

Themistocleous *et al.,* (2006) proposed a model and mentioned that EAI supports four levels of integration: (a) data, (b) process, (c) knowledge management and (d) application integration. In addition, Themistocleous *et al.,* (2006) model also consists of the following integration layers: (a) Connectivity, (b) Transportation, (c) Translation and (d) Process integration and (e) Knowledge Management Integration. The EAI levels and layers are presented in Figure 2.2 and described below.

Data Integration Level:

Themistocleous *et al.,* (2006) refer to the first three layers (Connectivity, Transportation and Translation) using the term data integration level. The Connectivity layer creates points of access between the applications and the EAI infrastructure. The Transportation layer is responsible for the exchange of the application elements (e.g. data, objects) between EAI infrastructure and applications (Zahavi, 1999). The Translation layer converts and reformats the application elements into a recognisable format for the target(s) systems.

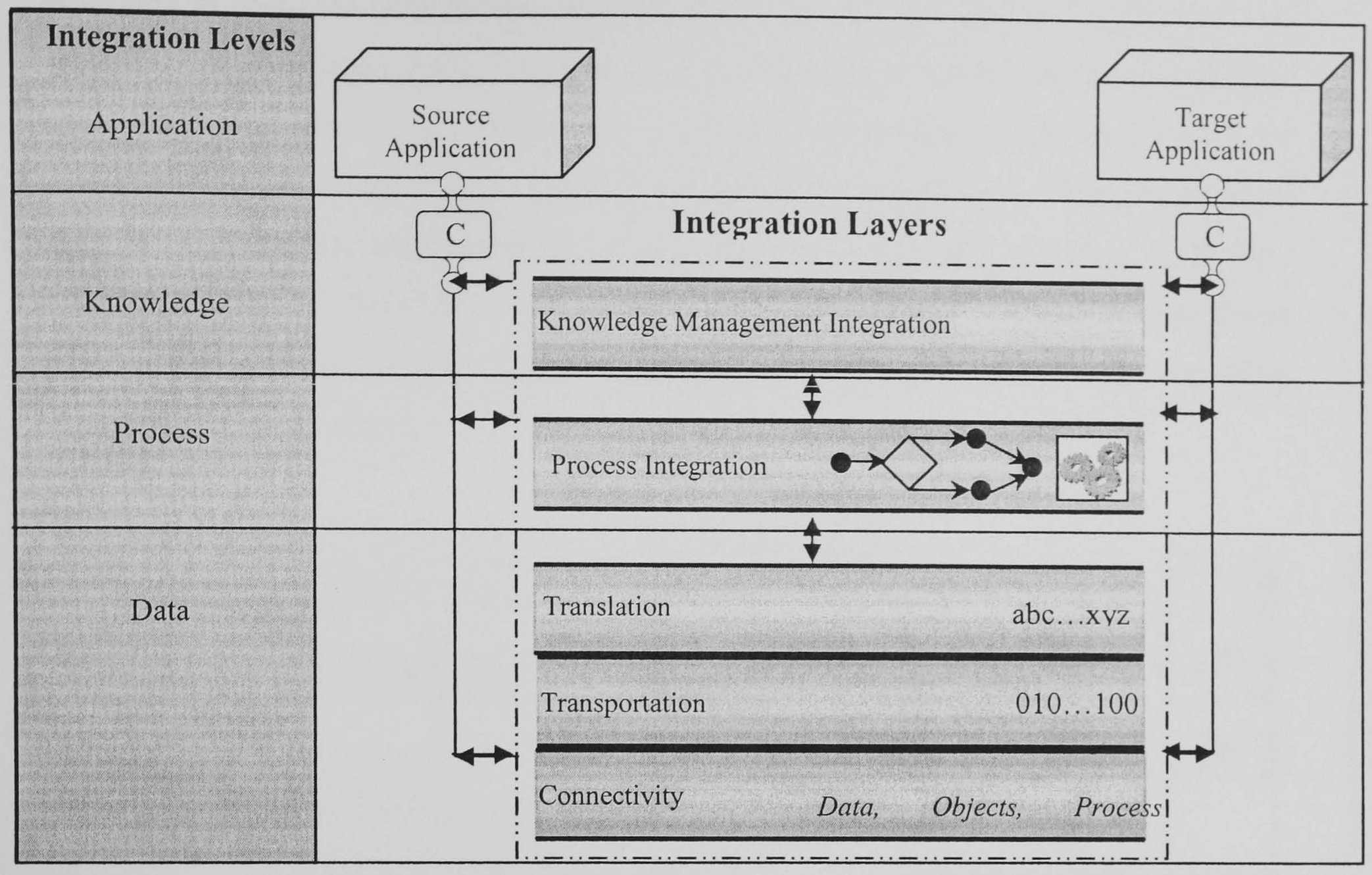


Figure 2.2: EAI Layers – Source: Themistocleous *et al.*, (2006)

Process Integration Level:

The Process Integration level uses the data integration level to automate and integrate business processes. Depending on the requests and information it receives and triggers all appropriate applications or tasks to integrate a business process. Literature has proved that EAI can efficiently support business process integration (Themistocleous and Corbitt, 2006).

An example of the use of EAI in UK healthcare sector is given in Figure 2.3, which illustrates that hospitals built their own EAI architecture with which they incorporate their systems. The integration requires the re-engineering, and automation of their business processes both at intra and inter-organisational level. The EAI architecture integrates also the administrative systems of the hospital as well as their supply chains. At a country level, hospitals, National Health Service (NHS), General Practitioners (GPs), researchers and suppliers are integrated through a centralised countrywide EAI infrastructure. This allows end-to-end exchange of information. The benefits derived from such EAI

architecture will be: (a) the generic benefits associated with EAI implementations as described in literature (Puschmann and Alt, 2001) and (b) the specific benefits that are related to the healthcare sector integration (e.g. less medical errors, better and efficient services) (Khoumbati *et al.*, 2006). For instance, researchers would have access to accurate patients' medical data and they would better assess the efficiency of their medicines. Therefore, they would be able to react faster and improve their medicines. Clearly there are healthcare implications from developing a robust integrated infrastructure that will benefit clinicians, patients, hospitals, NHS, government and other stakeholders' in this chain.

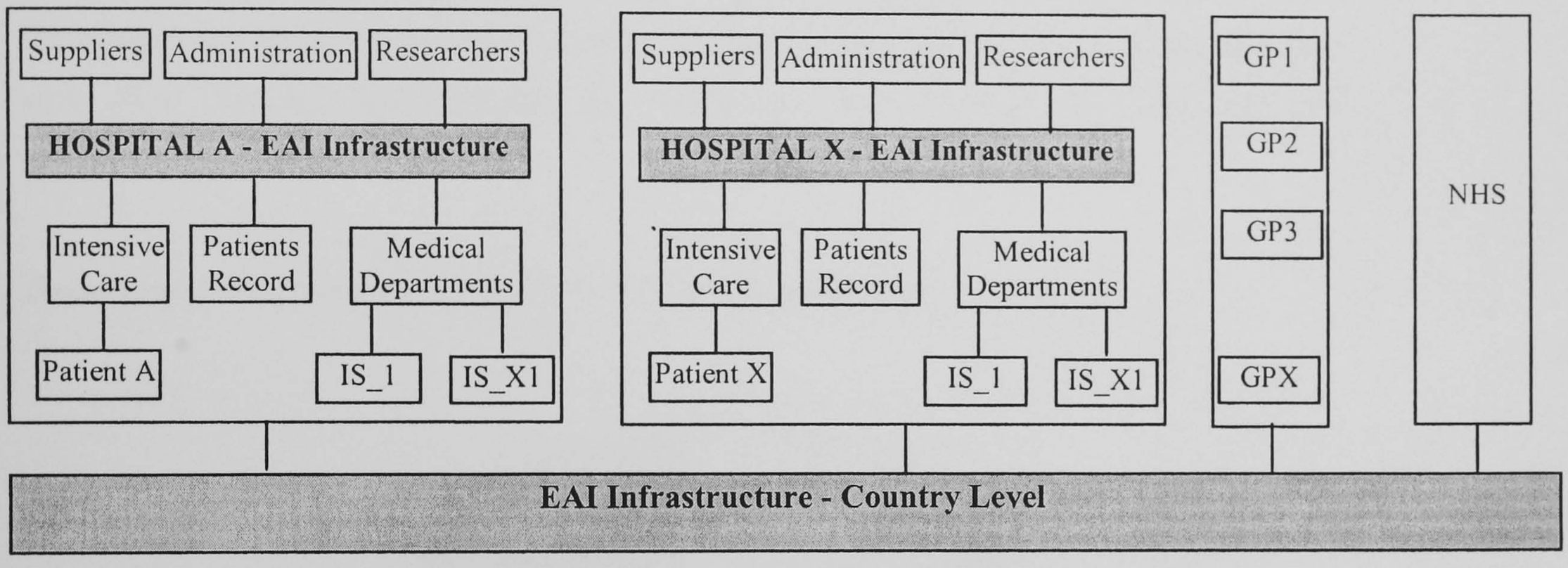


Figure 2.3: EAI Infrastructures in healthcare sector

Knowledge Integration Level:

Themistocleous *et al.*, (2006) suggested that EAI can not only support the Data and Process Integration levels but also the Knowledge Integration level. Themistocleous *et al.*, (2006) reported that EAI can successfully integrate the knowledge that is stored in multiple locations, services and IS. In doing so, these authors presented exemplar cases from the healthcare sector to demonstrate that the Knowledge Integration level results in more efficient, effective, informative and accurate decisions regarding patients' health. This finding also supports the researcher's point of view that EAI is an appropriate solution for the integration problems faced by healthcare organisations.

Application Integration Level:

Themistocleous *et al.*, (2006) stated that the Knowledge Management Integration layer is related to the Application Integration level as knowledge is pull out from applications and is integrated using important elements from the process integration level.

2.4.2 A Technical Perspective: EAI Development Methodology

To describe the development process of EAI applications, Themistocleous and Irani, (2006) proposed a structured methodology, which consists of eight descriptive stages, namely: (a) Planning, (b) Scenarios Building and Evaluation, (c) Business Process Reengineering, (d) Systems Restructuring, (e) Requirements Analysis, (f) Filling the Gap with New Systems Development (g) Integration and Testing (h) Operation and Maintenance.

These stages are presented in Figure 2.4 and explained below:

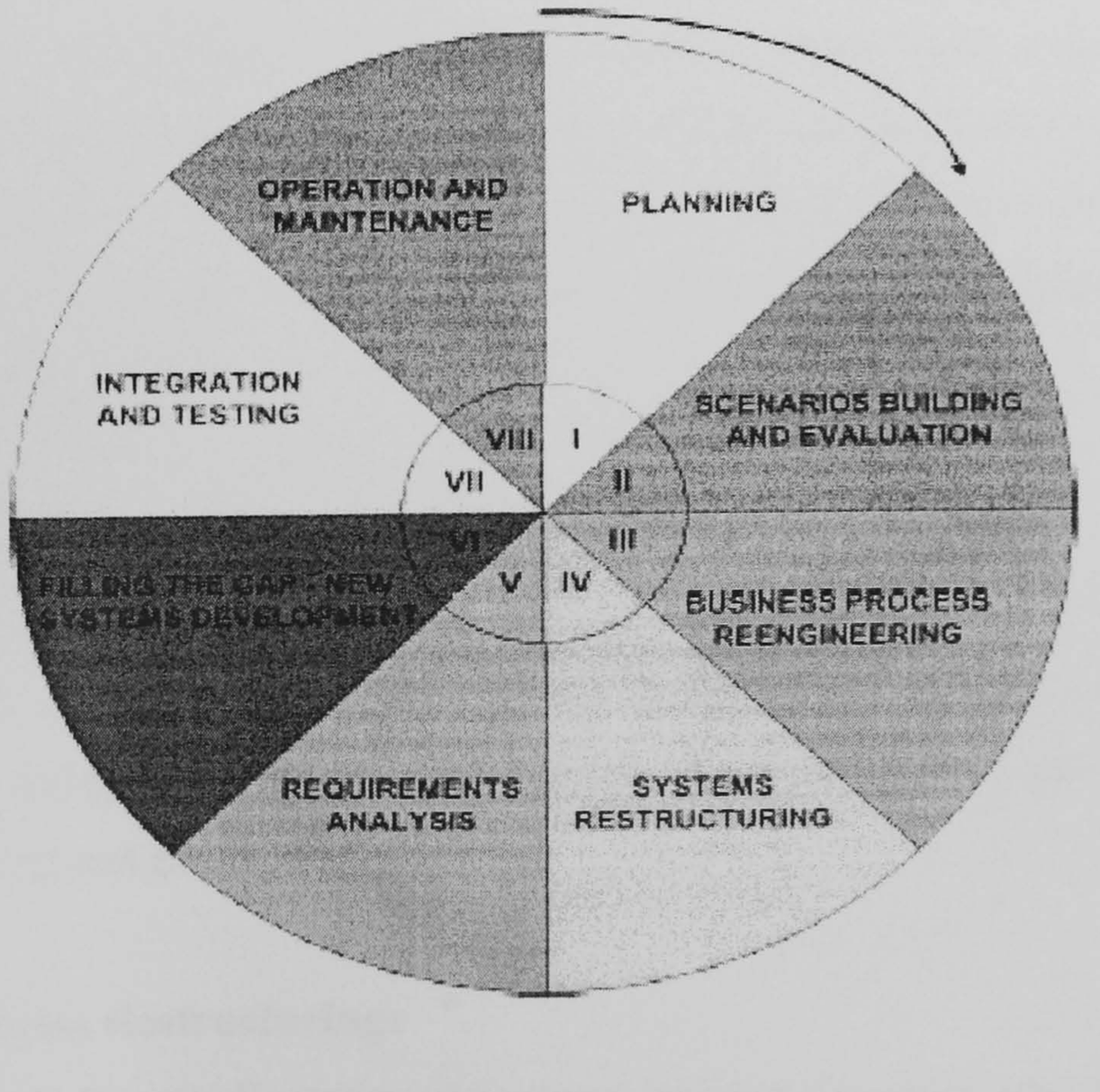


Figure 2.4: EAI Methodology - Source: Themistocleous and Irani, (2006)

Stage I - Planning:

Themistocleous and Irani, (2006) mentioned that prior to the decision for implementing an EAI solution, organisations need to understand and evaluate the parameters associated with such a project. During this stage, decision-makers should consider the following factors: (a) Costs, (b) Benefits, (c) Barriers, (d) Internal Pressures, (e) External Pressures, (f) Support, (g) IT Infrastructure, (h) IT Sophistication, (i) Evaluation Framework for the Assessment of Integration Technologies, and (j) Evaluation Framework for the Assessment of EAI Packages. All these factors should be considered as part of the *feasibility study* that is taking place in this stage. Clearly, these findings refer to the adoption of EAI. For instance, Khoumbati (2005) used these factors when he studied the EAI adoption in healthcare organisations. Based on these factors, Khoumbati (2005) proposed and evaluated the MAESTRO model, which is a healthcare specific model for EAI adoption.

Stage II - Scenarios Building and Evaluation:

After the planning stage, organisations should develop and evaluate a range of possible scenarios, such as: (a) the *Opportunistic Approach,* in which organisations use EAI to overcome integration problems on specific processes or departments and (b) the *Strategic Approach* which requires end-to-end application of EAI in organisation and is associated with the changes that the EAI will bring to organisations (Themistocleous and Irani, 2006). After the selection of the appropriate approach by organisations, integration scenarios are build and test.

Stage III - Business Process Reengineering:

Themistocleous and Irani, (2006) reported that many organisations reengineer their processes when introducing an EAI solution to improve their performance and gain competitive advantage. The Business Process Reengineering (BPR) takes place after the scenarios building and evaluation.

Stage IV - Systems Restructuring:

After the Business Process Reengineering stage, organisations integrate their systems in a way that it is flexible, manageable and maintainable, by reducing the redundancy of data and applications. In doing this, organisations clear and migrate data as well as to phase out all the unnecessary systems without causing problems to their performance.

Stage V - Requirements Analysis:

Following the Scenarios' Building and Evaluation, Business Process Reengineering and the Systems Restructuring stages, the next step is towards the requirements analysis. Organisations identify and analyse the requirements for the integration of their IT infrastructure (Themistocleous and Irani, 2006). Moreover, the appropriate technologies and tools for integration are evaluated, through the use of evaluation frameworks.

Stage VI - Filling the Gap – New Systems Development:

The sixth stage of the EAI methodology deals with the analysis and development of those applications that are required to complete the IT infrastructure (Themistocleous and Irani, 2006). At this stage, organisations know the gaps in their IT infrastructure, the processes that are not fully automated as well as the legacy systems that need to be replaced. Therefore, in this stage, they can use any kind of software engineering methodology that is available and suits their needs.

Stage VII - Integration and Testing:

At this stage, the actual integration of the IT infrastructure should start. During this stage, integrators build the four layers of the integration infrastructure, through a hub and spoke architecture or any other alternative (Themistocleous and Irani, 2006). Moreover, the applications' interfaces are integrated. In the end of this stage, the testing of the integrators and systems integration takes place.

Stage VIII - Operation and Maintenance:

The last stage of the methodology is related the operation and maintenance of the integrated IT infrastructure. The normative literature provides various techniques that can be used during this stage.

2.4.3 A Business Perspective

From a business perspective EAI results in the reduction of overall integration cost due to the decrement of both integration time and maintenance costs (Ring and Ward-Dutton, 1999). Also, EAI leads to Return on Investment (ROI) as it provides a flexible, manageable and maintainable IT infrastructure that supports the changing business and technical requirements. Based on an integrated enterprise architecture, organisations can

increase their productivity, provide better services and improve their relationships with their collaborators (Ruh *et al.*, 2000). Moreover organisations can improve their performance (Urlocker, 2000). Likewise, EAI supports strengthened supply chains and improved relationships and collaboration between organisations and suppliers. Other benefits include the provision of a centralised point of control, the reduction of skills level required to integrate applications, faster time to marketing and increased market share.

Despite considerably adoption from the private sector to implement EAI solutions (Puschman and Alt, 2001; Skoumpopoulou *et al.*, 2004); it took the healthcare sector significant time to realize its effectiveness. In particular, the normative literature has tended to focus on the identification of parameters affecting the EAI adoption process in the private sector (Puschman and Alt, 2001). Nonetheless, further work should be carried out in this field as: (a) the adoption and (b) the integration of health services and IT infrastructures were the most frequently cited priorities in UK (HIMSS, 2004). Thus, this dissertation focuses on the EAI adoption in healthcare organisations. In the following paragraphs, the adoption process and approaches related to this are described and discussed and the limitations of the proposed EAI adoption approaches are identified.

2.5 IS and EAI Adoption in Healthcare Organisations

The adoption of technological innovations has attracted a lot of research interest. Among others, it has been suggested that, the adoption process depends on issues like the organisational setting in which the innovation is introduced. For instance, the adoption of IS in Small and Medium Enterprises (SMEs) differs to larger organisations (Chen, 2005). Similarly, the role, importance and use of technological innovations vary from one organisation to another.

For example, Wiley-Paton and Malloy (2004) observed that the IS adoption in healthcare is more critical comparing to other organisations, as it is related to human lives. For this reason, the author suggests that the adoption of a technological innovation such as EAI in the area of healthcare should be thoroughly studied. As a result, the factors identified in the past as influential to EAI adoption in healthcare as well as other issues that had not been explored in this area (e.g. healthcare actors and their role) should be investigated.

In doing this, the author reviewed the normative literature and in Tables 2.4a and 2.4b presents recent studies on IS and EAI adoption in healthcare organisations and other sectors accordingly. To enhance the level of analysis and understanding, the authors have classified the factors of these models into Organisational (O), Technical (T), Human (H), Managerial (M) and Social (S) dimensions. More specifically, Tables 2.4a and 2.4b illustrate the factors of each model and the dimensions that these factors are related to.

Area		Reference	Factors	Factors Categories				
				O	T	H	M	S
Adoption of Innovations	IS in the Healthcare Sector	Hu *et al.*, (2000)	Technological		✓			
			Organisational	✓				
			External	✓		✓	✓	✓
		Lehoux *et al.*, (2000)	Human			✓		✓
			Organisational	✓				
		Chismar and Wiley-Paton, (2002)	Perceived Usefulness			✓		
			Perceived Ease of Use			✓		
			Intention to Use			✓		
			Usage Behaviour			✓		
			Subjective Norm					✓
			Image					✓
			Experience	✓	✓	✓	✓	✓
			Voluntariness					✓
			Job Relevance		✓	✓	✓	
			Output Quality	✓	✓	✓	✓	
			Result Demonstrability		✓	✓	✓	
		Gagnon *et al.*, (2004)	Individual Dimensions			✓		✓
			Professional Dimensions			✓	✓	✓
			Organisational Dimensions	✓				
			Contextual Dimensions	✓	✓	✓	✓	✓
		Wiley-Paton and Malloy, (2004)	Social Network Theory			✓		✓
			Persuasion/Social Theory			✓		✓
			IT Adoption Theories	✓	✓	✓	✓	✓

Table 2.4a: Classification of Factors that Support the IS Adoption

Tables 2.4a and 2.4b depict that much emphasis has been given on organisational, human, managerial and social dimensions, as the adoption process is associated with changes in structure, organisation and professions. Along similar lines, Chen, (2003b) and Chen, (2005) pointed out accordingly that the role of actors and the adopter characteristics should be considered among others during the adoption process. McGrath and More (2001), suggested that "People-Related Issues" (e.g. actors involved) should be taken into account and analysed by organisations. Robey (1979) and Ginzberg and Zmud (1998) have studied the importance of actors' beliefs and attitudes, and how these are affected and affect the factors influencing IS adoption. Rogers' (1995) diffusion theory indicates that stakeholders and the perceived characteristics of innovation have an impact on individual's adoption of IT. Thus, as illustrated in Tables 2.4a and 2.4b the important role

of organisational, human and social dimensions (actor) is highlighted and it is supported by normative literature too.

				Factors Categories				
	Area	**Reference**	**Factors**	**O**	**T**	**H**	**M**	**S**
Adoption of Innovations	EAI	Themistocleous (2002)	Benefits	✓	✓			
			Barriers	✓	✓			
			Costs	✓	✓			
			Internal Pressures	✓	✓		✓	
			External Pressures	✓	✓		✓	
			IT Sophistication		✓			
			IT Infrastructure		✓			
			Support		✓			
			Integration Framework for Technologies / Packages		✓		✓	
		Chen, (2003b)	Stakeholders	✓		✓		✓
			Organisational Factors	✓	✓		✓	
			IT Standard Characteristic		✓			
		Chen,(2005)	Nature of Resources	✓	✓	✓	✓	✓
			Integration Needs		✓		✓	
			Time				✓	
			Company Size	✓			✓	
			Adopter Characteristics	✓	✓	✓	✓	✓
			IT Sophistication		✓			
			External Pressure	✓	✓		✓	✓
			Trading Partners	✓				
			Government Regulation	✓				
			IT Infrastructure		✓			
			IS Complexity		✓			
			Internal Pressure	✓	✓		✓	✓
			Perceived Future Prospect	✓			✓	
			Perceived Benefits	✓	✓			
			Perceived Barriers	✓	✓			
			Financial Costs	✓	✓			
			Competitive Pressure	✓	✓		✓	✓
			External Factors	✓	✓		✓	✓
	EAI in the Healthcare Sector	Khoumbati , (2005)	Benefits	✓	✓			
			Barriers	✓	✓			
			Costs	✓	✓			
			Internal Pressures	✓	✓		✓	
			External Pressures	✓	✓		✓	
			IT Sophistication		✓			
			IT Infrastructure		✓			
			IT Support		✓			
			Evaluation Frameworks		✓		✓	
			Organisation Size	✓			✓	
			Telemedicine		✓			
			Physician and Administrators Relationship	✓		✓		✓
			Patient Satisfaction			✓		✓
			Security and Confidentiality	✓	✓		✓	
			Education	✓		✓		
			Compatibility		✓			

Table 2.4b: Classification of Factors that Support the EAI Adoption

In addition, Themistocleous (2002) studied the application of EAI in private and public organizations, proposed and validated a model, which explains factors influencing EAI adoption. This model includes factors like: (a) Cost, (b) Barriers, (c) Benefits, (d) External Pressures and (e) IT Infrastructure. In considering this, Themistocleous (2002) argued that issues related to the role that actors play during the adoption process should be investigated. This research has identified the role of actors, as it remains unexplored. Khoumbati (2005) applied the model proposed by Themistocleous (2002) and extended it based on a comprehensive literature review on health informatics. In doing so, he suggested that other factors, like medical (e.g. telemedicine) should be considered during the EAI adoption in the healthcare sector and proposed a model, namely MAESTRO. The MAESTRO model will be described and discussed in the following sections.

2.5.1 MAESTRO model for the EAI Adoption in Healthcare Organisations

The MAESTRO model was introduced, tested and validated, to investigate the factors that support the EAI adoption in the healthcare sector by Khoumbati, (2005). The factors/sub-factors that MAESTRO consists of, are presented in Figure 2.5, described and discussed in the following paragraphs. Further information regarding MAESTRO model is provided in Appendix E.

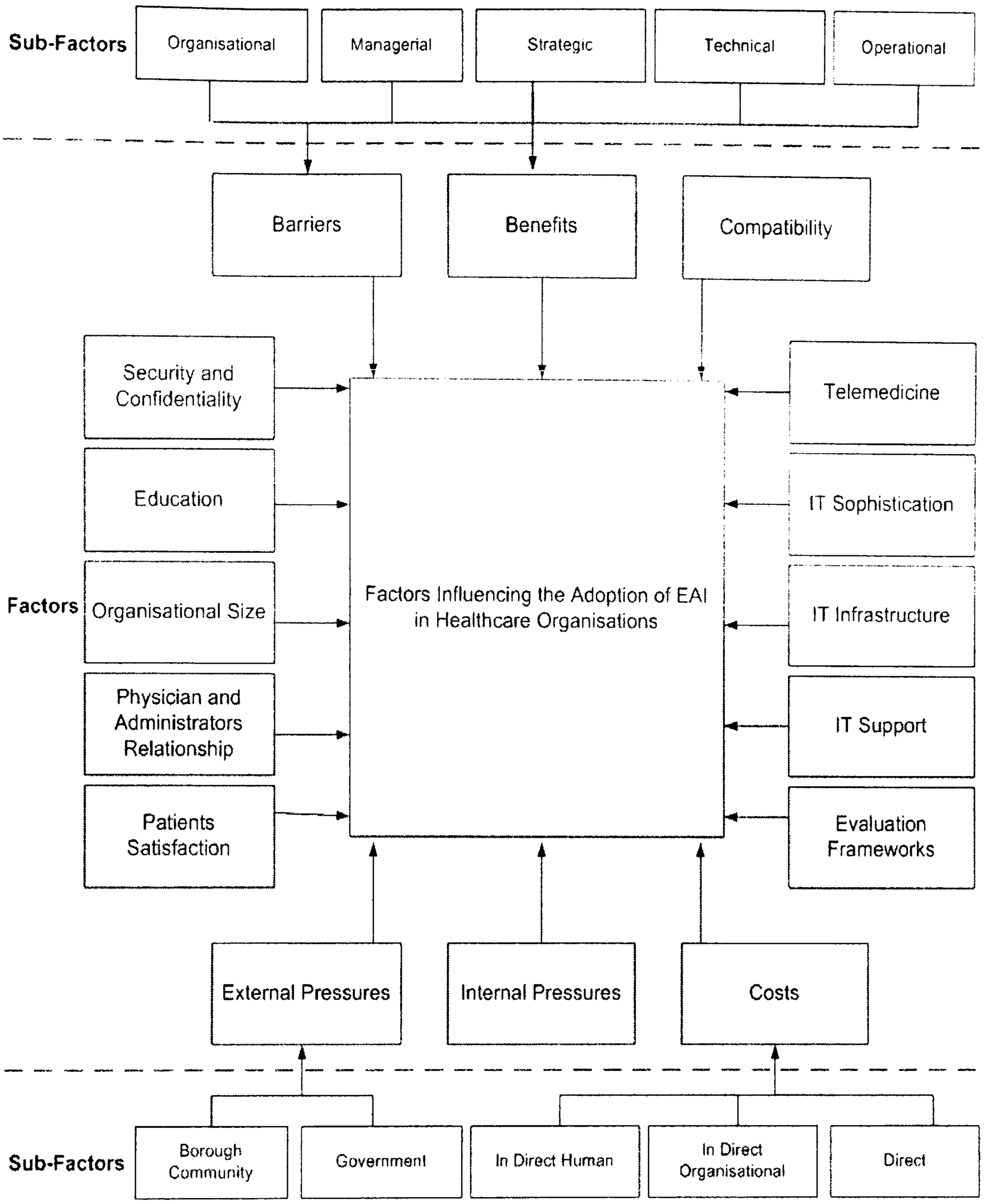


Figure 2.5: Factors that Support EAI Adoption in Healthcare Organisations (MAESTRO) – Source: Khoumbati, (2005)

Benefits:

This factor refers to the benefits that EAI can provide to the healthcare organisations. The most important EAI benefits have been identified and evaluated by Khoumbati, (2005) and classified into: (a) Operational; (b) Managerial; (c) Strategic; (d) Technical and (e) Organisational. These are presented in Table 2.5.

Benefits	Sub-Factors
Operational	Reduces information losses Increases performance Improves data quality Improves quality of patients care
Managerial	Reduces complexity Improves doctor-patient relationship Improves clinical decision- making Improves quality of patient care
Strategic	Supports to handle emergencies in time Improves discharge reporting process Avoids repeated tests and appointments
Technical	Supports reducing medical errors Simplifies referrals process
Organisational	Improves patient satisfaction Improves monitoring of drug usage Achieves clinical process integration

Table 2.5: EAI Adoption Benefits – Source: Khoumbati, (2005)

Barriers:

The adoption of EAI has been proved to cause barriers to healthcare organisations, such as operational, tactical and strategic. These barriers are considered before the organisation proceeds to the adoption of EAI. Khoumbati, (2005), classified the barriers in the following: (a) Organisational, (b) Managerial, (c) Strategic, (d) Technical and (e) Organisational, based on Shang and Seddon's (2002) classification. Moreover, Khoumbati, (2005) identified and evaluated the most important barriers affecting the EAI adoption in healthcare organisations. These are displayed in Table 2.6.

Barriers	Sub-Factors
Operational	Data authentication and consent issues Lack of specific security policy Design of clinical process Lack of common integration standards Lack of EAI skills
Managerial	Lack of standard medical terminologies Resistance to share information Lack of security rules Security and confidentiality concerns
Strategic	Cultural issues Lack of awareness of technology Lack of clinicians' and GPs' willingness Lack of communication between NHS and suppliers
Technical	Lack of EAI adoption benefits' realisation Difficulty in migrating from paper-work to electronic Physicians concerns about monitoring of practices as medical-legal issue
Organisational	High cost of security measures Threats from hackers Loss of autonomy fears of physicians

Table 2.6: EAI Adoption Barriers – Source: Khoumbati, (2005)

Compatibility:

Compatibility has been considered as a factor during the technology adoption process (Khoumbati *et al.*, 2006). Rogers (1983) defines compatibility as the degree to which an innovation is perceived as consistent with the existing values, past experience and needs of potential adopters.

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, (2005) proposed that Telemedicine affects the EAI adoption process in healthcare organisations.

IT Sophistication:

IT Sophistication is related to the level of technical expertise an organisation has (Khoumbati *et al.*, 2006). Furthermore, it influences the EAI adoption in the healthcare sector.

IT Infrastructure:

Healthcare organisations need to bridge together the heterogeneous HIS. The non-integrated nature of HIS adversely affects the services provided. Khoumbati *et al.*, (2004b) proposed that IT Infrastructure is a factor that influences the EAI adoption in healthcare organisations.

IT Support:

The consultants' and vendors' support is an additional factor that influences EAI adoption. Especially, in the healthcare sector, considerable amount of money is invested on the implementation of an integrated IT infrastructure and often healthcare organisations seek for consultants' support. Thus, this factor is considered as an influential parameter affecting EAI adoption in healthcare organisations.

Evaluation Frameworks:

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. The Evaluation frameworks Facilitate organisations to overcome the confusion regarding the selection of EAI technologies and packages. As a result, these Evaluation Frameworks are a factor that influence the adoption of EAI technology (Khoumbati, 2005).

Costs:

Cost appears to be a significant factor that influences the adoption of EAI in healthcare organizations (Khoumbati, 2005). A significant benefit of application integration is the reduction of overall integration costs (Puschmann and Alt, 2001). Therefore, the cost has been considered as an important factor for EAI adoption. Khoumbati (2005) classified costs affecting the EAI adoption in healthcare, into direct and indirect as it is presented in Table 2.7.

Costs		Sub-Factors
Direct		Hardware costs Software costs Maintenance costs Communication costs Consultancy costs
Indirect	**Human**	Training costs Staff-related costs Time for project team and external consultant Education Costs
	Organisational	Business process re-engineering costs Awareness costs Resistance to new systems Costs for Organization change management

Table 2.7: EAI Adoption Costs – Source: Khoumbati, (2005)

Internal Pressures:

Internal Pressures, such as technical and managerial affect the adoption process in healthcare organisations. Thus, they should be considered as an EAI adoption factor.

External Pressures:

The multiple healthcare actors such as patients, suppliers and insurance companies expect improved collaboration with organisations and enhanced provision of care. According to (Khoumbati, 2005) it should be considered as an EAI adoption influential factor.

Patient Satisfaction:

Multiple researchers have mentioned that Patient Satisfaction is a significant factor influencing adoption process (DoH, 2004; Lapointe et al., 2002). Khoumbati *et al.*, (2004b) proposed that Patient Satisfaction is a factor that influences the EAI adoption in healthcare organisations.

Physician and Administrators Relationship:

The relationship between physicians and administrators is an important factor influencing the EAI adoption in healthcare organisations. The physicians role has been characterised as crucial during the adoption of integrated technologies (Chan *et al.*, 2005; Stefanou and Revanoglou, 2006) as it can be a barrier during this process. Thus, it has been reported

that the administrators should consider physicians during the integration process (Khoumbati *et al.*, 2006).

Organisational Size: It has been reported that Organisational Size is a factor that affects the EAI adoption in healthcare organisations (Khoumbati *et al.*, 2006). Khoumbati, (2005) mentioned that the size of healthcare organizations can be described by the number of beds, total assets and number of personnel. However, the main measure used is the number of beds as the operational definition of size that influences the adoption of technological innovations.

Education: Along similar lines to the literature (Iacovou *et al.*, 1995), the education is strongly related to other parameters such as training and skills development (e.g. technical) (Bhattacherjee, 2000; Stefanou and Revanoglou, 2006).

Security and Confidentiality: The security and confidentiality of the patients' data is a factor that affects all the actors' decision making towards EAI adoption. This is according to the normative literature that suggests security and confidentiality is critical during the implementation and adoption of integrated solutions in a healthcare setting (Huston, 2001).

2.5.2 Discussion and Limitations of MAESTRO Model

The model proposed by Khoumbati, (2005) is based on a *factor-oriented approach* and *underestimates the multiple actors affecting the EAI adoption process*. In similar lines to Khoumbati, (2005), various studies have used factor models to analyse the adoption process. In doing this, these factor-oriented approaches can highlight important influences and identify critical issues that affect the adoption process. McMaster and Wastell, (2005) characteristically stated that:

> "...Many studies therefore seek to identify factors that facilitate or inhibit adoption, usually with a view to controlling these as far as it is believed such control is possible..."
>
> McMaster and Wastell, (2005, p.386)

On the contrary, multiple researchers, such as Kautz and Henriksen (2002), Robey and Boudreau, (1999), and McMaster and Wastell, (2005) have tried to explain and justify why these factor-oriented approaches are not sufficient to study the adoption process. In doing so, Kautz and Henriksen (2002) suggested that the explicit use of a factor-oriented approach is inefficient to support the IS adoption, as it is inadequate to describe the interactions among the various stakeholders influencing this process. Robey and Boudreau, (1999) stated that the factor approaches fail to capture the prosperous organisational dynamics that are affected by social contexts and time. In a more recent study, McMaster and Wastell, (2005) indicated that such factor-oriented approaches fail to capture the dynamic character of socio-technical innovations.

The normative literature suggests that individual actors (e.g. professionals) are critical in defining the success of IT adoption (Chan *et al.*, 2005). Chau and Hu (2002) stated that physicians have a significant role in introduction and use of IT. Wiley-Patton and Malloy (2004) pointed out that the adoption process is highly affected by actors. Healthcare actors are not passive acceptors of an idea, but they have an essential role during the adoption process. In support of this, Chen (2003a) recommended that actors should be considered and investigated along with other parameters affecting the decision making process. Moreover, Somers and Nelson (2004) studied Enterprise Resource Planning implementations and proposed that the six-stage ERP implementation stage model should be integrated with the factors' approach, as well as the key players (actors) to provide a more comprehensive research model for ERP implementations.

It appears that the actors involved in the adoption should be studied and analysed in relation to the influential factors. In doing so, their interrelations and roles should be identified and explained. Robey (1979) and Ginzberg and Zmud (1998) have studied the importance of actors' beliefs and attitudes and how these are affected and affect the factors influencing the innovations' adoption. Rogers (1995) proposed that the actors and the perceived characteristics of innovations have an impact on individual's adoption of IT. Thus, the factors identified in the past as influential to EAI adoption in healthcare organisations (MAESTRO model) as well as the healthcare actors that have been stated to be critical in studying this area (Somers and Nelson, 2004) should be investigated. Even if this issue has been highlighted before, there is a void in the relative literature related to the definition and identification of the healthcare actors. This will be analysed and discussed in Chapter 3 and a conceptual model will be proposed.

2.6 Conclusions

This chapter focuses on the description of the HIS and on the need for integration. Integration approaches followed by healthcare organisations are described and their benefits and barriers have been identified using the literature. According to the evaluation results, no single integration approach used by healthcare organisations has been proved to address all integration problems. On the contrary, there are evidences indicating that a new generation of software, called EAI can result in integrated healthcare IT Infrastructures and it can achieve this in a similar way to private and public organisations. Yet, EAI has not sufficiently been evaluated and studied in the healthcare sector and thus, further research has to be conducted on this area. Moreover, the adoption of EAI is a complicated process with many different influential factors (e.g. Costs, Barriers, Benefits, Internal Pressures, External Pressures, IT Infrastructure). The proposed approaches for EAI adoption are presented and their limitations are discussed (mainly the factor-oriented nature and the underestimation of human parameters). As the focus of this dissertation is on EAI adoption in healthcare organisations, the author presents and analyses in Table 2.8 the main limitation of MAESTRO model, using the normative literature.

	Limitation	Justification	Reference
MASTRO model Khoumbati, (2005)	Based on a Factor-Oriented Approach and underestimates the multiple actors affecting the EAI adoption process	Inefficient to support the IS adoption, as it is inadequate to describe the interactions among the various stakeholders influencing this process.	Kautz and Henriksen (2002)
		Fail to capture the prosperous organisational dynamics that are affected by social contexts and time. In a more recent study.	Robey and Boudreau, (1999)
		Fail to capture the dynamic character of socio-technical innovations.	McMaster and Wastell, (2005)

Table 2.8: Limitations of MAESTRO Model

To overcome the aforementioned limitation of MAESTRO model, the author suggests that the factor-oriented approach (followed by the MAESTRO model) should be mapped with the multiple healthcare actors, to increase the EAI adoption and better understand this area. The issue will be further explored in Chapter 3.

3

CHAPTER 3

CONCEPTUAL DEVELOPMENT

Summary

Chapter 2 highlighted some issues for further investigation. The main issues derived from Chapter 2 emphasised that: (a) the research in the area of Enterprise Application Integration (EAI) adoption in healthcare organisations remains limited, (b) the existing work (MAESTRO model) is based on a factor-oriented approach and underestimates the multiple actors affecting the EAI adoption process and (c) the factor-oriented approach should be combined with an actor-oriented. Thus, to address these issues, Chapter 3 derives and conceptualises a model that can be used to explain the adoption of EAI in healthcare organisations. The author uses the findings and literature reported in the previous chapter to further analyse the area under study. This is done with a particular focus on the research aim of this dissertation, as stated in Section 1.3. The proposed model attempts to contribute in the EAI adoption area, as it: (a) highlights the role of healthcare actors and attitudes towards EAI adoption, (b) introduces an actor-oriented approach and (c) combines the factors influencing EAI adoption with an actor-oriented approach.

3.1 Introduction

In Chapter 2, a critical review of the literature in the areas of Healthcare Information Systems (HIS) and EAI adoption was presented. As a result, the HIS, the need to integrate the heterogeneous HIS and the various integration approaches have been described. Yet, the integrated technologies that have been employed by healthcare organisations have not provided the expected level and quality of integration (Section 2.3.1). To overcome these integration problems, the literature suggests that Enterprise Application Integration should be used by healthcare organisations.

As, the aim of this dissertation is to *investigate the adoption of Enterprise Application Integration in healthcare organisations, by extending the established norms, using an actor-oriented approach,,* the author described various adoption approaches and focused on EAI adoption (Section 2.3). The adoption of EAI in healthcare organisations is a critical process, related to human lives and is affected by multiple actors that have different backgrounds and interests (Wiley-Paton and Malloy, 2004). In studying the EAI adoption in healthcare organisations, the author discussed the MAESTRO model, which was proposed by Khoumbati, (2005) and analysed its main limitation (Section 2.5).

The main limitation of MAESTRO is the fact that it is based on a factor-oriented approach and underestimates the crucial role of actors involved in the EAI adoption process. However, the healthcare actors should be understood and managed, as their role is important during the adoption process (Chen, 2003b). Thus, to overcome the limitations of MAESTRO, the author proposes that an actor-oriented approach should be combined with the factor-oriented approach, used by Khoumbati, (2005). To better understand the healthcare actors, it is proposed that they should be classified and identified. However, this is an area that requires further research (Vos and Achterkamp, 2006), as the literature remains limited and there are no structured methods that support the identification and classification of actors in healthcare organisations or other settings.

Hence, the author conceptualises a structured method to support healthcare actors' identification, named IGOHcaps (Part A of Conceptual Development). In Section 3.3 (Part B of Conceptual Development), the author attempts to piece together the factor and actor-oriented approaches and proposes a conceptual model to study the EAI adoption in healthcare organisations. This model combines the influential factors of MAESTRO

model (Figure 2.4) with the IGOHcaps method for healthcare actors' identification (Figure 3.2).

3.2 Role of Healthcare Actors in the EAI Adoption Process

In the healthcare sector, the adoption of IS is critical, as it is related to human lives and it is affected by multiple actors that have different backgrounds and interests (Wiley-Paton and Malloy, 2004). Healthcare actors often resist to the adoption of IS and they should therefore be managed as their role is important during the adoption process (Chen, 2003b).

It appears that the role of actors is considered to be of high importance during the Healthcare Information Systems adoption process (Chen, 2003b; Lehoux *et al.*, 2000; McGrath and More, 2001). To better manage healthcare actors, they should be initially defined and identified. Actors' identification will allow decision makers to better understand actors' views and role and therefore, take more informed decisions regarding the adoption of IS. However, the healthcare actors' definition and systematic identification is an area that requires further research (Vos and Achterkamp, 2006). In addressing this issue, the author introduces a structured method for actors' identification, which is called IGOHcaps. Therefore, the following issues should be addressed and investigated: (a) definition of healthcare actors, (b) proposition of a method that will support actors' identification, (c) identification of how these actors affect and/or get affected by the EAI adoption process and (d) mapping of actors and factors affecting the EAI adoption in healthcare organisations.

Hence, the author suggests that when exploring EAI adoption in healthcare, the mapping of actors against the factors provides a deeper understanding of such interrelationships. Thus, an actor-oriented approach might be considered when EAI is introduced to: (a) extend the current research in EAI adoption (MAESTRO model), (b) enhance the level of EAI adoption analysis and (c) support healthcare decision makers to adopt EAI. Hence, the author proposes the following research issue for further investigation:

> ***Factors and Actors Issue:*** *'Factors and actors should not be explored in isolation during the EAI adoption in healthcare organisations'.*

In an attempt to piece together these two approaches (factors and actors), there are numerous issues to be investigated. Among the first to be explored, is the identification of the healthcare actors that affect and are affected by the EAI adoption (actor-oriented approach). Therefore, in the following sections, the author: (a) addresses the aforementioned issues by reviewing and analysing the normative literature, (b) defines healthcare actors, (c) proposes IGOHcaps method for their identification and (d) combines this method with the proposed EAI adoption influential factors.

3.3 Deriving and Proposing the IGOHcaps method (Part A of Conceptual Development)

To identify healthcare actors involved in the EAI adoption process, the IGOHcaps method is grounded on the literature and consists of a static and dynamic approach. The former focuses on the definition of healthcare actors that can be considered as the first stage of actors identification (Vos and Achterkamp, 2006). While actors' definitions can provide a better understanding of healthcare actors, they (definitions) have some limitations. For instance, definitions: (a) offer simplistic views of IS (Lyytinen and Hirschheim, 1987), (b) provide generic lists of actors that are not appropriate for all contexts (Pouloudi and Whitley, 1997) and (c) do not provide practical guidelines for actors' identification. For that reason, the author combines the proposed definition (static approach) with a dynamic step to overcome these limitations.

3.3.1 Defining Healthcare Actors (Static Approach)

According to Chen, (2003b) actors have been defined as *individuals or organisations* that affect or are affected by IS applications. These views are shared by others like Miles and Huberman (1994a), Pouloudi and Whitley (1997) and Salmivalli and Nissilä (2004). These categories of actors should be studied during the adoption of a new technology, as it is essential to identify how the IS adoption affects and is affected by human relationships and organisational processes. The author recognises the existence of these

two lenses (*individuals or organisations*) but for the purpose of this dissertation, she will refer to them as *human* and *organisational*.

Thus, the following issue entitled the ***'Human and Organisational Issue'*** is proposed for further examination:

> ***Human and Organisational Issue:*** *'IS adoption in healthcare affects and is affected by human and organisational actors'.*

The ***Human and Organisational Issue*** contributes towards the understanding of the actors' nature (human and organisational). Such a classification may allow different strategies to be put into practice when focusing on the Human or Organisational lenses. For instance not the same strategies can be applied to support the adoption of IS by hospitals (organisations) and medical staff (human actors).

Since this issue focuses on the nature of actors (human and organisational), further research should be conducted to identify the actors' categories. In doing so, the author reviews the literature and identifies practical efforts that can support the classification of actors into more detailed categories. These efforts are summarized below:

- The National Health Service (NHS), in the UK, published a report that presented the benefits of Electronic Health Care Records (EHCR) on different actors (NHS, 1993). The report identified three different "worlds" that will be affected by EHCR use. In particular worlds (categories) of actors were identified as: (a) Patients (Patients, Next of Kin), (b) Clinicians (Clinicians, Non-Clinicians, responsible Clinician, a healthcare facility and Clinical Student) and (c) third parties (Controller, Technologist, Administrator, Legal Professional).

- Siau *et al.*, (2002) studied the benefits of decision support and internet applications on the different healthcare actors. According to their study, healthcare actors were classified as: (a) providers and, (b) consumers. Similarly, to study the Internet use in healthcare organisations, Siau (2003) mentioned that the internet can be used to link Hospitals', Suppliers' (Insurance, Pharmaceutical companies), Physicians' and Patients' operations.

- The impact of IS on pharmaceutical companies has been studied in relation to actors. Houghton (2002) initially identified empirically which actors interact with IS. The actors had been classified into: (a) Payers, (b) Providers, (c) Practitioners and (d) Patients.

Based on these efforts, the author proposes that the following issue (***Actors' Categorisation Issue***) should be investigated:

> ***Actors' Categorisation Issue:*** *'Healthcare actors can be categorised into: (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 (DoH, 2004), the author places the acceptors (patient's world) in the centre of this categorisation (Figure 3.1).

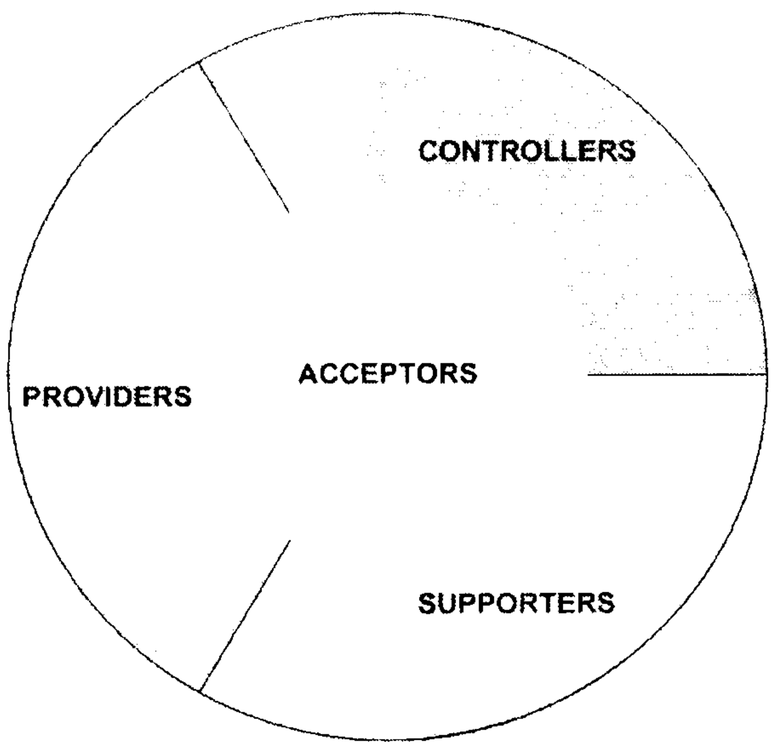


Figure 3.1: Proposed Categories of Healthcare Actors

The author suggests that the combination of the ***Human and Organisational*** and the ***Actors' Categorisation Issues*** can be used to define healthcare actors. Based on this combination, a definition for healthcare actors ***(Actors' Definition Issue)*** is proposed for further research:

> ***Actors' Definition Issue:*** *'The healthcare actors involved in the adoption of IS can be defined as: any human and/or organisation that accepts, provides, supports or controls healthcare services'.*

As discussed in the beginning of this section, the proposed definition ***(Actors' Definition Issue)*** can be considered as the first step towards the development of IGOHcaps structured method for the identification of healthcare actors.

This first step towards healthcare actors' identification can be characterised as ***static***, since it identifies a standard number (four) of human and organisational categories of healthcare actors. In an attempt to overcome these limitations the author proposes a more detailed and ***dynamic*** identification of the actors participating to the IS adoption process. According to Pouloudi, (1998), actors' identification should be dynamic, iterative and interpretive. Such a dynamic approach will address the unsteadiness of organisational reality, the changing roles of actors and the multiple perceptions about actors and their roles respectively. Therefore, the author suggests the following ***Mix Approach Issue*** for further investigation:

> ***Mix Approach Issue***: *'The static and dynamic approaches can be combined to support the identification of healthcare actors'.*

3.3.2 Identifying Healthcare Actors (Dynamic Approach)

IGOHcaps seeks to define, categorise and provide the guidelines to support the identification of healthcare actors in a dynamic healthcare environment. This section focuses on the ***dynamic*** approach (guidelines) to support the identification of healthcare actors and it is grounded on the published literature. In doing this, the author reviewed the normative literature and identified that during the last two decades few efforts have been made to identify healthcare actors. These are based on the *principles* introduced by Pouloudi and Whitley (1997) or the *dimensions* proposed by Lyytinen and Hirschheim (1987), which are be explained below:

- ***Principles*** (Pouloudi and Whitley, 1997): In particular, the first principle suggests that all actors depend on a specific context and time frame. For this reason, the actors' categorisation proposed by Pouloudi (1998) can not be used since it refers to a different context (NHSnet) and time frame. Thus, a detailed identification of the healthcare actors involved in EAI adoption is proposed by the author. The second principle recommends that the interrelationships among

actors should be investigated too. In addition, it has been stated that the actors' roles change over time (principle 3). For example, a human might be at the same time an acceptor (e.g. patient) and provider (e.g. doctor) of healthcare services. According to the fourth principle, actors have different agendas and goals, as they have dissimilar interests. This signifies that actors might have conflicting interests, which affect the EAI adoption. For example, patients always support technologies that result in the provision of better healthcare services whereas doctors usually resist to the adoption of IT solutions (Anderson, 1997). Thus, it is fundamental to identify the multiple actors and their views regarding the introduction of EAI.

- ***Dimensions*** (Lyytinen and Hirschheim, 1987): These dimensions offer some guidance for actors' identification. The first one focuses on the nature of software system under implementation. This dissertation deals with the integration of intra and inter-organisational HIS. Similarly to the fourth principle proposed by Pouloudi and Whitley (1997), the second dimension highlights the need to study internal versus external actors, as they have different interests and political agendas. Moreover, Lyytinen and Hirschheim, (1987) recommended that the actors' roles should be acknowledged. This is in accordance to the third principle proposed by Pouloudi and Whitley (1997). In the last two dimensions, the depth of impact and level of aggregation should be identified.

The author acknowledges that both principles and dimensions support the identification of actors. However, the author suggests that these two efforts should be combined as the exclusive use of the one or the other effort may not capture all the healthcare actors (Table 3.1).

Proposed Guidelines for Healthcare Actors' Identification		Proposed by:	Used in the Healthcare Area by:
Principles	**G1**: Actors depend on the specific context and time frame	Pouloudi and Whitley, (1997)	Hu *et al.*,(2000) Lapointe *et al.*,(2002)
	G2: Actors can not be viewed in isolation		Hu *et al.*,(2000)
	G3: The position of each actor may change over time		Mantzana and Themistocleous,(2004)
	G4: Feasible options may differ from the actors' wishes		Mantzana and Themistocleous, (2005)
Dimensions	**G5**: The nature of the IS to be adopted	Lyytinen and Hirschheim, (1987)	Menachemi *et al.*,(2004)
	G6: Internal versus external actors		Mantzana and Themistocleous, (2005)
	G7: The type of relationship to the system		Menachemi *et al.*,(2004)
	G8: Depth of impact		Menachemi *et al.*,(2004)
	G9: Level of aggregation		Lapointe *et al.*,(2002) Gagnon *et al.*,(2004)

Table 3.1: Proposed Guidelines for Healthcare Actors Identification

Since these efforts were explained and analysed in the literature, it is not the author's intension to explain them. The combination of the aforementioned efforts leads to the proposition of the ***Guidelines Issue*:**

> ***Guidelines Issue*:** *'The guidelines presented in Table 3.1 support the actors' identification during the dynamic step'.*

3.3.3 IGOHcaps Method: Combining the Static and Dynamic Approaches

In Table 3.2, the author summarises the issues proposed in the previous sections for further investigation. These issues are considered as the main constructs of the proposed IGOHcaps method for the identification of healthcare actors involved in IS adoption (Figure 3.3).

Proposed Issues for Investigation of IGOHcaps Method	
Issue	**Description**
Human and Organisational	IS adoption in healthcare affects and is affected by human and organisational actors
Actors' Categorisation	Healthcare actors can be categorised into: (a) Acceptors, (b) Providers, (c) Supporters and (d) Controllers
Actors' Definition	The healthcare actors involved in the adoption of IS can be defined as: 'any human and/or organisation that accepts, provides, supports or controls healthcare services'
Mix Approach	The static and dynamic approaches can be combined to support the identification of healthcare actors
Guidelines	The 9 guidelines presented in Table 3.1 support the actors' identification during the dynamic step

Table 3.2: Proposed Issues for Investigation of IGOHcaps Method

The proposed IGOHcaps is presented in Figure 3.2 and indicates that healthcare actors involved in the adoption process can be defined ***(Actors' Definition Issue)*** as any human and/or organisation (***Human and/or Organisational Issue)*** that accepts, provides, supports and controls ***(Actors' Categorisation Issue)*** healthcare services (static step). This static step should be combined with the dynamic to enhance the actors' identification process ***(Mix Approach Issue)***. The dynamic step consists of a set of guidelines ***(Guidelines Issue)*** that can be used to identify a full range of actors.

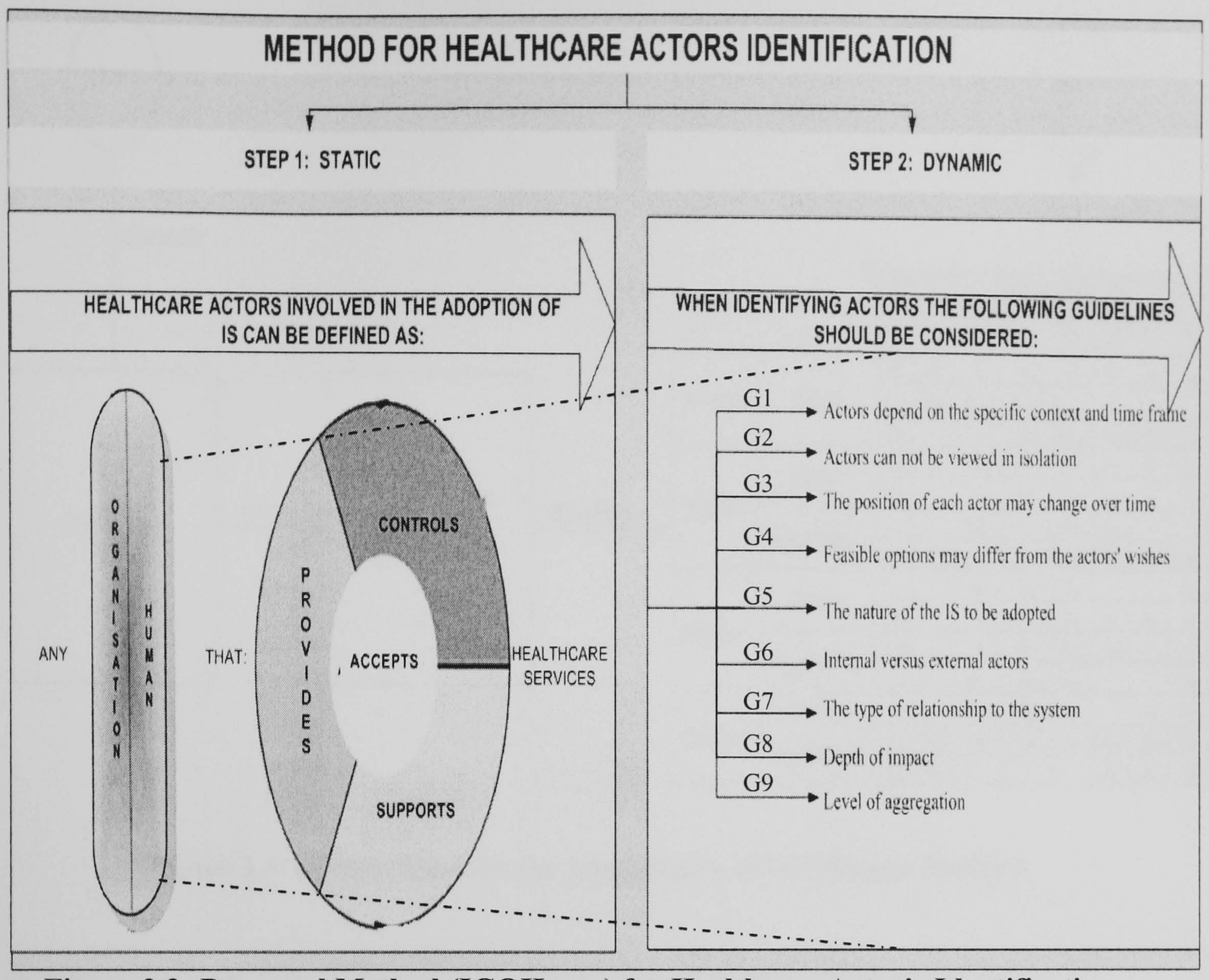
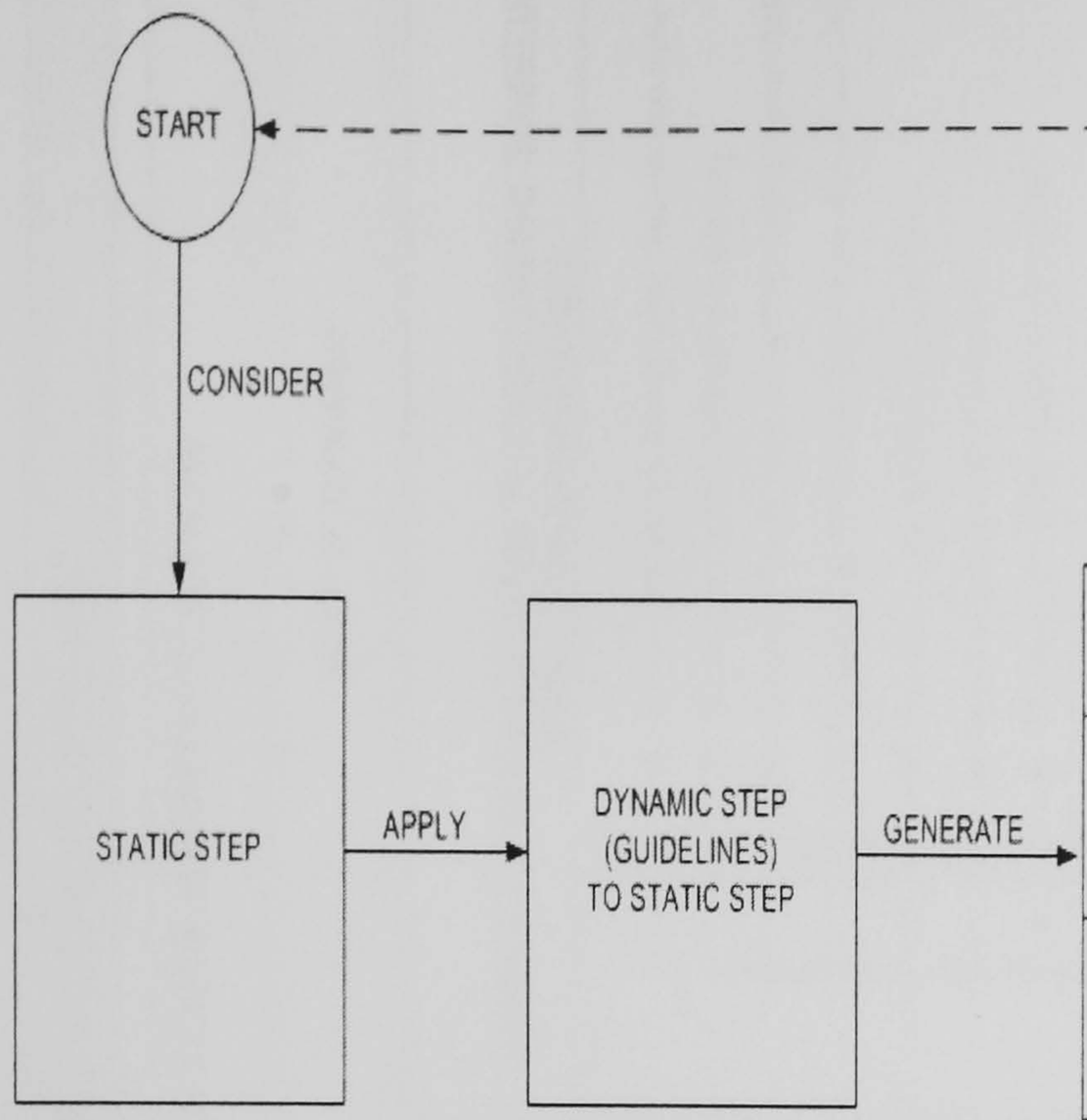


Figure 3.2: Proposed Method (IGOHcaps) for Healthcare Actor's Identification

When applying this method, the static step (definition) should be considered before the dynamic. Then each of the guidelines should be applied to each of the proposed Human and/or Organisational categories (static step) individually (e.g. Human Acceptors, Human Supporters etc). In doing so, a list of healthcare actors is generated and then evaluated in the case study, as the full actors' list depends on the specific context and timeframe. The aforementioned instructions, on the way that IGOHcaps method should be applied in the practical arena are displayed in Figure 3.3.



Proposed Guidelines									
		G1	G2	G3	G4	G5	G6	G7	G8	G9
Acceptor	Human	A_1	A_2	A_3	A_4	A_5	A_7	A_8	A_9	A_{10}
		A_{11}	A_{12}	A_{13}	... A_N	-	-	-	-	A_8
		A_4	-	-	A_1	A_{12}	A_{10}	A_{10}	A_{10}	-
Provider	Human	A_4	-	A_3	A_3	A_3	A_N	A_1	A_1	-
		A_4	-	A_3	A_3	A_3	A_{12}	A_1	A_1	A_N
	Organisational	-	-	A_{12}	-	A_{12}	A_N	-	-	-
		A_1	A_1	-	-	A_6	A_6	A_6	A_6	A_6
Supporter	Human	-	-	A_N	A_N	A_N	-	-	A_N	A_{12}
		A_N	-	-	A_4	A_4	A_2	A_2	A_2	
	Organisational	A_{12}	-	A_{12}	A_{10}	A_{10}	A_{10}	-	-	-
		-	-	A_1	A_1	A_{12}	-	-	A_N	A_{12}
Controller	Human	-	-	A_N	A_N	-	-	A_3	A_3	A_3
	Organisational	A_3	A_3	A_8	A_8	A_8	A_{12}	A_3	A_3	A_3
		A_3	A_3	-	-	-	A_1	A_1	A_N	A_N

Figure 3.3: Instructions for the Application of IGOHcaps Method

3.4 Factors and Actors involved in EAI adoption (Part B of Conceptual Development)

The role of actors is considered to be of high importance during the EAI and Healthcare Information Systems adoption process. As a result, the author proposes that when exploring EAI adoption in healthcare, the mapping of actors against the factors provides a deeper understanding of such interrelationships. Thus, an actor-oriented approach might be considered during the EAI adoption process to: (a) overcome main limitation of the current research in EAI adoption, (b) improve the level of analysis and (c) support healthcare decision makers when adopting EAI.

To this end, the author proposes that to study the EAI adoption in healthcare organisations, the two approaches (factors and actors) should be integrated. In doing so, the influential factors of MAESTRO model (Figure 2.5), as well as the IGOHcaps method for healthcare actors' identification (Figure 3.2) should be combined. This is illustrated in Figure 3.4.

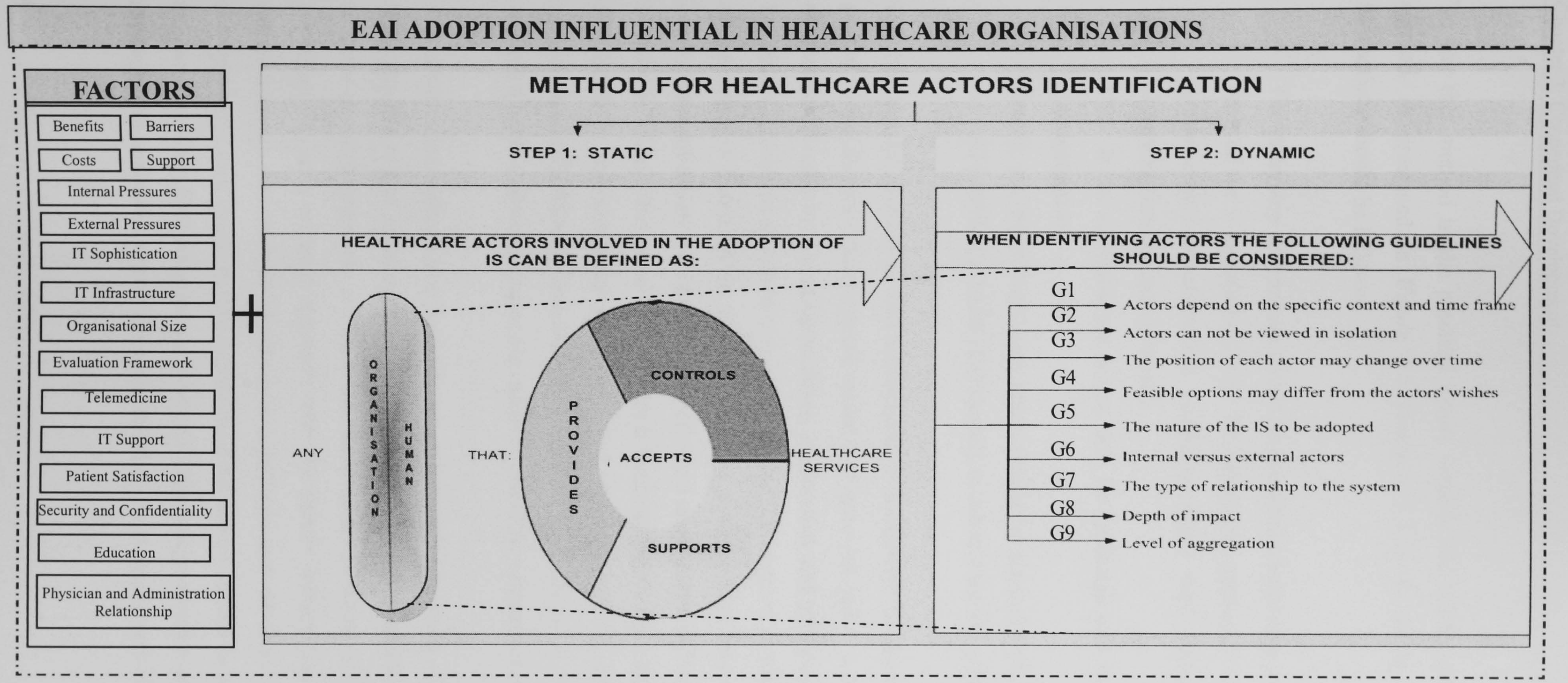


Figure 3.4: Proposed Conceptual Model

To use this method in the practical arena, initially the IGOHcaps method should be applied, as presented in Figure 3.3 (Section 3.3.3). In doing this, the following instructions should be followed:

- The static step (definition) should be considered before the dynamic.
- Each of the 9 guidelines (Table 3.1) should be applied to each of the proposed human and/or organisational categories (static step) individually (e.g. human acceptors, human supporters etc).
- Thus, a list of healthcare actors will be generated and then evaluated in the practical arena
- Finally, the list of healthcare actors should be mapped with the factors affecting the EAI adoption (MAESTRO model), to achieve the aim of this dissertation.

In following the aforementioned instructions, it is expected to identify which actors are related to the factors. The proposed model in Figure 3.4 makes a novel contribution at two levels. Firstly, at a conceptual level, it identifies and proposes a classification of healthcare actors that should be considered during the adoption of EAI. The identification of the actors is based on the theoretical works conducted by others in this area. As a result, the justification and identification of actors is grounded in the normative literature. In addition to this, the model incorporates influential factors reported in previous studies (MAESTRO) and combines them with the proposed method for healthcare actors' identification (IGOHcaps). Secondly, at a practical level, the proposed model contributes towards a better understanding of the research area (EAI adoption in healthcare).

This dissertation makes a step forward and contributes to the body of knowledge as it: (a) highlights the role of healthcare actors and attitudes towards EAI adoption, (b) introduces an actor-oriented approach, (c) identifies those actors involved in this process and (d) combines the actor-oriented approach with the factors influencing EAI adoption. The author believes that such an approach is significant and novel as it: (a) facilitates the multiple healthcare actors in the realization of the factors related to the EAI adoption, (b) enhances existing EAI adoption models by incorporating an actor-oriented analysis and (c) facilitates healthcare organisations in making robust decisions for EAI adoption.

3.5 Conclusions

To overcome the limitation of the MAESTRO model, the author reviews the normative literature and proposes that the factor-oriented approach should be mapped with the multiple healthcare actors, to speed up the EAI adoption and increase the understanding in this area. Even if this issue has been highlighted before, there is a void in the relative literature related to the deficient involvement and identification of healthcare actors in the adoption process.

Thus, a structured method that supports the healthcare actors' identification (IGOHcaps) is conceptualised and proposed for further investigation (Part A of Conceptual Development). IGOHcaps method is grounded on literature and consists of two steps, namely static and dynamic to support the healthcare actors' identification. Furthermore, in piecing together the factor and actor-oriented approaches, a conceptual model to study the EAI adoption in healthcare organisations is proposed (Part B of Conceptual Development). This model combines the influential factors of MAESTRO model (Figure 3.1) with the IGOHcaps method for healthcare actors' identification (Figure 3.3). In testing this model in the practical arena, the author proposed six research issues, which are presented and summarised in Table 3.3.

Proposed Issues For Further Investigation	
Issue	**Description**
Factors and Actors	Factors and actors should not be explored in isolation to one-another during the EAI adoption in healthcare organisations
Human and Organisational	IS adoption in healthcare affects and is affected by human and organisational actors
Actors' Categorisation	Healthcare actors can be categorised into: (a) Acceptors, (b) Providers, (c) Supporters and (d) Controllers
Actors' Definition	The healthcare actors involved in the adoption of IS can be defined as: 'any human and/or organisation that accepts, provides, supports or controls healthcare services'
Mix Approach	The static and dynamic approaches can be combined to support the identification of healthcare actors
Guidelines	The 9 guidelines presented in Table 3.1 support the actors' identification during the dynamic step

Table 3.3: Proposed Issues for Further Investigation

In Chapter 4, the author presents the research methodology used to test the aforementioned model and issues proposed for investigation.

4

CHAPTER 4

RESEARCH METHODOLOGY

Summary

In Chapter 3, the conceptual model related to the factors and actors affecting the Enterprise Application Integration (EAI) adoption in healthcare organisations was proposed and described. In this chapter, the author based on the aim of this research, develops an argument for the selection of a suitable research methodology. While, researchers in the Information Systems (IS) field have to choose among multiple methods, approaches and techniques, the normative literature needs to be reviewed. This review leads to the justification for the selection of the interpretivism qualitative epistemological research stance for the purpose of theory testing. Moreover, justification for the selection and use of the multiple case studies research strategy is provided. Then, the author proposes and analyses the empirical research methodology, which consists of three interrelated parts, namely: (a) research design, (b) case study / data collection and (c) case study / data analysis. Finally, the research protocol that was employed to conduct this research is presented and analysed and conclusions are provided.

4.1 Introduction

The purpose of this chapter is to describe the methodology followed in this dissertation. The IS research is characterised by methodological pluralism and the selection of an appropriate research methodology is a topic that attracts researchers' attention (Galliers, 1994; Miles and Huberman, 1994b; Yin, 1994). Moreover, Galliers (1992) stated that the study of information systems is a complex topic, and very much a social, rather than a wholly technical subject. Therefore, a researcher in the IS field has to choose among a variety of research methods, approaches and techniques to develop an appropriate research framework.

In Chapter 4, the author presents the research methodology followed in this dissertation for the examination of issues under research, as these have been presented in Chapters 2 and 3. To construct an appropriate research framework, the author adopted an interpretive research approach as the most appropriate. Interpretive research is commonly used as it can support and enhance the understanding of complex IS phenomena (Walsham, 1995a). Therefore, in the light of the knowledge gained and the issues raised in the preceding chapters, the author discusses an appropriate research approach choice in Section 4.2, whereas in Section 4.3 the philosophical perspective of this research is presented. Thereafter, the empirical research methodology, the justification for the selection of a case based research strategy and this dissertation's research protocol are analysed.

4.2 Research Approach

Information Systems have been characterised as social systems of which Information Technology is one aspect (Land, 1992). Information Systems is a multi-disciplinary endeavour, and it has been reported that it is unlikely that there is a universal IS research approach, which can include all the domains of knowledge needed for the study of Information Systems (Galliers, 1992). Thus, the selection of an appropriate research approach that can support the study of Information Systems is one of the most difficult and critical decisions for a researcher.

In this section, the selection and justification of a quantitative or qualitative research approach is made, based on the aim and objectives of this research, as these are reported in Section 1.3. The aim of this research focuses on the investigation of EAI adoption in healthcare organisations, by extending the MAESTRO model using an actor-oriented approach (Figure 3.5). Thus, it appears that this research is based on the understanding of different variables, such as people and technology. In doing so, the author reviewed the normative literature and in the following paragraphs justifies the reasons behind the adoption of a qualitative research approach.

4.2.1 Justifying the Selection of Qualitative Research Approach

Qualitative research is described as one that is based upon words, rather than numbers (Miles and Huberman, 1994b). Van (1983) defines qualitative methods as follows:

> "*Qualitative research is an array of interpretive techniques which seek to describe, decode, translate and otherwise come to terms with the meaning, not the frequency of certain more or less naturally occurring phenomena in the social world*"
>
> Van, (1983, p. 9).

Denzin and Lincoln, (1994) mentioned that qualitative research is a multi-method in focus and employs a naturalistic approach. Benbasat *et al.*, (1987a) supports that qualitative research can provide various benefits, such as: (a) allows the researcher to understand the nature and complexity of the process being examined, (b) provides

insights into new research areas and (c) supports the examination of a phenomenon in its natural setting.

On the contrary, **quantitative research** is directed towards the development of testable hypotheses and theory that can be generalised across settings. In the quantitative research the data gathered is usually numerical and it does not consider the dissimilarities between human beings and objects of the natural sciences. To highlight the importance of qualitative over quantitative research, Kaplan and Duchon (1988) state that the goal of understanding a phenomenon from the participants' point of view and its particular social and institutional context is largely lost when textual data are quantified.

The distinguishing difference between qualitative and quantitative research is the number of organisational units involved, the type of questions asked and the research's length of time (Benbasat *et al.*, 1987b). The aforementioned discussion justifies the selection of the qualitative research approach, as the more appropriate one for this dissertation. In doing this, the researcher can: (a) investigate little-known and complex phenomena like understanding and analysing EAI adoption in healthcare organisations, (b) analyse and understand the role of healthcare actors during the EAI adoption, (c) examine the phenomenon in its natural setting and, (d) learn from practice (Miles and Huberman, 1994b). Thus, the author proposes that a qualitative approach should be used to conduct this research, as it allows close involvement of the researcher, resulting in a considerable insight into the events and actions (Benbasat *et al.*, 1987b).

4.3 Philosophical Perspective

The selection of an appropriate epistemological stance is an important and complicated task during the research process (Walsham, 1995). Orlikowski and Baroudi, (1991) identified three categories of epistemological stances, namely: (a) positivist, (b) interpretive and (c) critical. These are described and discussed in the following paragraphs.

4.3.1 Justifying the Selection of Philosophical Perspective

Positivist studies have been considered as the basis for all the others and are based on the premise of a realistic ontology. Positivist studies test theory in an attempt to increase the predictive rather than developing descriptive understanding of the phenomenon under research (Walsham, 1995). Positivists act usually as observers. They establish quantifiable measures of variables, hypotheses testing, and make statistical generalizations (Orlikowski and Baroudi, 1991).

Interpretive studies have emerged in the IS field, partly in response to the recognized failings of positivism approach. According to the interpretivists, the truth can be fully identified and understood, through subjective interpretations (Davison, 1998). Interpretive studies attempt to understand a phenomenon by accessing the meanings that participants assign to them (Orlikowski and Baroudi, 1991; Walsham, 1995). Interpretive studies make the epistemological assumption that reality is subject to multiple interpretations, and can not be studied objectively to establish a truth.

In **critical studies** the main task is the social critique, whereby the restricted conditions of the status quo are brought to light (Hirschheim and Klein, 1994). Critical studies assume that the social reality is produced and reproduced by people. It has been suggested that critical research consists of two major tasks, which are the following: (a) to investigate the nature of phenomena at local levels and (b) to critique assumptions that are taken for granted (Alvesson and Deetz, 2000).

The aforementioned epistemological stances have an impact on the empirical research strategy and have been widely discussed and analysed. The selection of a research approach and method is a critical research task. Gill and Johnson (1991) proposed that researchers should adopt an approach that allows them to get close to participants and penetrate their internal logic. Evidence from the IS literature indicated that the positivism approach has been the most frequently used epistemology in IS research (Galliers, 1992; Miles and Huberman, 1994b; Walsham, 1995; Yin, 1994). When conducting a positivist study, the researchers are perceived as observers and establish mainly quantifiable measures of variables. Positivist studies assumed that observations of the phenomena under investigation can be made objectively and rigorously (Galliers, 1994) and this is their main disadvantage. However, while applying an interpretive research stance, the

researchers gain knowledge by participating in the empirical study (Irani *et al.*, 1999). The research presented herein is not based on quantifiable measures of variables, so the positivism approach can not support it. Moreover, many issues, such as people and technological are related to this dissertation, so there is a need for a more subjective research method to be used.

Given the complex and busy nature of healthcare organisations, the author attempted to understand the social world, by adopting an interpretive perspective, as the aim of this research is to investigate the adoption of EAI in healthcare organisations, by using an actor-oriented approach. To reflect upon the aim of this dissertation, and to evaluate the proposed conceptual model (Figure 3.3), an interpretive stance was adopted, as it supports: (a) an enhanced navigation and explanation of the phenomenon in its organizational setting (Walsham, 1995) and (b) the analysis of issues related to causality and human purpose (Pouloudi, 1998).

4.4 Research Strategy

Having already justified the adoption of a qualitative interpretive research method, this section focuses on the selection of the appropriate research strategy. Galliers (1992) stated that a research strategy is the means of going about one's research, adopting a particular style and different research methods for data collection. Multiple research strategies can be applied to test the IGOHcaps method, such as: (a) experimental, (b) survey, (c) case study or (d) action research. These are described and discussed below and justification for the selection of a case study is provided.

4.4.1 Justifying the Selection of Case Study Research Strategy

During the **Experimental Research,** the researcher controls the environment that should be observed and analysed. This research has roots in scientific practice of biologists and physicians, where variables are manipulated over time, associated numeric data collected, and causal or correlation models tested through statistical analysis. The main limitation is that the experimental situation is oversimplified and isolated from most variables identified in the real world. The **Survey** has its roots in work of economists and sociologists. The researcher is trying to validate models and hypotheses, by using

questionnaires, which are quantitatively analysed. A **Case Study** has its roots in business studies and is used to build up or validate models or theories. The data collection is typically made through interviews. The researcher captures the 'reality' in greater detail through the case study. However, it is difficulty to generalise the data retrieved. Finally, the **Action Research** has its origins to socio-psychological studies and work-life issues. The researcher is trying to improve organisation and participate in research projects.

For the purpose of this study, a case based strategy through the employment of qualitative research approach was considered as it supports the investigation of: (a) little-known phenomena (e.g. actors identification in healthcare) and (b) complex processes (IS adoption) in their natural setting. Yin, (1994) mentions that the researcher, in order to structure case studies should: (a) identify specific research questions (issues) before conducting research and (b) do the fieldwork systematically according to a planned schedule. Klein and Myers, (1999) mentioned that the case study is a valid strategy and can be used in IS research field. Reality can be easier identified by an observer-researcher than is typically possible in experimental and survey research (Davison, 1998).

4.5 Case Studies

A qualitative case based strategy, can offer a 'holistic' view of the processes involved, as well as a realisation of the topic under research (Zmud *et al.,* 1989). A case study can be considered as a rigorous examination of a phenomenon in its natural setting and it employs multiple data collection methods, such as: (a) interviews, (b) observation, (c) questionnaires and (d) written material (Yin, 1994). The author reviewed the literature and identified different types of case studies, which are displayed in Table 4.1and analysed below.

Criteria	Type of Case Study	Reference
Theoretical Aim of Case Study	Exploratory Descriptive Explanatory	Yin (1994)
Number of Case Studies	Single Multiple	Yin (1994)

Table 4.1: Case Studies Types

Yin (1994) distinguishes three types of case studies, namely: (a) exploratory, (b) descriptive and (c) explanatory. During an exploratory case study, the researcher aims to answer *what* is happening, to look for new insights and to raise questions. In doing this, the researcher conducts a literature review, discusses and interviews experts (Saunders *et al.*, 2000). The descriptive case study is based and guided by a theory. This theory is proposed before the data is collected and analysed. When conducting an explanatory case study, the researcher is trying to identify cause-and-effect relationships, to search for explanatory theories and answer *why* questions of the phenomenon under research. Thus, the author proposes that an exploratory case study should be used in this research.

Moreover, a case study can be: (a) single or (b) multiple. A single case provides extensive information of a single organisational case. Irani *et al.*, (1999) stated that single case design supports the researcher to analyse a phenomenon in detail. Yin (1994) suggests that single-case studies are applicable in a case that is: (a) revelatory (e.g., it is a situation previously inaccessible to scientific investigation), (b) critical for testing a well-formulated theory and (c) unique. However, a single case may not offer adequate data to support the justification and explanation of the factors and actors affecting the EAI adoption. Therefore, in the light of the characteristics of this research, a single case study will not be appropriate. Conducting multiple case studies is desirable when the research intends to describe, build and test theory. The application of multiple case studies supports the in-depth and cross-checked examination and analysis of research findings (Benbast *et al.*, 1987). Moreover, the theory tested can be extended and more general research results can be obtained. Hence, to study the EAI adoption in the critical healthcare setting, the author proposes that an exploratory multiple case study strategy should be employed.

4.5.1 Justifying the Cases Selection

While employing a multiple case study strategy, the justification of the cases selection is an important issue. Ragin, (1999) mentioned that the cases selection is based on their substantive significance or theoretical relevance. In the literature there is indistinctness related to the number of cases that should be used by researcher. Bassey (1981) proposed some criteria that should be considered while choosing the number of cases, who

suggested that the value of a case study is the extent to which the case details are sufficient for others in similar situations.

In the context of the research presented in this dissertation, two case-organizations (HOSPITAL_UK and HOSPITAL_GR) were studied. The researcher therefore employed multiple cases studies as suggested by Bassey (1981). The main reasons for selecting these cases are the following: (a) both healthcare organisations have world-wide reputation on the specialized care services they provide, (b) both HOSPITAL_UK and HOSPITAL_GR adopt EAI and (c) they are based in different countries. The data collection process was carried out until enough data were collected to test the issued under research, and stopped only when additional data collection provided 'non-value'. In Figure 4.1, the author presents the timeline of the research conducted in the two organizations selected.

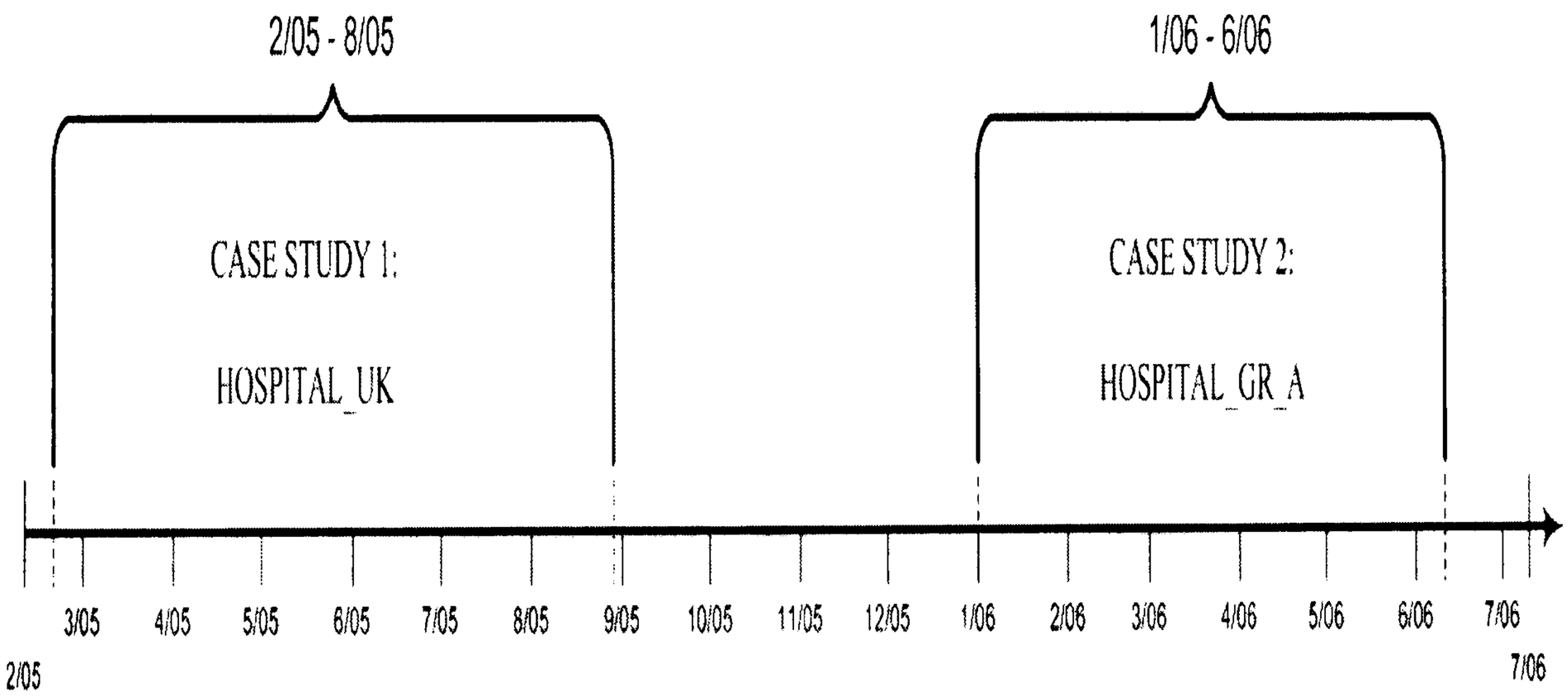


Figure 4.1: Research Timeline

4.6 Empirical Research Methodology

The author has developed an empirical research methodology that acts as the blue print for the research process, to evaluate the proposed conceptual model and the following issues related to the EAI adoption in healthcare organisations:

- **Factors and Actors Issue:** "Factors and actors should not be explored in isolation to one-another during the EAI adoption in healthcare organisations",

- **Human and Organisational Issue:** "IS adoption in healthcare affects and is affected by human and organisational actors",

- **Actors' Categorisation Issue:** "Healthcare actors can be categorised into: (a) Acceptors, (b) Providers, (c) Supporters and (d) Controllers",

- **Actors' Definition Issue:** "The healthcare actors involved in the adoption of IS can be defined as: 'any human and/or organisation that accepts, provides, supports or controls healthcare services",

- **Mix Approach Issue:** "The static and dynamic approaches can be combined to support the identification of healthcare actors" and

- **Guidelines Issue:** "The guidelines presented in Table 3.6 support the actors' identification during the dynamic step".

The proposed empirical research methodology takes into account the case variants discussed and justified in the previous sections. Moreover, this methodology is based on three development stages namely: (a) research design, (b) case study / data collection and (c) case study / data analysis (Jankowicz, 2000) and presented in Figure 4.2.

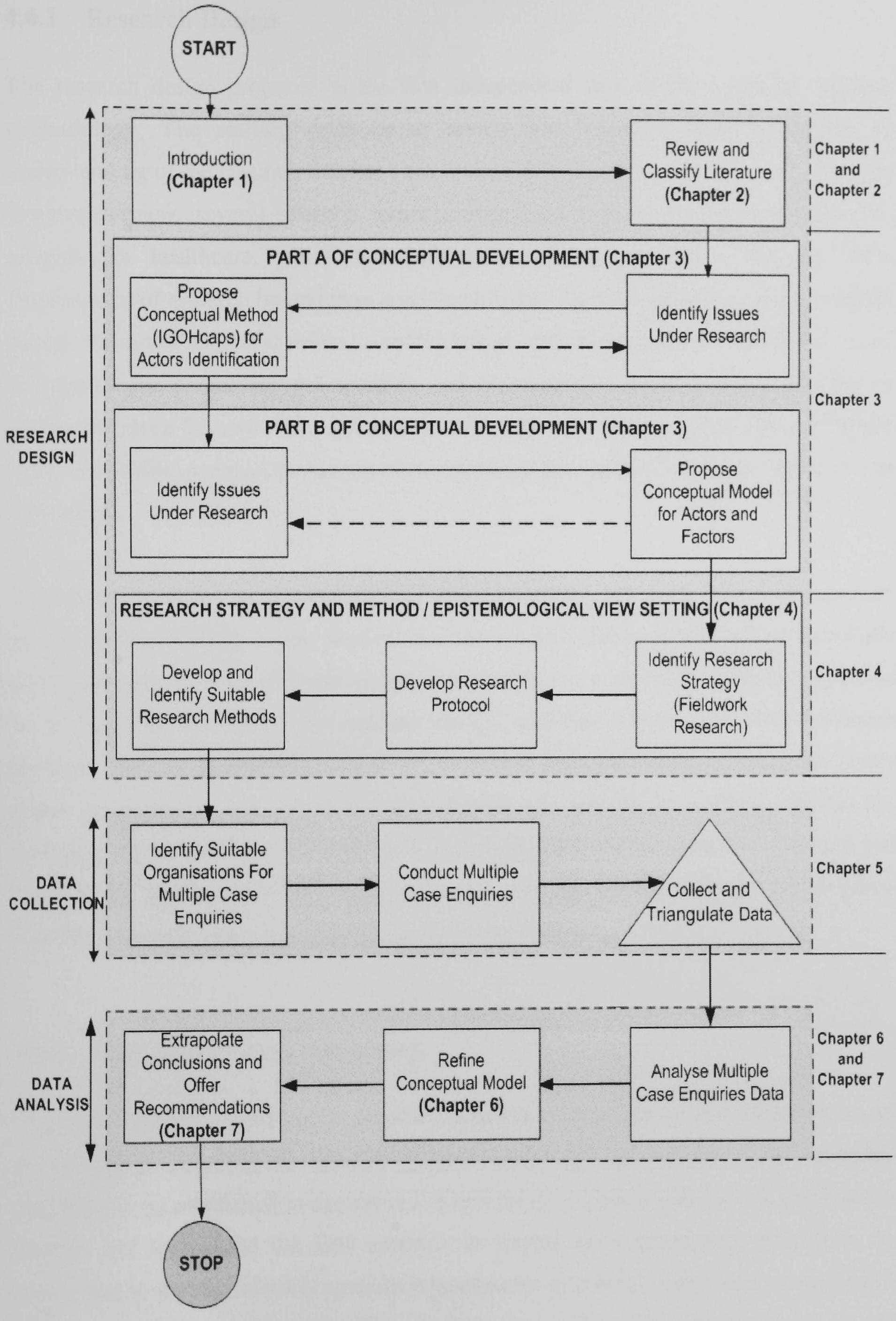


Figure 4.2: Research Methodology

4.6.1 Research Design

The research design proposed is the first independent part of the empirical research methodology. The starting point is to review the literature, thus developing an understanding of the research that has been done and to identify a suitable void. From the literature review, several research issues emerged for a more focused study on EAI adoption in healthcare. Miles and Huberman (1994b) mentioned that the latter (formulation of research issues) may precede or follow the development of the conceptual model. From the literature, several research issues were highlighted and identified, so as to support the conceptual development and to make the study on EAI adoption in healthcare more focused. This led to a specific research area and identified a research need. Thereafter, a conceptual model that represents the intended empirical research was developed.

Aspects of the model were investigated through empirical case study. Based on the needs of the empirical study, it was decided that the research design would utilise a multiple case study strategy through the employment of qualitative research methods (as explained in the previous sections). The research design was then transformed into a research protocol (will be analysed in Section 4.6.4), which especially needed, where the issues under investigation are subjective, and depend on qualitative methods. Within the protocol, a qualitative research approach was deployed to collect data (as explained and justified in Section 4.2). The data collection was the second step of the proposed empirical research and is analysed in the following Section.

4.6.2 Case Study / Data Collection

The aim of the second part of the empirical research methodology is the collection of rich set of data surrounding the specific research issue, and the capture of the contextual complexity. As mentioned in Section 4.5, a multiple case based strategy was employed to explore and understand the EAI adoption in healthcare organisations. Therefore, the author had to initially identify suitable organisations to conduct interviews. A qualitative multiple case study strategy can offer a 'holistic' view of the processes involved, as well as a realisation of the topic under research (Zmud *et al.*, 1989).

Yin (2003) mentioned that data can be collected through: (a) documentation, (b) interviews, (c) direct observation, (d) participant observation, (e) archival records and, (f) physical artifacts. Table 4.2 describes the data collection techniques as well as the sources used in this research.

Data Collection Techniques	Description	Use of Sources in this Research
Documentation	Documentation is a data source that is stable and can be reviewed repeatedly. In addition, it supported the author's familiarization with the NHS.	• Organisational reports • White papers • Reference material downloaded from Internet • Newspapers articles
Interviews	Through interviews, the researcher can access information about the topic under investigation, from key informants. Moreover, it facilitates communication between people working healthcare organisations.	• Structured interviews • Semi-structured interviews • Unstructured interviews
Direct Observations	The direct observations aim to capture what the users do. The researcher observed actors in their office and tried to cover events in real time.	• Formal and informal meetings with interviewees
Participant Observations	Same as for direct observations.	• Simple participation
Archival Records	Same as for documentation.	• Organisational records (e.g. charts, layouts)
Physical Artifacts	The researcher tried to gain insight into cultural features and technical operations.	• Infrastructure components • Hardware and software

Table 4.2: Data Collection Techniques employed in this Dissertation

4.6.2.1 Interviews

As described in Section 4.4.2, the author used various techniques for data collection, such as interviews, documentation and observation. Denzin and Lincoln (1994) considered the interviews as the main tool of the qualitative data collection process. According to Lee (1991) interviews are described as verbal confirmation or disconfirmation of an observation or any formal informal or causal answers to a question constituting the interview (Lee, 1991). Denzin and Lincoln (1994) identified three types of interviews, namely: (a) structured, (b) semi-structured and (c) unstructured.

In the context of this research, interviews were the main data source that the author used to collect data and to capture the verbatim. In most of the cases structured (and semi-structured or unstructured) interviews took place in the office of the interviewees. Structured interviews were based on the interview agenda designed for this research (Appendices B and C). Using this agenda, the interviewees replied to specific questions related to factors and actors affecting the EAI adoption. The interview agenda consists of seven sections and each section has multiple questions, to guide the author during the structured interviews. The overview of the agenda as well as the aim of each section is presented in Table 4.3.

Section		Questions	Aim
A.	General Company Information	A.1 –A.3	To collect data regarding the organisation under study. Such data include information about the: (a) nature of organisation and (b) number of organisational departments.
B.	General Interviewee Information	B.1 – B.4	To collect data regarding the interviewee. Such data include among others: (a) contact details, (b) age, (c) sex and (d) position in organisation.
C.	Healthcare Information Systems (HIS) Information	C.1 – C.2	To find the type of systems and Information Technology (IT) infrastructure in organisation.
		C.3 – C.4	To find the HIS integration.
D.	Enterprise Application Integration (EAI) Adoption Information	D.1 – D.3	To collect data regarding the factors affecting the EAI adoption.
E.	Healthcare Actors Identification Information	E.1 – E.2	To collect data regarding the actors identified through the application of the IGOHcaps method, as well as their importance during the EAI adoption process. This Section is different from a case study, to the other, as it depends on the application of IGOHcaps to each case.
F.	Healthcare Actors and Factors Information	F.1	To collect data regarding the actors identified through the application of the IGOHcaps method and the factors affecting the EAI adoption process.
G.	Comments	G.1	General Comments.

Table 4.3: Interview Agenda Overview

Semi-structured interviews took place without the use of an interview agenda and were conducted during breaks. These involved a series of open-ended questions based on the topic areas the researcher wants to cover (Mathers *et al.*, 2002). The open-ended nature of the questions supports them to define the topic under investigation. Moreover, it provides

the opportunity for both interviewer and interviewee to discuss the topic in more detail. Using this type of interview the author attempted to clarify issues that derived from structured interviews and to collect some important data regarding actors' beliefs. Unstructured interviews dealt with discussions that the author had with interviewees but without using a structured or semi-structured type of interview. During the unstructured interviews that were conducted during breaks some important data regarding actors' beliefs were collected.

Multiple actors were interviewed during the structured interviews in each case study. These interviews lasted at least forty-five minutes. Initially actors were selected for interviews based on the proposed list of actors identified in each case study, when applying the IGOHcaps method for healthcare actors' identification. During this stage, the following actors were interviewed in HOSPITAL UK: (a) IT Director, (b) Clinician A, (c) Clinician B, (d) Clinician C, (e) Non-Clinician A, (f) Non-Clinician B, (g) Non-Clinician C, (h) Administrator A, (i) Administrator B, (k) Patient, (l) Next of Kin, (m) Researcher, (n) Clinical Student, (o) Medical Director, (p) Project Manager. Moreover, in HOSPITAL_GR, the author interviewed the following actors: (a) Citizen A, (b) Citizen B, (c) Citizen C, (d) Clinician A, (e) Clinician B, (f) Clinician C, (g) Clinician D, (h) Non-Clinician A, (i) Non-Clinician B, (k) Non-Clinician C, (l) Administrator A (m) Administrator B, (n) Departmental Director A, (o) Departmental Directors B, (p) Office Director A and (q) Office Director B. The availability of interviewees was a problem during the case study, since they had demanding schedules. During the process of interviewing, the researcher monitored the progress and kept a discreet eye on the interviewee, and time. As reported by Scheurich (1997) and Delamont (1992), a good researcher needs to wind things up within the allotted time, and to have covered most of the key issues. If the interviewer can do this job well, the interview process can achieve the aim during the progress of the interview itself. Therefore, during the interview, the researcher: (a) identified the main points expressed by the interviewee, (b) looked for the logic of what the interviewee said, (c) identified the inconsistencies in the position being outlined by the interviewee and (d) gave a suitable eye contact throughout the interview and used non-verbal communication. This process can help the interviewer interpret more things beyond the interview talk.

When a researcher conducts an interview, she/he plays an important role with good communication skill to create a phenomenon on listening to, recoding, and decoding what

interviewees say (Mishler, 1986). Therefore, all interviews were tape recorded and transcripts prepared as soon as possible after each individual interview. Tape recording supported the author in collecting accurate data and for its analysis. Taking notes during the interviews simply reduces the time of interviews since note-taking requires more time, thus, the author considered tape recording as a more effective way of conducting interviews. In addition to the interviews, data were collected through several sources such as archival documents, minutes for meetings, consultancy reports, and the website of the organisation.

4.6.3 Case Study / Data Analysis

The final step of the proposed empirical research was the data analysis. At this stage, the author interpreted the data collected during the course of the fieldwork. The data analysis supports the interpretation and understanding of the phenomenon under research. In doing this, the author used an interpretive approach. The interpretation of qualitative data is a continuous process that begins in the research setting and involves the data collection and validation processes. An interpretivism stance supports: (a) enhanced navigation and explanation of a phenomenon in its organizational setting (Walsham, 1995) and (b) the analysis of issues related to causality and human purpose (Pouloudi, 1998). Thus, the proposed conceptual model was redefined. Moreover, conclusions were drawn and verified and the implications for the research and action were generated.

To achieve high quality conclusions, it has been reported that the research findings should be trustworthy (Graneheim and Lundman, 2004). There are four major components that comprise trustworthiness criteria: (a) confirmability, (b) transferability, (c) dependability and (d) credibility (Lincoln and Guba, 1985). These will be analysed and explained in the following paragraphs.

Confirmability is concerned with establishing that the participants and the context of the enquiry have determined the findings of a study rather than the biases, motivations and perspectives of the researcher. It has been reported that confirmability is established when credibility, dependability and transferability are achieved (Guba and Lincoln, 1989).

Transferability refers to the extent to which the findings can be applied and transferred to other settings (Polit and Hungler, 1999). It addresses whether the research findings can be used in different or similar settings. The researcher is responsible for providing sufficient information about the research conducted, so as the reader will be able to identify if there is a similarity between the findings of the specific research and of any other research.

According to Lincoln and Guba (1985, p.229) dependability "seeks means for taking into account both factors of instability and factors of phenomenal or design induced changes". It refers to the degree to which data change during the research and to the way that the researcher deals with this change. It is related to the researcher's responsibility for ensuring that the process was logical, traceable and documented (Schwandt, 2001).

Credibility evaluates whether a study is credible and presents faithful descriptions to the participants of the research as well as to the readers (Lincoln and Guba, 1985). To achieve credibility, information about the context, participants and settings should be presented thoroughly. Credibility involves a series of activities that increase trust, protects confidentiality, demonstration of depth of understanding and cross checking information. The use of representative quotations of the transcribed data can provide credibility to research. Credibility depends upon the richness of the data and the analytical abilities of the researcher. For the purpose of achieving credible data, Denzin and Lincoln, (2000) identified the technique of triangulation, which addresses the use of a variety of data sources in study.

4.6.3.1 Data Triangulation

The bias that is considered to be a danger in using qualitative, multiple case study research approach was overcome in this research through data triangulation. The use of multiple data collection methods makes the triangulation possible which provides stronger substation of theory (Eisenhardt, 1989). For the purpose of this dissertation, three types of triangulation are used namely: (a) Data triangulation: where verities of data are used in the study (Denzin, 1978), (b) Methodological triangulation: where multiple research strategies are used to study a single problem (Denzin, 1978) and (c) Interdisciplinary triangulation: where investigation issues are related with more that one disciplines (Janesick, 2000).

The researcher applied multiple data sources as data and methodological triangulation within each case study to preserve the reliability and validity of findings. In addition the researcher employed well multiple methods to study a single problem as methodological triangulation and also conduct multiple levels of interviewees, which the same empirical data can be collected from senior mangers, and then approve it by interviewing someone from middle or low level management.

4.7 Case Study Protocol

The author used a research protocol to: (a) increase the reliability of the case based research and (b) to guide the author in collecting the data. A research protocol can act as an action plan, and can set rules and regulations by which data would be collected. Yin (1994) mentioned that a research protocol can keep the researcher targeted on the subject of the case study. Yin (1994) mentioned that the questions in case studies can be categorised at five levels, as presented in Table 4.4.

Level	Issues Under Research	Section Reference
Level 1	Questions asked of specific interviewees	4.6.2.1, Appendix B and Appendix C
Level 2	Questions asked of individual case study	4.6.2.1, 4.7.1, 4.7.2, 4.7.3, Appendix B and Appendix C
Level 3	Questions asked across multiple case enquires	4.6.2.1, 4.7.1, 4.7.2, 4.7.3, Appendix B and Appendix C
Level 4	Questions asked of entire study	4.6.2.1, 4.7.1, 4.7.2, 4.7.3, Appendix B and Appendix C
Level 5	Questions about recommendations and conclusions beyond scope of study	4.6.2.1, Appendix B and Appendix C

Table 4.4: Questioning Levels in Multiple Case Enquiries

Moreover, Yin (1994) stated that a case study protocol should have the following sections: (a) case study overview, (b) fieldwork research procedure, (c) issued under research, and (d) guide for the case study report. Based on these sections, in the following paragraphs the case study protocol followed in this research is described.

4.7.1 Case Study Overview

Case study overview covers the background information about this dissertation, the substantive issues being investigated, and the relevant readings about the issue.

Therefore, the author needs to gather data that are required to investigate the adoption of EAI in healthcare organisations (e.g. identify healthcare actors by using the IGOHcaps method). In doing this, the author should:

- Test ***Human and Organisational Issue***
- Test ***Actors' Categorisation Issue***
- Test ***Actors' Definition Issue***
- Apply IGOHcaps (Individual, Group, Organisational, Human, Controllers, Acceptors, Providers, Supporters) method to HOSPITAL_UK (***Human and Organisational, Actors' Categorisation, Actors' Definition, Guidelines*** and ***Mix Approach Issues***)
- Propose ***Actors' List Issue***
- Test ***Actors' List Issue***
- Test ***Guidelines Issue***
- Test ***Mix Approach Issue***
- Test ***Factors and Actors Issue***

4.7.2 Fieldwork Research Procedures

In conducting a case study research, fieldwork research procedures should be properly designed, since the researcher will be collecting data from people and organisations in their everyday situations, not within a laboratory, or through a rigid questionnaire (Yin, 1994). Hence, real-world events should be considered and integrated with the needs of the data collection plan. For conducting interviews, there are some issues that the researcher should not ignore, such as the schedule and availability of the interviewee, the effort needed to extrapolate answers from an interviewee etc. In coping with such events, the author needed to have a well-planned fieldwork procedure, which is presented below: (a) Gain access to key organisations, (b) Gain access and contact key interviewees, (c) Gain access to sufficient resources, (d) Develop a procedure for calling for assistance and guidance and (e) Plan a clear time schedule for the data collection activities.

4.7.3 Research Questions and Output of Study

The case based research should focus on the research's aim and be guided by the issues under research. These issues: (a) should guide the author in designing the interview agenda, (b) are the reminders regarding the information that needs to be collected and (c) keep the researcher on track as data collection proceeds. Moreover, the researcher should review the issues under research, before starting a particular interview. For this reason, the author proposed six research issues, which are presented in Table 4.5.

Proposed Issues for Investigation	
Issue	**Description**
Factors and Actors	Factors and actors should not be explored in isolation to one-another during the EAI adoption in healthcare organisations
Human and Organisational	IS adoption in healthcare affects and is affected by human and organisational actors
Actors' Categorisation	Healthcare actors can be categorised into: (a) Acceptors, (b) Providers, (c) Supporters and (d) Controllers
Actors' Definition	The healthcare actors involved in the adoption of IS can be defined as: 'any human and/or organisation that accepts, provides, supports or controls healthcare services'
Mix Approach	The static and dynamic approaches can be combined to support the identification of healthcare actors
Guidelines	The guidelines presented in Table 3.1 support the actors' identification during the dynamic step

Table 4.5: Proposed Issues for Investigation

After collecting the data, the author should deal with the analysis, outline, format, or audience of the case study report. This decision was based on the designed interview agenda and on the proposed for investigation issues. The output of the empirical inquiry and the empirical data analysis are presented in Chapter 5.

4.8 Conclusions

This chapter justifies the selected research methodology used in this dissertation. An interpretivism, qualitative multiple case study approach was selected, to test the conceptual model. The quantitative and qualitative research approaches and the research strategy were analysed and discussed and the appropriate one was adopted. A justification for the selected method used, was provided. Moreover, the empirical research methodology that will be used in this research was graphically represented and described. In Table 4.6 the author summarises the outcomes of this chapter, through highlighting the major decisions and justification made to conduct this research.

Level of Decision	Choice for the Specific Research Setting	Justification for Choice Made	Chapter/ Section
Research Topic	Factors and Actors Affecting the EAI Adoption in Healthcare Setting	-	3
Case Studies Research Timeline	HOSPITAL_UK: 02/2005 – 08/2005 HOSPITAL_GR: 01/2006 – 06/2006	The data collection process was carried out until enough data were collected to test the issued under research, and stopped only when additional data collection provided 'non-value' (Bassey, 1981)	4.5
Research Approach	Qualitative	Allows close involvement of the researcher in the case study, resulting in a considerable insight into the events and actions (Benbasat *et al.*, 1987b)	4.2
Philosophical Perspective	Interpretive Stance	Supports the enhanced navigation and explanation of a phenomenon in its organizational setting (Walsham, 1995) as well as the analysis of issues related to causality and human purpose (Pouloudi, 1998)	4.3
Research Strategy	Multiple Case Studies	Supports the in-depth and cross-checked examination and analysis of research findings (Benbast *et al.*, 1987)	4.4 and 4.5
Data Collection Research Methods	(a) Documentation, (b) Interviews, (c) Direct Observation, (d) Participant Observation, (e) Archival Records (f) Physical Artifacts	-	4.6.2
Data Analysis	Qualitative Interpretive Multiple Case Studies	-	4.6.3

Table 4.6: Summary of the Research Design

In Chapter 5, the author will present the case studies used to evaluate the conceptual model and issues under research. Moreover, the data collected will be analysed.

CHAPTER 5

CASE STUDIES AND RESEARCH FINDINGS

Summary

In the previous chapter, the research methodology (Figure 4.2) employed in this dissertation was justified and analysed. The research methodology is used in this chapter to test the conceptual model (Figure 3.4). In doing so, Chapter 5 presents and analyses the empirical data collected from two healthcare organisations, namely HOSPITAL_UK and HOSPITAL_GR. The preliminary research findings are described and the data retrieved are used to test the conceptual model and the issues under investigation, as these were summarised in Table 3.3. In doing this, the author tests and evaluates the conceptual model proposed in Chapter 3. This chapter commences by providing background information on each case organisation. Thereafter, a detailed presentation of the two cases conducted in United Kingdom (HOSPITAL_UK), and Greece (HOSPITAL_GR) is given. As a result, different case study perspectives are presented and analysed. Nonetheless, the analysis of the empirical data should not be seen as a comparison among cases. Instead, this chapter offers an empirical analysis of different case study perspectives that describes actors' behaviour and perceptions during the adoption of EAI. Consequently, rather than generalising the results of these cases, the researcher proposes to examine each case by describing respective approaches to the adoption of EAI in healthcare organisations. In doing so, allowing others to draw parallels in outcome.

5.1 Introduction

In Chapters 2 and 3 the author reviewed the normative literature and proposed a novel conceptual model, to i*nvestigate the adoption of Enterprise Application Integration (EAI) in healthcare organisations.* The proposed model, as was presented in Figure 3.4, seeks to: (a) extend the established norms, such as the MAESTRO model (Figure 2.5), proposed by Khoumbati, (2005) and (b) combine the influential factors of MAESTRO model with the novel IGOHcaps method (proposed in this dissertation) that supports healthcare actors' identification (Figure 3.2). To support the aim of this dissertation (Section 1.3), a suitable research methodology was justified in Chapter 4 and used in this chapter.

Chapter 5 tests and assesses the proposed model (Figure 3.4) using multiple case studies, as explained and justified in Sections 4.6 and 4.7. In doing so, the cases of two healthcare organisations are presented and analysed in the Sections 5.2 and 5.3. The findings of this study were used as a basis to investigate the adoption of EAI in healthcare organisations. The main reasons for selecting the specific case organisations are listed below: (a) both healthcare organisations have world-wide reputation on the specialized care services they provide, (b) both HOSPITAL_UK and HOSPITAL_GR adopt EAI and (c) case organisations are based on different countries, healthcare environments and systems. The latter allows the researcher to test the proposed model in different environments, explore, validate, evaluate and/or improve the proposed model. The author studied only two case organisations, as the information gathered was rich enough to assess the proposed model.

Chapter 5 is structured as follows: In Section 5.2, an overview of the National Health Service (NHS) in UK as well as a description of the HOSPITAL_UK are provided. The technological background, the need for integration and the process for the adoption of EAI followed by the case organisation, are discussed. The analysis of the case study to test the conceptual model is presented in Section 5.2.2. In a similar way, Section 5.3 presents and analyses the second case study conducted in HOPSITAL_GR, by introducing the National Health Service (NHS) in Greece.

5.2 Case Study One: HOSPITAL_UK

Due to confidentiality reasons, the author uses the name HOSPITAL_UK, to refer to the first case organisation. HOSPITAL_UK is a specialized acute trust and a major international centre for postgraduate teaching and research, placed in the United Kingdom (UK). In an attempt to better understand this case study, before analysing the case data, a description of the National Health Service in UK and information about HOSPITAL_UK is provided.

In doing so, the research: (a) describes the background related to this case organisation, (b) explains the decision for the integration of HOSPITAL_UK IT Infrastructure and (c) identifies healthcare actors, by applying the IGOHcaps method (Figure 3.2) in HOSPITAL_UK, as the identification of full list of healthcare actors' depends on the specific context and timeframe.

5.2.1 Overview of National Health Service in United Kingdom

Before the establishment of the National Health Service in UK, healthcare was provided to some extent by the state, charities, or on a private basis (Walker, 1995). In 1948, the NHS was established as a free healthcare service for the entire population. Nowadays, NHS is one of the biggest public service organisations in the world. It has been estimated that in a typical day in NHS, 33,000 people receive healthcare services in hospital accident and emergency departments, 25,000 operations are carried out and one million people visit their doctor (DoH, 2000).

The National Health Service in UK is divided into two sections. The first is dealing with the strategy, policy and managerial issues and the second with clinical aspects. The latter consists of the primary (e.g. frontline care, pharmacists), secondary (e.g. hospitals) and tertiary care (e.g. highly specialised doctors). The NHS Act of 1946 provided a free of charge medical care at the time it is required for all citizens. It constituted by six fundamental principles, which are summarised below:

- A distinction was made between primary and secondary care, as General Practitioners (GPs) were supposed to provide first-contact treatment and diagnosis, whist hospitals and local Health Authorities should provide a more comprehensive range of medical facilities,
- All health care was expected to be provided free at the time needed,
- The financing of healthcare was expected to come from general taxes,
- A full service, ranging from accident and surgery to geriatric mental care should be provided,
- Health care should be available to all and
- The government was supposed to own the organisation and to employ its staff.

From the 1960s to late 1980, multiple reports were commissioned regarding the reform of the NHS (DoH, 1991). These reports attempted to: (a) reduce bureaucracy, (b) increase accountability, (c) provide better healthcare services, (d) assure quality of services provided to citizens, (e) use resources efficiently and (f) reduce inefficiencies, such as unnecessary referrals and prescriptions (DoH, 1991). Since 1970, multiple efforts have been made to reform the NHS and computers had been introduced and used in general practice. Initially, IT Infrastructure developments supported administrative processes, such as patient indexing and appointments' booking. Moreover, systems for general practitioners, resource management, clinical audit and hospital information support systems had been introduced to support clinicians.

For more than 20 years, these multiple efforts had been usually unsuccessful, as they left clinicians often frustrated. However, as the main aim of the IT in healthcare has been the enhancement of the services provided to patients and citizens and not just to support administration processes (DoH, 1991). Therefore, in 1993, the NHS initiated a three-year research and development Programme, namely Electronic Patient Record (EPR) Programme, as HIS lack of integration. This means that the majority of the clinicians cannot update the EPR or retrieve data about their patients. EPR Programme's aimed to support medical doctors, nurses and health care professionals in providing enhanced healthcare services to patients. In doing so, the Electronic Patient Records would be: (a) available on time, (b) retrieved, accessed and managed in an easier way and (c) different people can access the record at different places at the same time. The aforementioned characteristics of EPR are a great help to medical record managers but does little for

clinicians as HIS lack of integration. This means that the majority of the clinicians can not retrieve or update data regarding their patients.

The EPR Programme Board members, after commissioning multiple scoping studies, decided that the focus of EPR should be shifted from paper-based record library concepts to generating and sharing information as a by-product of clinical activity. Therefore, they suggested that a communication and integration approach, based not only on systems integration, but also on organisational and human/computer integration, should be followed. In achieving the suggestion for integration, the Board attempted to: (a) identify best practices and (b) map out a progressive path for EPR development. Moreover, the aforementioned suggestion for integration is supported by the aim of this research, which indicates that the adoption of EAI should extend the factor oriented approach by considering the multiple actors (human and organisational) involved in this process.

In 2001, NHS published a document that supported the NHS Plan (DoH, 2000), to: (a) outline the information and IT systems needed to deliver the NHS plan and (b) support patient-centred care and services. In March 2001, Wanless examined the future trends affecting the health services in the UK over the next two decades and published a report, namely 'Securing our Future Health: Taking a Long-Term View' *(Wanless et al., 2002)*. The Wanless' report, published in April 2002, recommended among others, the following: (a) doubling and protecting of IT investments, (b) centrally managed national standards for data and IT and (c) enhances management of the NHS. The report coincided with the publication of *Delivering the NHS Plan*, which developed the vision of a service designed around the patient, offering patients more choice of where and when to access treatment *(Wanless et al., 2002)*.

Following the Wanless report, in 2002, the Department of Health (DoH) recognised the need to integrate the EPR with with social care records, and to focus on the patient in a holistic manner (DoH, 2002). The key objectives for the UK Government Health Sector, within the National Health Service, in this era 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 information systems strategy (DoH, 2002).

In 2004, the NHS announced the creation of a new organisation, namely NHS Information Authority (NHSIA), which was responsible for the delivery of the National

Programme for IT, as well as the management of the IT-related functions. In 2005, NHS Connecting for Health was established as the single national IT provider for the NHS that was responsible to deliver the National Programme and ensure the maintenance, development and effective delivery of the IT projects, delivered by the former NHS Information Authority.

5.2.1.1 Background of HOSPITAL_UK

HOSPITAL_UK is a specialized acute trust and was established more than 100 years ago. Due to confidentiality reasons, the exact date of the establishment of this organisation cannot be reported. It is a major international centre for postgraduate teaching and research in the UK. HOSPITAL_UK has more than 1,000 employees, in 11 sites in UK. The main HOSPITAL_UK consists of 1 administrative and 3 clinical divisions with each division having different departments. Each employee, service and department, belongs to one of these divisions. Moreover, each division has separate management, with the management team comprising of a Chief Executive Officer (CEO), who heads the HOSPITAL_UK and departmental directors (e.g. Director of Finance, Director of Nursing and Operations Director of Research and Development and Medical Director). Patients in UK visit HOSPITAL_UK rather than any other hospital or clinic, to receive a world-wide recognized, specialized care. This is based on the expertise of the clinical staff and the cutting-edge research taking place on site.

This case study lasted for 7 months and during this period, the author conducted interviews, to test and evaluate the proposed conceptual model (Objective 4). In doing so, the author initially applied the IGOHcaps method to identify actors and then interviewed the following fifteen actors: (a) IT Director, (b) Clinician A, (c) Clinician B, (d) Clinician C, (e) Non-Clinician A, (f) Non-Clinician B, (g) Non-Clinician C, (h) Administrator A, (i) Administrator B, (k) Patient, (l) Next of Kin, (m) Researcher, (n) Clinical Student, (o) Medical Director, (p) Project Manager.

5.2.1.2 Technological Background of HOSPITAL_UK

Over the years, in HOSPITAL_UK, multiple Information Systems had been implemented that range from Radiology IS to Management IS. Below, a list with the more important Information Systems is provided:

- Galaxy Theatre IS
- Syslogic Laser System
- Radiology IS
- Nursing IS
- Cortex Pharmacy IS
- Laboratory IS
- Management IS
- Scheduling IS
- Locally developed database systems
- Patient Administration IS and
- Logistic IS

In Chapter 2 the different types of Healthcare Information Systems were categorized, based on a critical review of the literature. As presented in Table 2.1, HIS can be classified into: (a) clinical, (b) non-clinical - support systems (c) non-clinical – administrative, (d) non-clinical – financial, (e) pharmaceutical and (f) laboratory. The author uses this classification to categorise the HIS that have been implemented in HOSPITAL_UK and these are presented in Table 5.1.

Healthcare Information Systems in HOSPITAL_UK			
Process Supported		**Healthcare IS**	**Description**
Non-Clinical	Clinical	Galaxy Theatre System	Records all clinical incidents
		Syslogic Laser System	Supports the use of lasers by registering doctors and issuing smartcards
		Radiology IS	Stores, captures, manipulates, retrieves, and transmits data about patients' radiological examinations
		Nursing IS	Records all nursing activities
	Pharmaceutical	Cortex Pharmacy IS	Keep records about drugs' ordering, stocking and distribution
	Laboratory	Laboratory IS	Physicians or nurses use devices at the point of-care to provide lab results (blood gasses, glucose), thus assisting physicians in ordering medications right at the point of care.
	Support Systems	Management IS	Manages drugs resource and receives demographic patient data, via daily download, from the Patient Administration IS
		Scheduling IS	Supports booking processes and manages human resource
		Locally developed database systems	Stores information
	Administrative	Patient Administration IS	Holds all patient demographics, such as address, date of birth and admission details
	Financial	Logistic IS	Support financial transactions with patients, employees, suppliers, insurance companies etc and accounting processes

Table 5.1: Classification of Healthcare Information Systems in HOSPITAL_UK

When the author asked the IT Director of HOSPITAL_UK to comment upon this classification, he stated that:

> 'The HIS classification provided is representative, as it provides the main categories of systems and types of HIS supporting each of the categories…It can support IT managers in healthcare organisations, during the decision-making process towards healthcare systems' implementation…'

Since similar views were shared by other interviewees, it appears that the classification of IS used in healthcare (presented in Section 2.2.1) is validated.

5.2.1.3 Challenges Faced by HOSPITAL_UK

Although HOSPITAL_UK implemented the IS, summarised in Section 5.2.1.2, to improve its services, it did not solve all problems. In addition, many other integration problems were arisen, due to the heterogeneity of those systems. By 1997, HOSPITAL_UK sought for support from the Commission for Health Improvement (CHI), which evaluated the hospital's processes and identified that HOSPITAL_UK faced challenges that were related to the Information Quality, Availability and HIS Integration.

The author attempts to identify and analyses these challenges through interviews, documentation and observation. In addition, the literature findings, reported in Section 2.2.2 are used to identify the potential of HIS, as well as the challenges faced by healthcare organisations. The potential and current challenges were categorised in four main thematic areas, namely: (a) Information Quality, (b) Information Availability, (c) Medical Errors and (d) HIS Integration (as presented in Table 2.2). Based on this classification, the challenges faced by HOSPITAL_UK are displayed in Table 5.2. and are analysed in the following paragraphs.

Thematic Areas		HIS Potential (Table 2.2)	HOSPITAL_UK Challenges
1.	Information Quality	Improve quality of information - Wanless *et al.*, (2002)	Heterogeneous communication infrastructure delays the exchange and transfer of health and administration information - IT Director
2.	Information Availability	Improve availability of information - Trimmer et al., (2002), Neri et al., (1998)	Information needed for administration, diagnosis or prescribing purposes often is redundant or missing - Clinician A
3.	Medical Errors	Reduce medical errors - Sutherland and Willem, (2002)	-
4.	HIS Integration	Improve integration of health information - Donlon, (2003)	Lack of integration of primary, secondary and tertiary services - Medical Director Lack of collaboration between research and development - IT Director Lack of communication between the trust and its patients from admission to discharge – Non-Clinician B Lack of delivery of high quality services and care - Medical Director

Table 5.2: HOSPITAL_UK Challenges

The empirical data reveals that the Information Systems implemented in HOSPITAL_UK, are based on different platforms that range from mainframes to personal computer and multiple database repositories, such as Microsoft SQL and Oracle, IMS (Information Integration). Table 5.2 depicts that in some cases, the systems' heterogeneity resulted in redundant or even missing information, needed for administration, diagnosis or prescribing purposes. Missing or redundant information is related to information quality and availability. It is also associated to medical errors, as doctors could not make accurate diagnosis, since information was missing or was not available on time. In addition, data redundancy causes confusion, as new and old data about patients were mixed up and presented together.

Clearly, these findings indicate that there was a negative impact on the delivery of healthcare services. From the interviews, it appears that the IT infrastructure was heterogeneous and had caused numerous problems to the hospital (Information Integration), such as lack of: (a) Integration of primary, secondary and tertiary services, (b) Collaboration between research and development, (c) Communication between the trust and its patients from admission to discharge and (d) Delivery of high quality services and care.

5.2.1.4 Need for Integrated IT Infrastructure

The limitations of the existing IT infrastructure led HOSPITAL_UK to take a decision to significantly advance its services. This decision was also supported by the UK Commission for Health Improvement, as it is in accordance with the practices of the UK healthcare sector modernization effort that is taking place. The analysis of relevant documents that were collected during the case study indicates that the UK government through the UK National Health Service Care plan has focused on the development of an essential patient-centric IS. The key objectives of the NHS plan is to efficiently and effectively provide care, based on an integrated IT infrastructure (DoH, 2004; Wanless *et al.*, 2002). The literature suggests that such an infrastructure will result in the delivery of quality care twenty four hours - seven days a week (24/7) (NHSIA, 2004).

To this end, it appears that the problems with the existing infrastructure in the HOSPITAL_UK and the NHS plan formed a kind of internal and external pressures. This

finding validates the normative literature, which supports that, among other factors, the *IT infrastructure*, the *Internal* and *External Pressures* influence the decision making process for EAI adoption (Khoumbati *et al.*, 2006b).

In 2003, HOSPITAL_UK initiated a plan for developing a more efficient IT infrastructure, to address the limitations of its existing systems, and to meet the targets set by the NHS. The decision for this plan was made by the managing board after discussing this issue with the IT Manager. The proposed plan was seeking a low cost solution that will:

- Develop an integrated patient centric IT infrastructure,
- Keep the health professionals up to date informed in their practices,
- Deploy and integrate telemedicine and e-Health applications with existing systems and
- Reduce medical errors and patients' waiting times.

The IT Manager of HOSPITAL_UK reported that it has limited knowledge on the area of systems integration and it therefore turned to consultants for support in terms of solution development and training. As a result, the consultants suggested that the hospital should rely on Enterprise Application Integration (EAI) technology (Daniel and White, 2005; Volkof *et al.*, 2005) to build the proposed integrated IT infrastructure. This decision is in line with the published literature, which suggests that organisations seek support from consultants and other experts to evaluate and adopt EAI solutions (Skoumpopoulou and O'Kane, 2004). Moreover, the consultants proposed the development of a pilot project to assess the:

- Performance and efficiency of EAI and
- Various organisational and managerial parameters associated with its adoption (e.g. restructuring, costs, and benefits).

This finding is in accordance to the normative literature, which indicates that during the first stage of an EAI development (Planning), organisations run pilot projects to gather sufficient evidences to proceed to an EAI project (Themistocleous and Irani, 2006). The pilot project focused on the integration of a small number of processes and services at

HOSPITAL_UK. The aim of the pilot project was to demonstrate that EAI can result in the development of an efficient, flexible, reliable and maintainable IT infrastructure. HOSPITAL_UK decided to integrate the Patient Administration System (PAS) that holds all patient demographics (e.g. address, date of birth, admission details) with existing administrative and clinical systems as shown in Figure 5.1.

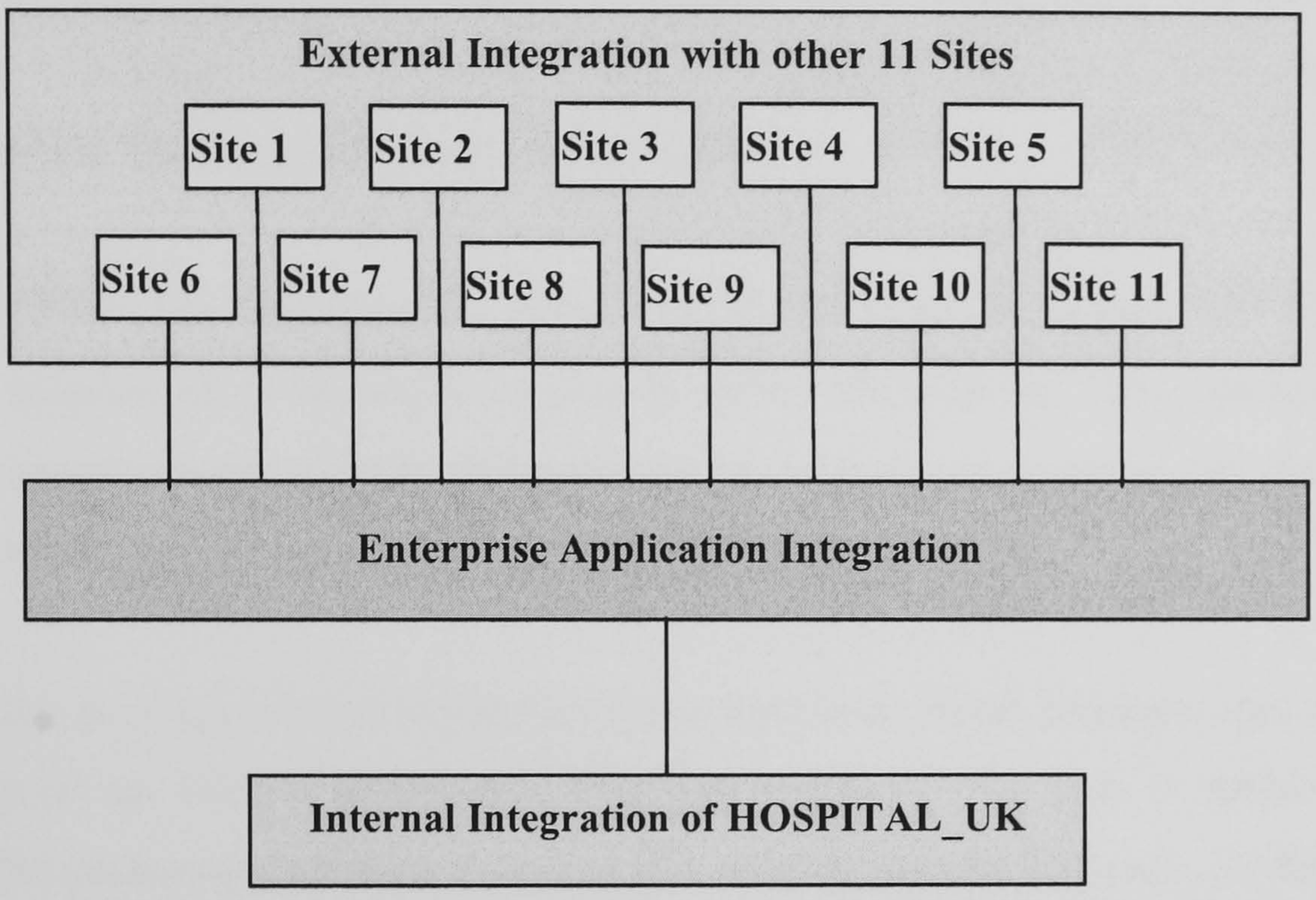


Figure 5.1: Integration Strategy for HOSPITAL_UK

The pilot lasted for one year in which the solution was implemented, tested and used. As reported by interviewees, the pilot system provided a lot of benefits such as technical (sharing of critical data and provision of quality information), managerial (improved communication), operational (reduced operation and maintenance cost) and strategic (increased patients satisfaction).

The pilot system was successful, and as a result the hospital agreed to develop a complete EAI solution. Since the hospital lacks of technical knowledge, it subsequently agreed to form an alliance with an EAI vendor to run the project. This decision is in accordance with the literature reporting that organisations tend to turn to consultancy support when implementing EAI projects (Lam, 2005). However, it is one thing to turn to EAI consultants and another to EAI vendors. The decision to work with EAI vendors can be described as a risky one, as in this case, the vendor did not explain to HOSPITAL_UK what other EAI solutions are available but took the decision to customise its EAI software

and use the hospital as a test-bed. Similar practices were followed by government organisations when adopted EAI and characterised as risky ones (Themistocleous and Irani, 2006). These practices indicate that organisations have low IT sophistication levels, as they cannot fully understand the complexity of the EAI market.

In turning to vendors, the IT department of HOSPITAL_UK did not have to evaluate the integration technologies. The vendor evaluated these (integration approaches) and decided to implement the EAI project based on the mutual benefits for both the hospital and the vendor. The Project Manager reported that:

> *'When an organisation makes the decision to implement an EAI solution, it is important to clearly define the criteria. This can help organisations identify the appropriate integration solution for their needs, saving time and money while reducing risk...'*

This finding is in accordance to the normative literature, which indicates that during the first stage of an EAI development (Planning), organisations need to understand and evaluate the parameters associated with such a project, such as: (a) costs, (b) benefits, (c) barriers, (c) evaluation framework for the assessment of integration technologies etc (Themistocleous and Irani, 2006).

5.2.1.5 Process for EAI Adoption

Despite the success of the pilot system, it can not be argued the same for the system that is under implementation. As it was revealed, the case organisation did not consider the critical role of the actors affected and affect the adoption of the EAI solution. These actors were not informed about the changes that such a project brings. When the author asked the IT Director of HOSPITAL_UK, he denoted that:

> *'We may have to address a lot of problems when the system is finished. We have not made any discussion with the clinicians and the other professionals. We estimated that we need to spend 20,000 staff hours for training after the implementation. Currently the clinicians are not aware of this. Staff is too busy... and the question is when this training*

> *will take place. We have not informed them [clinicians] about the changes to their processes and services that this project brings....Moreover, the training costs haven't been considered and this can cause even more problems...'*

Thus, the changes and issues associated with this project, such as the cost of training and the time needed to train staff (20,000 staff hours!), were not considered, discussed and understood by the multiple actors. As a result, the training, which is a process that should be considered during the Planning stage of the EAI development, was not understood and well thought-out by the multiple actors (Themistocleous and Irani, 2006). Therefore, actors' reaction and attitude towards EAI adoption might be affected, as the EAI effect on HOSPITAL_UK actors is unclear and forms a risk for the project. This finding is in accordance to the normative literature (Lim *et al.*, 2005). In regard of this issue, the same person reported that:

> *'These issues may result in conflicts and resistance to change. We have to find a way to control all these people's reaction. In our area the consensus of professionals is of high importance as all are significant for the operation of the hospital. For instance, if nurses decide to boycott the new system, the system will be out of order.'*

The project mainly involved IT staff, which presents a myopic and one-dimensional view. The explanation for this is that an IT development in such a critical environment should consider non technical staff as well. In doing so, social, organisational and managerial aspects will be explored in detail. In this case, there were issues regarding the control of the processes and the changing role of the actors that had not been explored or discussed.

These concerns indicate that it is of high importance to study and analyse the actors' views since their actions can have a great impact on IS adoption. These comments are in line with the normative literature which highlights that actors' reactions might lead to IS failure (e.g. London Ambulance System) (Fitzgerald and Russo, 2005).

5.2.2 Testing of Issues under Research in HOSPITAL_UK

The aforementioned views, regarding the HOSPITAL_UK adoption of EAI, further support the aim of this research and demonstrate that there is scope for timeliness and novel research in this area. Therefore, it is important to identify the actors and understand their stances towards EAI adoption. In order to identify and study healthcare actors, the proposed IGOHcaps method (Figure 3.2) was introduced and evaluated through the empirical data collected from this case organisation. In doing this, the instructions for the application and testing of the IGOHcaps method (Figure 3.3) were followed.

Initially the researcher *applied and tested the static step* of the proposed method ***(Human and Organisational, Actors' Categorisation*** and ***Actors' Definition Issues)***. The validation of this step is important for the application of the method as the dynamic approach is grounded on the static step. This means that before the *application and testing of the dynamic step*, the static one should be tested. The application of both static and dynamic steps results in the identification of a list of healthcare actors that are involved in the adoption of IT. Thus, at the last stages of this research the following are evaluated: (a) a list of actors that derived from the IGOHcaps method, (b) the guidelines (dynamic step - *Guidelines Issue*) and (c) the combination of static and dynamic steps *(Mix Approach Issue).* Accordingly, multiple healthcare actors (such as Patient, Next of Kin, Clinician) were identified and interviewed to assess the research issues. Moreover, the results of the method were evaluated, through these interviews and the findings are presented in the Section 5.2.2.1 to Section 5.2.2.6.

The steps followed to evaluate the conceptual model (presented in Figure 3.4) are summarised in Table 5.3 and analysed in the following sections.

Stage of Empirical Investigation	Aim
1	Test ***Human and Organisational Issue***
2	Test ***Actors' Categorisation Issue***
3	Test ***Actors' Definition Issue***
4	Apply IGOHcaps method to HOSPITAL_UK (***Human and Organisational, Actors' Categorisation, Actors' Definition, Guidelines*** and ***Mix Approach Issues***)
5	Propose ***Actors' List Issue***
6	Test ***Mix Approach Issue***
7	Test ***Guidelines Issue***
8	Test ***Actors' List Issue***
9	Test ***Factors and Actors Issue***

Table 5.3: Stages of Empirical Investigation in HOSPITAL_UK

5.2.2.1 Testing *Human and Organisational, Actors' Categorisation and Definition Issues* (Stages 1, 2 and 3)

The interviewees were initially asked to comment on the use of human and organisational lenses and the proposed classification ***(Actors' Categorisation Issue)*** to define healthcare actors ***(Actors' Definition Issue)***. From the discussions, it appeared that all interviewees were positive towards these issues.

Regarding the ***Human and Organisational Issue***, Clinician B mentioned that:

> *'It is good to see that you separate the human actors from the organisational because in many cases human actors express different views from their organisations'.* The same person gave as an example, the case of clinicians and clinics as he reported that: *'There are instances where we [doctors-humans] disagree with the suggestions of our clinics [organisational] in terms of the use of IT.'*

An interesting issue came out during the interviews is that *humans and organisations should not only be seen individually but also as groups (of people or organisations) [Individuals and Groups sub-lenses]*. This is in accordance to the normative literature (Sarker *et al.*, 2005). For example, a clinician might have a different stance towards the

adoption of a system, than a group (or different groups) of clinicians. In addition, the author suggests that further issues such as power, control, legitimacy and influence might be related to the formulation of opinions of these individuals and groups.

Interviewees validated the ***Actors' Categorisation Issue*** which deals with the different categories of actors. It appears that the interviewees could not suggest another classification of actors or enrich the proposed one as it ***(Actors' Categorisation Issue)*** seems to be satisfactory. For instance, the Medical Director reported that:

> '*Your categorisation [**Actors' Categorisation Issue**] is clear and captures all different groups of actors in healthcare'.*

To this end, the empirical evidence shows that the static approach is accurate and sufficiently describes the types (lenses) and the categories of healthcare actors involved in the adoption of IT. As ***Actors' Definition Issue*** is based on the combination of *Human* ***and Organisational Issue*** and ***Actors' Categorisation Issue***, it appears that healthcare actors can be defined as*: any human and/or organisation that accepts, provides, supports and controls healthcare services (**Actors' Definition Issue**).*

5.2.2.2 Application of IGOHcaps Method (Stages 4 and 5)

After validating the static step the proposed guidelines (Table 3.1) were applied individually to the four categories (acceptors, providers, supporters and controllers) of the human and/or organisational lenses (e.g. the guidelines were applied to the human acceptor, organisational acceptor etc). For instance the researcher applied the fifth guideline (related to the nature of IS) to the organisational providers (sub-category). The type of IS to be adopted is an EAI solution that will be used to integrate inter and intra-organisational systems. Therefore, the organisational providers identified are the Hospitals and the Medical Departments (both intra and inter-organisational).

Thus, using the proposed guidelines (as presented in Table 3.1), within the specific case context and timeframe the following healthcare actors were identified (Table 5.4). Table 5.4 shows how the guidelines were used to identify healthcare actors, with the first column referring to the guidelines and the rest to the actors being identified using these

guidelines. The symbol (✓) indicates that the specific actor is identified by the specific proposed guideline, where the symbol (×) shows the opposite. Moreover, the symbols **G1-G9** represent the following guidelines (as presented in Table 3.1):

G1: Actors depend on the specific context and time frame

G2: Actors can not be viewed in isolation

G3: The position of each actor may change over time

G4: Feasible options may differ from the actors' wishes

G5: The nature of the IS to be adopted

G6: Internal versus external actors

G7: The type of relationship to the system

G8: Depth of impact

G9: Level of aggregation

			Proposed Guidelines								
			G1	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**	**G8**	**G9**
Acceptor	**H**	**1. Patients**	✓	✓	✓	✓	✓	✓	✓	✓	✓
		2. Next of Kin	✓	✓	✓	×	×	×	×	✓	✓
Provider	**H**	**3. Clinicians**	✓	✓	✓	✓	✓	✓	✓	✓	✓
		4. Non-Clinicians	✓	✓	✓	✓	✓	✓	✓	✓	✓
		5. Clinical students	✓	✓	✓	×	✓	✓	✓	✓	✓
	O	**6. Hospitals**	✓	✓	×	✓	✓	✓	✓	✓	✓
		7. Medical Departments	×	✓	×	✓	✓	✓	✓	✓	✓
Supporter	**H**	**8. Administrators**	✓	✓	✓	×	✓	✓	✓	✓	✓
		9. Legal professionals	✓	✓	✓	×	✓	✓	✓	✓	✓
		10. Researchers	✓	×	✓	×	✓	✓	✓	✓	✓
	O	**11. Suppliers**	✓	✓	✓	✓	✓	✓	✓	✓	✓
		12. Technologists	✓	✓	✓	✓	✓	✓	✓	✓	✓
		13. Insurance companies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controller	**H**	**14. Managers**	✓	✓	✓	✓	✓	✓	✓	✓	✓
	O	**15. Government**	×	✓	×	✓	✓	✓	✓	✓	✓
		16. Health Authorities	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 5.4: Actors Identification through the IGOHcaps Method in HOSPITAL_UK

After identifying the list of healthcare actors, a new issue under research, named ***Actors' List Issue*** (Stage 5) has arisen:

> ***Actors' List Issue:*** *'The list of healthcare actors presented in Table 5.4 is complete and representative, in the specific time frame and context'.*

Figure 5.2 illustrates the outcome of the proposed method's application as it was explained in Table 5.4 and analysed in this section.

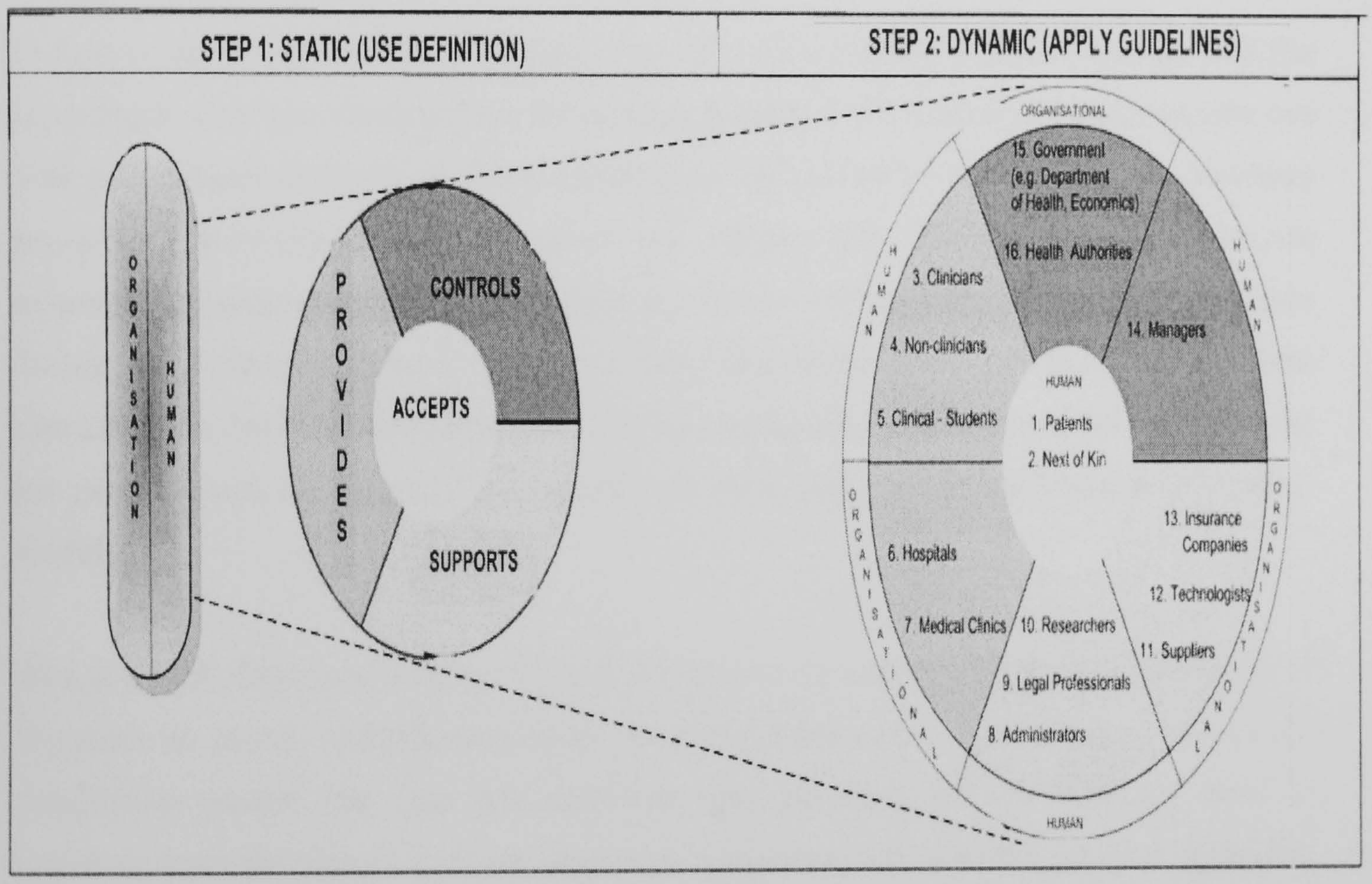


Figure 5.2: Identification of EAI Adoption Actors through the Application of IGOHcaps

5.2.2.3 Testing *Actors' List Issue* (Stage 6)

Initially, the interviewees were asked to comment on the proposed list of healthcare actors (***Actors' List Issue***) presented in Table 5.4. Twelve out of the fifteen interviewees from different actors' categories mentioned that other actors exist such as the **Bank**. The actor **Bank** does not appear to directly affect the EAI adoption, as this actor is involved in

some financial processes conducted by the HOSPITAL_UK. Based on the classification of the HIS in HOPSITAL_UK (presented in Table 5.1), it appears that the actor **Bank** is involved actually with the Logistic IS, which is characterised as a non-clinical financial Healthcare Information System.

Also, the empirical data reveals that the various actors should be analysed in more detail. For instance, in the proposed taxonomy in Table 5.4, the actor **Manager** (in the category Controller) represents all managers at all levels. The research findings show that this is not accurate in terms of analysis, as diverse categories of managers exist with different interests (e.g. IT Manager, Clinicians' Manager, Finance Manager).

In further exploring and understanding why the various types of actor Manager and the actor Bank were not identified by the proposed method (IGOcaps), the author came out with a significant observation. More specifically, the researcher remarks that *the business processes' descriptions and definitions can support the identification of healthcare actors.* For example, the author happened to see some descriptions of business processes during one meeting with the IT Director. When she studied more carefully these business processes, she realised that the actors identified, using the IGOHcaps method were almost the same (except the types of managers) with those reported in the business processes' models.

This is a very important finding, since to the best of the author's knowledge, the body of literature on actors' identification does not explore this issue. For instance none of the researchers studied this area had proposed such an issue. On the contrary, there is literature from the area of business processes suggesting that business process modelling methods, such as IDEF0 is used to map internal actors with specific tasks or processes. Nonetheless, it is worth noting that business process models can not be adopted per se as they do not separate actors from resources (e.g. computer, documents, equipment etc). To this end, the author suggests that bridging together the literature from the areas of business process modelling and actors identification. In doing so, the limitation of the guidelines proposed in Table 3.1 (IGOHcaps method) can be overcome by adding a new guideline that focuses on business process models. This finding is significant as the normative literature has not paid attention to this issue.

Another actor that was not identified using the IGOcaps method was the actor Citizen. Regarding this actor, Clinician C stated that:

> '*Patients should be differentiated from the* ***Citizens****, for whom the government is trying to improve the quality of life'.*

In support of this, it has been mentioned in different European Union (EU) plans that the focus of healthcare should not be on *how* to provide treatment to patients but on minimising the percentages of people that need treatment. In doing so, the healthcare should improve Citizens' quality of life. It appears that the Citizens could not be identified by the use of the proposed guidelines (see Table 3.1). This is attributed to that the researcher contacted the interviewees in a period of six months (from 02/2005 to 08/2005), as presented in Figure 4.1. During the first months of the empirical investigation, while the author applied the IGOHcaps method, the information about the citizens was not available. However, a couple of months later, the patients had been separated from the citizens. Thus, although the author failed to identify the actor Citizen, the guidelines covered this issue as the first guideline suggests that the actors depend on the specific context and timeframe.

5.2.2.4 Testing *Guidelines* (Stage 7)

When the author tested the proposed guidelines (presented in Table 3.1), it was realised that they have a limitation as they omit the information regarding the *business processes* (as identified and explained in Section 5.2.2.3). Therefore, the author suggests that the following guideline should be considered and tested when identifying actors: *business processes definitions and especially business models, such as IDEF0 models should be considered for the identification of different actors. When business models are considered, actors should be separated from other resources.*

The reason behind this suggestion is that the adoption of IS aims to automate business processes. Thus, human and organisational actors (internal or external) related to these processes should be studied as they affect or are affected by the adoption of a system. *This finding is significant as the literature has not paid attention to this issue.*

5.2.2.5 Testing *Mix Approach Issue* (Stage 8)

As it is explained above, the static and the dynamic steps were validated, with empirical evidences suggesting the addition of:

- The Individual and Group sub-lenses (discussed in 5.2.2.1): *humans and organisations should not only be seen individually but also as groups (of people or organisations)* and

- One new guideline (discussed in 5.2.2.4): *The business processes should be considered when identifying different actors.*

Despite these findings the interviewees mentioned that the Mix Approach enhance the understanding, identification and classification of healthcare actors. Therefore, the *Mix Approach Issue* was validated by the interviewees.

5.2.2.6 Testing of *Factors and Actors Issue* (Stage 9)

After testing the ***Actors' List Issue***, the interviewees were asked to express their views regarding the mapping of actors against the factors that affect the EAI adoption process in healthcare organisations (***Factors and Actors Issue***). In response, the vast majority of interviewees agreed that the factors influencing EAI adoption should be presented and explained to the multiple healthcare actors involved in the decision making process.

Table 5.5, presents the results collected by combining EAI influential factors with the healthcare actors involved in the adoption of EAI in this case organisation (Figure 5.2). Such a combination can provide a more detailed level of analysis. Horizontally, Table 5.5 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 lenses. Due to space limitations the author refers to each of the actor using: (a) its initial letter and (b) the corresponding number given to them in Table 5.4. For instance actor number 1 refers to the actor Patient (P) whereas actor number 16 to the Health Authorities (HA). To better understand the scope of these factors, the interviewees were asked to rank them

appropriately. The ranking follows the scale of ranking used by Miles and Huberman, (Miles and Huberman, 1994), which represents less important (○), medium important (◒) and most important (●).

	EAI Adoption Actors in HOSPITAL_UK															
	Acceptor		**Provider**					**Supporter**						**Controller**		
	H		**H**			**O**		**H**			**O**			**H**	**O**	
EAI Adoption Factors	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
	P	**NK**	**C**	**NC**	**CS**	**H**	**MD**	**A**	**LP**	**R**	**S**	**T**	**IC**	**M**	**G**	**HA**
Cost	○	○	●	●	◒	●	●	◒	○	●	●	●	○	●	●	●
Barriers	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Benefits	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
IT Support	○	○	○	○	○	●	●	○	○	◒	●	●	○	●	●	●
Internal Pressures	○	○	●	●	○	●	●	○	○	◒	●	●	○	●	●	●
External Pressures	○	○	●	●	○	●	●	○	○	◒	●	●	○	●	●	●
IT Infrastructure	○	○	○	○	○	○	○	○	○	●	●	●	●	●	○	○
IT sophistication	○	○	○	○	○	○	○	○	○	●	●	●	●	●	○	○
Evaluation Frameworks	○	○	○	○	○	○	○	○	○	●	●	●	●	●	○	○
Organisational Size	○	○	○	○	○	●	●	○	○	●	◒	◒	○	●	○	○
Telemedicine	●	●	●	●	●	●	●	○	○	●	○	○	○	●	●	●
Patient Satisfaction	●	●	●	●	●	●	●	●	○	●	○	○	●	●	●	●
Security and Confidentiality	●	●	●	●	●	●	●	●	●	●	◒	●	●	●	●	●
Compatibility	○	○	○	○	○	○	○	○	○	●	●	●	●	●	◒	○
Physicians and Administrators Relationship	○	○	●	●	◒	○	○	●	○	◒	○	○	○	●	○	○
Education	◒	◒	●	●	◒	●	●	●	◒	●	◒	◒	◒	●	◒	◒

Table 5.5: Mapping of Actors and Factors Influencing the EAI Adoption in HOSPITAL_UK

The interviewees reported that the proposed actor and factor approach supports them, realising the nature of EAI technology and the factors related to its adoption. It is worth reporting the views of Non-Clinician C:

> *'The development of the new system will probably affect the way we work. We need to know in advance the changes associated with this system. The hospital should inform us about the nature of the changes and how we will be affected by that. Many times we react to the introduction of new systems as these are proposed quite often. For that reason we can not base our work on these systems as we need to be trained all the time and change the way we work. On the other hand, if you knew that a system makes our life easier or significantly improves the delivery of services and care, we will accept and use it with pleasure.'*

Since many other actors share similar views to the one reported above, *it appears that the various influential factors should be examined in relation to the actors who affect and/or are affected by the EAI adoption.* This finding confirms the author's approach to consider both factors and actors when adopting EAI.

An example of this is one issue that shows that each actor was interested in specific factors affecting the EAI adoption process. For instance, not all actors are interested in the technical factors. This implies that multiple interrelationships among factors and actors do exist. However, these interrelationships and their nature (negative, positive) remain unknown. Khoumbati *et al.*,(2006a) studied the interrelationships among different factors that influence the EAI adoption in healthcare organisations and demonstrated the importance of understanding and studying these interrelationships. As a result, the following proposition is put forward as this research extends Khoumbati's (2005) work:

> *'It appears that the casual interrelationships that exist among the actors and the factors are important and thus, should be investigated in depth'.*

Despite the fact that the author attempted to explore this proposition during the data collection process, more research is required to fully understand this phenomenon.

Empirical data elicits that actors believe that some factors are medium or most important for them. This is illustrated in Table 5.6a (which is based on Table 5.5) with the following paragraphs analysing the data retrieved for the examination of the ***Factors and Actors Issue***.

EAI Adoption Factors		Actors Influenced in HOSPITAL_UK
Cost	●	Clinicians, Non-Clinicians, Hospitals, Medical Departments, Researchers, Suppliers, Technologists, Managers, Government, Health Authorities
	◒	Clinical students, Administrators
Barriers and Benefits	●	**All Actors**
	◒	-
IT Support	●	Hospitals, Medical Departments, Suppliers, Technologists, Managers, Government, Health Authorities
	◒	Researchers
Internal Pressures and External Pressures	●	Clinicians, Non-Clinicians, Hospitals, Medical Departments, Administrators, Legal professionals, Suppliers, Technologists, Managers, Government, Health Authorities
	◒	Researchers
IT Infrastructure, IT sophistication, Evaluation Frameworks and Compatibility	●	Researchers, Suppliers, Technologists, Insurance companies, Managers
	◒	-
Organisational Size	●	Hospitals, Medical Departments, Researchers, Managers
	◒	Suppliers, Technologists
Telemedicine	●	Patients, Next of Kin, Clinicians, Non-Clinicians, Clinical students, Hospitals, Medical Departments, Researchers, Managers, Government, Health Authorities
	◒	-
Patient Satisfaction	●	Patients, Next of Kin, Clinicians, Non-Clinicians, Clinical students, Hospitals, Medical Departments, Administrators, Researchers, Insurance companies, Managers, Government, Health Authorities
	◒	-
Security and Confidentiality	●	Patients, Next of Kin, Clinicians, Non-Clinicians, Clinical students, Hospitals, Medical Departments, Administrators, Legal professionals, Researchers, Technologists, Insurance companies, Managers, Government, Health Authorities
	◒	Suppliers
Physicians and Administrators Relationship	●	Clinicians, Non-Clinicians, Administrators, Managers
	◒	Clinical students, Researchers
Education	●	Clinicians, Non-Clinicians, Hospitals, Medical Departments, Administrators, , Researchers, Managers,
	◒	Patients, Next of Kin, Clinical students, Legal professionals, Suppliers, Technologists, Insurance companies, Government, Health Authorities

Table 5.6a: Summarising Factors and Actors Influencing the EAI Adoption in HOSPITAL_UK

Cost factor

It appears that Cost factor is of most important for the following actors: (a) Clinicians, (b) Non-Clinicians, (c) Hospitals, (d) Medical Departments, (e) Researchers, (f) Suppliers, (g) Technologists, (h) Managers, (i) Government, and (j) Health Authorities, and medium important for: (a) Clinical students and (b)Administrators. The case data indicates that different actors are related to different parameters of the Cost factor. For example, Clinicians and other actors are related to one or more parameters of Cost factor (e.g. training) whereas the actor Hospital relates to the overall cost of EAI adoption. This indicates that a detailed classification of the Cost factor can be used to facilitate this study.

Barriers and Benefits factors

All the actors interviewed are interested in understanding the EAI Benefits and Barriers related to healthcare organisations. From *this finding, it appears that actors should be informed (e.g. through workshops or discussion forums) during the EAI adoption process.* Such an issue is also emphasized in the normative literature (NHS, 1993; Siau, 2003). In similar lines with the analysis of the Cost factor, it seems that a more detailed classification of the sub-factors of benefits and barriers can be used to enhance the level of analysis. In addition to this the interrelationships between the actors and the different parameters of Benefits and Barriers should be identified. For instance, when introducing the idea of EAI adoption to the Clinicians it is important to explain the benefits that are related with them. In doing so, there is no need to discuss the technical benefits as these are not relevant for Clinicians and they will not understand them.

In doing so, the causal interrelationships among actors and the specific sub-factors of Benefits and Barriers should be identified. As a result, information regarding the interrelationships among actors and factors like Benefits and Barriers and the nature of these interrelationships (positive-negative) should be understood and analysed by decision makers during the EAI adoption process. This will allow decision makers to better handle the various issues related to EAI when introducing the plans for EAI adoption to the actors involved. Hence, the author suggests that further research is required in this area to identify the interrelationships among the actors and the factors and their nature. From the discussion with the interviewees it seems that this evidence applies to most influential factors. It is therefore proposed that:

> *'It is important to investigate the interrelationships among a full range of factors (including sub-factors) with actors involved in EAI adoption in healthcare to facilitate a deeper level of analysis.'*

IT Support factor

The empirical data reveals that the IT Support factor is mostly important to the following actors: (a) Clinicians, (b) Non-Clinicians, (c) Hospitals, (d) Medical Departments, (e) Suppliers, (f) Technologists, (g) Managers, (h) Government, and (i) Health Authorities, and of medium importance to the Researchers. It appears that due to the complexity of EAI and the lack of employees with EAI skills, there is a need for support from external entities. For instance, within the context of this case study, HOSPITAL_UK seeks support from consultants. This is finding is in accordance to the published literature (Ginzberg and Zmud, 1998; Themistocleous and Irani, 2006) .

Internal and External Pressures factors

It appears that the IT Support factor is mostly important to the following actors: (a) Clinicians, (b) Non-Clinicians, (c) Hospitals, (d) Medical Departments, (e) Administrators, (f) Legal professionals, (g) Suppliers, (h) Technologists, (i) Managers, (j) Government, and (k) Health Authorities, and of medium importance to the Researchers. *This indicates that these actors cause or receive pressures that are related to the EAI adoption process.* The conflicting interests of these actors have been seen to lead to Internal and External pressures. For example, the Medical Director mentioned that:

> *'...a healthcare manager may be positive to EAI adoption as s/he believes that such a solution will improve the delivery of services. Admittedly, a supplier may resist as his/her company does not have the resources to implement an EAI solution.'*

Thus, it appears that these pressures and their interrelationships with the aforementioned actors should be designated in depth.

IT Infrastructure, IT Sophistication, Compatibility and Evaluation Framework of Integration Technologies factors

From the empirical data it was revealed that these technological factors can be examined and analysed as a group since, they are related to the same set of actors: Organisational Supporters (Suppliers, Technologists, Insurance companies). This finding suggests that

the technological factors should be studied in relation to the aforementioned actors (Supporters) to facilitate EAI adoption. In support of this, Grimson *et al.,* (2000) reported that the exiting healthcare IT Infrastructure and Sophistication are the main barriers in the healthcare services improvement.

Organisational Size factor

Khoumbati *et al.*, (2006b) mentioned that the size of healthcare organizations can be described by the number of beds, total assets and number of personnel. However, the main measure used as the operational definition of size is the number of beds and this influences the adoption of technological innovations. Although HOSPITAL_UK has 40 departments with small bed capacity, it provides services for special diseases treatment to a large volume of the population geographically dispersed over the 11 different sites. From the data retrieved, it appears that it is an issue that affects the EAI adoption and the actors mostly interested in this factor are the: (a) Organisational Providers (Hospitals and Medical Departments – Clinics), (b) Researchers, and (c) Managers. Moreover, the Suppliers and Technologists are affected less by the Organisational Size factor. This is in accordance to the normative literature, which suggests that the larger the organisational size, the greater the need for integrating the heterogeneous systems (Khoumbati *et al.*, 2006b).

Telemedicine factor

The Patients and Next of Kin (Acceptors), the Human and Organisational Providers (Clinicians, Non-Clinicians, Clinical Students, Hospitals, Medical Departments - Clinics), the Researchers, the Managers and the Organisational Controllers (Government, Health Authorities) are related to the Telemedicine factor. From this finding it appears that the application of EAI should support the Telemedicine that is significant for the HOSPITAL_UK as well as the aforementioned actors. However, not all the Managers and Researchers appeared to be interested in these factors, as they were not familiar to EAI technology and its advantages. *It is worth noting that Researchers and Managers should be broken down into subcategories* (e.g. type of manager, researcher [IT manager, financial manager, hospital manager etc]) to better support the analysis of data.

Patient Satisfaction factor

The Patients' Satisfaction factors affect and/or are affected by all the actors expect the Legal Professionals, Suppliers, and Technologists (as presented in Table 5.6). As the

vision of the healthcare sector is towards 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.*

Security and Confidentiality factor

Evidences from the data collected revealed that there is a need for security and confidentiality. Security and patients' data confidentiality is a factor that affects all the actors' decision making towards EAI adoption (expect the Suppliers). This is within similar lines with the normative literature that suggests security and confidentiality is critical during the implementation and adoption of integrated solutions in a healthcare setting (Huston, 2001).

Physicians and Administrators Relationship Factor

It appears that the Physicians and Administrators Relationship factor is mostly important to the following actors: (a) Clinicians, (b) Non-Clinicians, (c) Administrators and (d) Managers, and of medium importance to the Clinical Students and Researchers. The findings indicate that the relationship between Physicians and Administrators is an important factor influencing the EAI adoption in healthcare organisations. The physicians role has been characterised as crucial during the adoption of integrated technologies (Chan *et al.*, 2005; Stefanou and Revanoglou, 2006) as it can be a barrier during this process. Thus, it has been reported that Administrators should consider physicians during the integration process (Khoumbati *et al.*, 2006b)). From the empirical data, it appears that Clinicians', Non-Clinicians', Administrators' and Managers' decisions towards EAI adoption are affected by this factor with Administrator B reporting that:

> '*The integration technology should support not only the systems' integration, but also the employees' cooperation [e.g. among physicians and Administrators]...*'

Education factor

The findings show that the Education factor is associated with all the actors and it is more important to: (a) Clinicians, (b) Non-Clinicians, (c) Hospitals, (d) Medical Departments, (e) Administrators, (f) Researchers and (g) Managers. The remaining actors are less affected by the Education factor while deciding towards the adoption of EAI. Along similar lines to the literature (Iacovou *et al.*, 1995)), the education is strongly related to other parameters such as training and skills development (e.g. technical) (Bhattacherjee,

2000; Stefanou and Revanoglou, 2006)). All these parameters derive from different factors (in this case, Barriers and Cost) influencing and being influenced by various actors. This indicates that the analysis should focus 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). Since the complexity of this observation is high, it might be more helpful if modelling techniques were used to model and analyse these interrelationships. In using a cognitive map, the inter-relationships and dependencies between the various factors and actors associated with EAI adoption will be explored. Thus, the author proposes that:

> *'The interrelationships between a full range of factors (including parameters) with actors might be studied and mapped using modelling techniques (e.g. Fuzzy Cognitive Mapping and Structural Equation Modelling), to enhance the decision making process.'*

The author has presented (Table 5.5), summarised (Table 5.6a) and analysed the mapping of factors against the actors that affect the EAI adoption process in HOSPITAL_UK. From the analysis, it *appears that: (a) the various influential factors affect different or (in some cases) the same actors and (b) the various influential factors should be examined in relation to the actors who affect and/or are affected by the EAI adoption.* Such a combination can enhance the level of analysis. In examining the ***Factors and Actors Issue***, the author realised that the data (presented in Table 5.5) could not only be summarised based on those actors that affect each influential factor (Table 5.6a). The analysis could be based as well on those factors affect each actor. However, the author did not use this way to summarise and analyse the data, as it is risky to base the analysis of data collected on the proposed actors' list that was generated by the application of IGOHcaps, as: (a) IGOHcaps is a new method proposed in this research that has not been validated in other cases and (b) the proposed list of actors' is based on this method.

Therefore, the author decided to present in Table 5.6b the results, based on the factors affect each influential actor but not to analyse them. Table 5.6b horizontally illustrates the healthcare actors and groups them into acceptors, providers, supporters and controllers. Each of these categories is broken down into Human (H) and Organisational (O) lenses. Due to space limitations the author refers to each of the actor using: (a) its initial letter and (b) the corresponding number given to them in Table 5.5. Vertically, the factors that

affect the EAI adoption are presented and are ranked as medium (◒) and most important (●). Therefore, in Table 5.6b the factors that each actor is affected from are displayed.

					FACTORS	
					Most important (●)	Medium important (◒)
ACTORS	Supporter	Acceptor	H	1 P 2 NK	Barriers, Benefits, Telemedicine, Patient Satisfaction, Security and Confidentiality	Education
		Provider	H	3 C 4 NC	Cost, Barriers, Benefits, Internal Pressures, External Pressures, Telemedicine, Patient Satisfaction, Security and Confidentiality, Physicians and Administrators Relationship, Education	-
				5 CS	Barriers, Benefits, Internal Pressures, External Pressures, Telemedicine, Patient Satisfaction, Security and Confidentiality	Cost, Physicians and Administrators Relationship, Education
			O	6 H 7 MD	Cost, Barriers, Benefits, IT Support, Internal Pressures, External Pressures, Organisational Size, Telemedicine, Patient Satisfaction, Security and Confidentiality, Education	-
		Supporter	H	8 A	Barriers, Benefits, IT Support, Patient Satisfaction, Security and Confidentiality, Physicians and Administrators Relationship, Education	Cost
				9 LP	Barriers, Benefits, Security and Confidentiality	Education
				10 R	Cost, Barriers, Benefits, IT Infrastructure, IT sophistication, Evaluation Frameworks, Organisational Size, Telemedicine, Patient Satisfaction, Security and Confidentiality, Compatibility, Education	IT Support, Internal Pressures, External Pressures, Physicians and Administrators Relationship
			O	11 S	Cost, Barriers, Benefits, IT Support, Internal Pressures, External Pressures, IT Infrastructure, IT sophistication, Evaluation Frameworks, Compatibility	Organisational Size, Security and Confidentiality, Education
				12 T	Cost, Barriers, Benefits, IT Support, Internal Pressures, External Pressures, IT Infrastructure, IT sophistication, Evaluation Frameworks, Security and Confidentiality, Compatibility	Organisational Size, Education
				13 IC	Barriers, Benefits, IT Infrastructure, IT sophistication, Evaluation Frameworks, Patient Satisfaction, Security and Confidentiality, Compatibility	Education
		Controller	H	14 M	Cost, Barriers, Benefits, IT Support, Internal Pressures, External Pressures, IT Infrastructure, IT sophistication, Evaluation Frameworks, Organisational Size, Telemedicine, Patient Satisfaction, Security and Confidentiality, Compatibility, Physicians and Administrators Relationship, Education	-
			O	15 G	Cost, Barriers, Benefits, IT Support, Internal Pressures, External Pressures, Telemedicine, Patient Satisfaction, Security and Confidentiality	Compatibility, Education
				16 HA	Cost, Barriers, Benefits, IT Support, Internal Pressures, External Pressures, Telemedicine, Patient Satisfaction, Security and Confidentiality	Education

Table 5.6b: Summarising Actors and Factors Influencing the EAI Adoption in HOSPITAL_UK

5.2.3 Summarising Findings Obtained from HOSPITAL_UK

The empirical investigation indicates that the proposed method can be used to identify the healthcare actors involved in the adoption process. The case data indicated that few additional findings and propositions for further research related to the actors' identification arose. These findings are summarised below and presented in Table 5.7.

Table 5.7 summarises the stages of the empirical investigation, and the issues under research. Moreover, the symbol tick (✓) is used to indicate that the specific issue was defined, applied, tested and/or validated. Moreover, the findings and propositions, identified for each research issue, are presented in the last column. For example, the fourth stage of the empirical investigation is related to the application of the IGOHcaps method and Table 5.7 depicts that the IGOHcaps method was applied to HOSPITAL_UK and 16 healthcare actors were identified. More specifically, Table 5.7 indicates that all issues under examination were validated.

Stage of Empirical Investigation	Research Issue	Defined	Applied	Tested	Validated	Findings and Propositions
1	Test ***Human and Organisational Issue***			✓	✓	Humans and organisations should not only be seen individually but also as groups (of people or organisations)
2	Test ***Actors' Categorisation Issue***			✓	✓	
3	Test ***Actors' Definition Issue***			✓	✓	Healthcare actors involved in the adoption of IS can be defined as: 'any individual or group of human and/or organisation that accepts, provides, supports or controls healthcare services'
4	Apply IGOHcaps method in HOSPITAL_UK (***Human and Organisational, Actors' Categorisation, Actors' Definition, Guidelines*** and ***Mix Approach Issues***)		✓			16 actors were identified (see Table 5.4)
5	-	***Actors' List Issue***				16 actors to be tested
6	Propose ***Actors' List Issue***			✓	✓	**2 New Actors:** Banks and Citizens were identified The different types of actors Manager and Researcher should be identified and tested.
7	Test ***Guidelines Issue***			✓	✓	**1 New Guideline**: Business processes *and especially business process models, such as IDEF0* should be considered when identifying different actors. This guideline should be tested
8	Test ***Mix Approach Issue***			✓	✓	
9	Test ***Factors and Actors Issue***			✓	✓	Propositions for further research made (presented below)

Table 5.7: Main Findings in HOSPITAL_UK

Moreover, the case data uncovered additional attributes of ***Human and Organisational, Actors' Definition, Guidelines, Actors' List and Factors and Actors Issues***.

Human and Organisational Issue:

Sub-lenses should to be used to distinguish *individuals from groups* of human and organisational actors (discussed in 5.2.2.1). Thus, the case data indicated that the following proposition should be further investigated: *Humans and organisations should not only be seen individually but also as groups (of people or organisations)*

Actors' Definition Issue:

Healthcare actors involved in the adoption of IS can be defined as: *'any individual or group of human and/or organisation that accepts, provides, supports, or controls healthcare services'.*

Guidelines Issue:

The case data indicated that (discussed in 5.2.2.4) one new guideline derived for healthcare actors identification involved in the EAI adoption: '*business processes definitions and especially models, such as IDEF0 should be considered for the identification of different actors. When business process models, such as IDEF0 are considered, actors should be separated from other resources.'* It seems that this guideline may be used to identify not only the healthcare actors that are involved in the adoption of EAI but it can also be used in other environments as well. However, this issue should be further explored and tested.

Actors' List Issue:

In addition to the actors identified in Table 5.4, the actors *Banks and Citizens should be considered as well.* Also, *different types of the actor Manager should be identified and tested.*

Factors and Actors Issue:

Through the empirical investigation, the following issues were identified and proposed for further research:

- *'The casual interrelationships that exist among the actors and the factors are of high importance and thus, should be investigated in depth'*

- *'It is important to investigate the interrelationships among a full range of factors (including sub-factors) with actors involved in EAI adoption in healthcare to facilitate a deeper level of analysis.'*

- *'Researchers and Managers should be broken down into subcategories* (e.g. type of manager, researcher [IT manager, financial manager, hospital manager etc]) to better support the analysis of data.'

- '*The interrelationships between a full range of factors (including parameters) with actors might be studied and mapped using modelling techniques (e.g. Fuzzy Cognitive Mapping and Structural Equation Modelling), to enhance the decision making process.'*

5.3 Case Study Two: HOSPITAL_GR

The name of the hospital where the second case study was conducted can not be published for confidentiality reasons. The researcher has adopted the pseudo-name HOSPITAL_GR, to refer to this organisation. HOSPITAL_GR is a specialised hospital that is based in Greece. It operates as a private non-profit organisation. Before analysing the case data, the author presents the National Health Service in Greece and background information regarding HOSPITAL_GR.

In doing so, the researcher: (a) describes the background related to HOSPITAL_GR (b) explains the need for HOSPITAL_GR Information Systems' integration and (c) supports the identification of healthcare actors, by applying the IGOHcaps method (Figure 3.2) in HOSPITAL_GR, as the identification of full list of healthcare actors' depends on the specific context and timeframe.

5.3.1 Overview of National Health System in Greece

In 1983, the Greek National Health System, named ESY, was established under the Law 1397/1983 (HAPC, 2003). The Ministry of Health and Welfare is responsible for the healthcare provision as well as for the national health policy and strategy development. The Greek NHS consists of the following three subsystems, which operate almost independently (Koutsouris *et al.*, 2005):

- The National Health System (ESY), which comprises of public hospitals, Health Centres and the National Centre of Emergency Care. ESY provides hospital, healthcare and emergency pre-hospital care on a universal basis. It aims to provide free and comprehensive health care coverage.

- The Social Security Institution (IKA) and other Social Insurance Funds, which are dealing with the insurance coverage and

- The private sector, with numerous diagnostic centres, private clinics, laboratories etc.

ESY constitutes of 123 general and specialised public hospitals (36,621 beds) and 9 psychiatric clinics (3,500 beds). Moreover, 32 hospitals out of the 123 provide tertiary and highly specialised care (HAPC, 2003). Healthcare services are provided as well by public hospitals, which include 13 Military hospitals financed by the Ministry of Defence, 5 Hospitals of the Social Security Institution (IKA) and two university hospitals operating under the authority of the National and Kapodistrian University of Athens. Emergency pre-Hospital Care is provided by the National Centre of Emergency Care (EKAB) which is a NHS agency.

Health Centres provide also emergency services, short hospitalisation and follow up of recovering patients, dental treatment, family planning services, vaccinations, and health education. In addition, healthcare services are provided extensively by private healthcare organisations (26%). Nowadays, 234 private hospitals and clinics operate in Greece, with a total capacity of 15,397 beds (HAPC, 2003). It appears that the Greek NHS is a mixed system of public-private funding and provision of health care services.

Since the establishment of the National Health System in 1983, several efforts for modernisation have taken place. Initially, these efforts were dealing with issues, such as managerial, primary health care networks, decentralisation of the system and quality assessment. Nonetheless, these reforms were not fully implemented. In 2000, an *ad hoc* committee was set up to make proposals related to the NHS modernisation (Koutsouris *et al.*, 2005).

The committee summarised the findings of similar committees set up a few years ago and assisted the rational political decisions made by the Minister of Health. The propositions of the committee were related to structural changes such as the operation of 17 Regional Health Authorities and the establishment of new managerial structures in public hospitals. Regarding the public hospitals, it was suggested that these should operate as legal entities subject to private law. Most of these proposals were enacted in a new law in February 2001.

During the period 1990-1992 (Mediterranean Integrated Systems Programme), the first efforts to modernise the healthcare sector, through the use of Information Systems was made (HAPC, 2003). The aim was to computerise the paper-based healthcare organisations. However, these efforts mainly focused on the design of new HIS. The need

for developing an integrated healthcare IT infrastructure that will enhance the services provided to citizens and will support the management and administration, became apparent (Koutsouris *et al.*, 2005).

In doing so, the Greek National Health System secured funds from the second European Support Framework (1994-1999), to:

- Upgrade nine Hospitals' Servers,
- Develop an Integrated System for the National Centre of Emergency Care (EKAB),
- Implement Telemedicine Applications and
- Face the Y2K problem in 128 healthcare organisations.

Within the third European Support Framework, the desicions made regarding the HIS implementations in Greece, are the following:

- Interconnection of resources to support the accessibility of scientific and administrative staff and enhance the diagnosis and prescription processes,
- The development of integrated information systems to healthcare centers,
- The development of secure systems for the accessibility of confidential information regarding the health conditions of patients and
- The development of information systems and telematic applications for elderly and disabled citizens.

In public hospitals, the distribution of Information Systems per unit appears to be unbalanced. It has been estimated that 80% of the implemented systems is directed in the service of administrative operations, and 18% supports medical related applications (Koutsouris *et al.*, 2005). The recent initiatives of the Greek health sector aim at the introduction of Healthcare Information Systems and their integration. The development of a unified HIS is being promoted while measures are being taken for the safety, confidentiality and reliability of patients' data (Koutsouris *et al.*, 2005).

5.3.1.1 Background of HOSPITAL_GR

HOSPITAL_GR is based in Greece and operates as a non-profit institution, under the supervision of the Ministry of Health. It provides the complete spectrum of services to the local and international community, including preventive medicine and diagnosis and treatment for heart diseases. The hospital supports research related to the prevention, diagnosis and treatment of diseases, by providing considerable scientific resources. In doing so, HOSPITAL_GR cooperates with distinguished educational institutions, and specialized research centres, in Greece and abroad. In 2005, it had been estimated that 7.808 patients were hospitalised in HOSPITAL_GR and 1.681 patients had an operation.

In terms of services provided, HOSPITAL_GR is organised in the following departments: (a) Medical and Nursing Services Department, (b) Financial Services Department and (c) Managerial Services Department. Each department has separate management, with the management team comprising of a Chief Executive Officer (CEO), who heads the HOSPITAL_UK and departmental directors (Director of Medical and Nursing, Director of Finance, and Director of Management). The Managerial Services Department is organised in different sub-departments (offices), such as the Quality Assurance Office, Nutrition Office, Technical Office, Education Office, Patient Records Office, Information Systems Management Office etc and each office has its own Office Director.

The latter (Information Systems Management Office) aims to support the business plan set by the management team of the hospital. In doing this, the information and data needed for diagnosis, prescribing and administration purposes should be available on time to the multiple users of the system. More specifically, the Information Systems Management Office deals with the following:

- Management of the IT Infrastructure of HOSPITAL_GR,
- Management and distribution of clinical and managerial information,
- Support of medical research, through the analysis and distribution of hospital's statistical data,
- Support of software implementations and hardware healthcare IT applications,
- Provision of quality assurance and
- Provision of training to users etc.

This case study lasted for 6 months and during this period, the author conducted interviews, to test and evaluate the proposed conceptual model (Objective 4). In doing so, the author initially applied the IGOHcaps method to identify actors and then interviewed the following actors: (a) Citizen A, (b) Citizen B, (c) Citizen C, (d) Clinician A, (e) Clinician B, (f) Clinician C, (g) Clinician D, (h) Non-Clinician A, (i) Non-Clinician B, (k) Non-Clinician C, (l) Administrator A (m) Administrator B, (n) Departmental Director A, (o) Departmental Directors B, (p) Office Director A and (q) Office Director B.

5.3.1.2 Technological Background of HOSPITAL_GR

Since the beginning of its operation, HOSPITAL_GR realised the catalytic role of Information Systems and developed its first integrated Healthcare IT Infrastructure. The latter comprised from a set of Information Systems and Applications. Initially, the Healthcare Information System communicated on-line with the Laboratory Information System (LIS). The HIS transmits to the LIS electronic orders of laboratorial examinations (with complete use of bar-codes for speed and safety). After the execution of the examination, the latter is checked either automatically from the laboratory analysts from LIS, or manually by the laboratory doctors. The examination's results are collected by the LIS and the laboratorial doctor verifies, approves and dispatches it to the HIS. Then, the Electronic Medical Record of the patient is updated automatically and disposed to the medical/nursing personnel for review or printing. This communication was based on proprietary protocol of communication, which was similar to HL7.

The system proved to be a viable, effective and efficient integrated solution that provided significant benefits to the healthcare organisation. However, in 2000, due to the increasing needs and demands of HOSPITAL_GR, the management team decided to advance the existing healthcare IT infrastructure. Thus, they implemented an Integrated healthcare IT Infrastructure that consisted (except from the HIS and LIS) from the following Information Systems:

- Enterprise Resource Planning System,
- Picture Archiving and Communication System (PACS)
- Radiology IS
- Personnel Management IS,

- Clinical IS
- Administrative IS,
- Patient Pricing IS,
- Drugstore IS,
- Internal Business-to-business Network and
- Electronic medical libraries IS

In Chapter 2 the different types of Healthcare Information Systems were categorized, based on a critical review of the literature. As presented in Table 2.1, HIS can be classified into: (a) clinical, (b) non-clinical - support systems (c) non-clinical – administrative, (d) non-clinical – financial, (e) pharmaceutical and (f) laboratory. The author uses this classification to categorise the HIS that have been implemented in HOSPITAL_GR and presents this in Table 5.8.

Healthcare Information Systems in HOSPITAL_GR			
Process Supported		**Healthcare IS**	**Description**
Clinical		Clinical IS	Records all clinical incidents
		Healthcare IS	Manages information related to patient (e.g. booking appointments, financial, clinical etc)
		PACS	Stores, retrieves, manages radiological pictures
		Radiology IS	Stores, captures, manipulates, retrieves, and transmits data about patients' radiological examinations (e.g. X-rays, Ultrasound etc) - (exchanges data with PACS
Pharmaceutical		Drugstore IS	Keep records about drugs' ordering, stocking and distribution
Laboratory		Laboratory IS	Physicians or nurses use devices at the point of-care to provide laboratory results
Non-Clinical	Support Systems	Electronic medical libraries IS	IS that communicates with electronic medical libraries
		ERP	Manages Financial Transactions and Warehouses
		Personnel Management IS	Manages human resource
		Internal Business-to-business Network	Supports Business-to business transactions.
	Administrative	Administrative IS	Holds all patient demographics, such as address, date of birth and admission details)
	Financial	Patient Pricing IS	Support financial transactions with patients

Table 5.8: Classification of Healthcare Information Systems in HOSPITAL_GR

In support of this, the author asked the IS Manager of HOSPITAL_GR (Office Director A) to comment upon this classification and he stated that:

> *'I like the way you have categorised the IS developed in HOSPITAL_GR...However, what is extremely interesting about the development of IS in our hospital [HOSPITAL_GR] and should be highlighted, is that the patient was the main consideration of the presented IS implementations. The hospital's information should be collected and distributed, based on the patient. For example, in HOSPITAL_GR, each patient is identified by a unique registration number and one or more unique incident's registration number(s) that are assigned to him/her [patient] during the registration of every incident...'*

To better explain this, the IS Manager designed on a paper the diagram displayed in Figure 5.3.

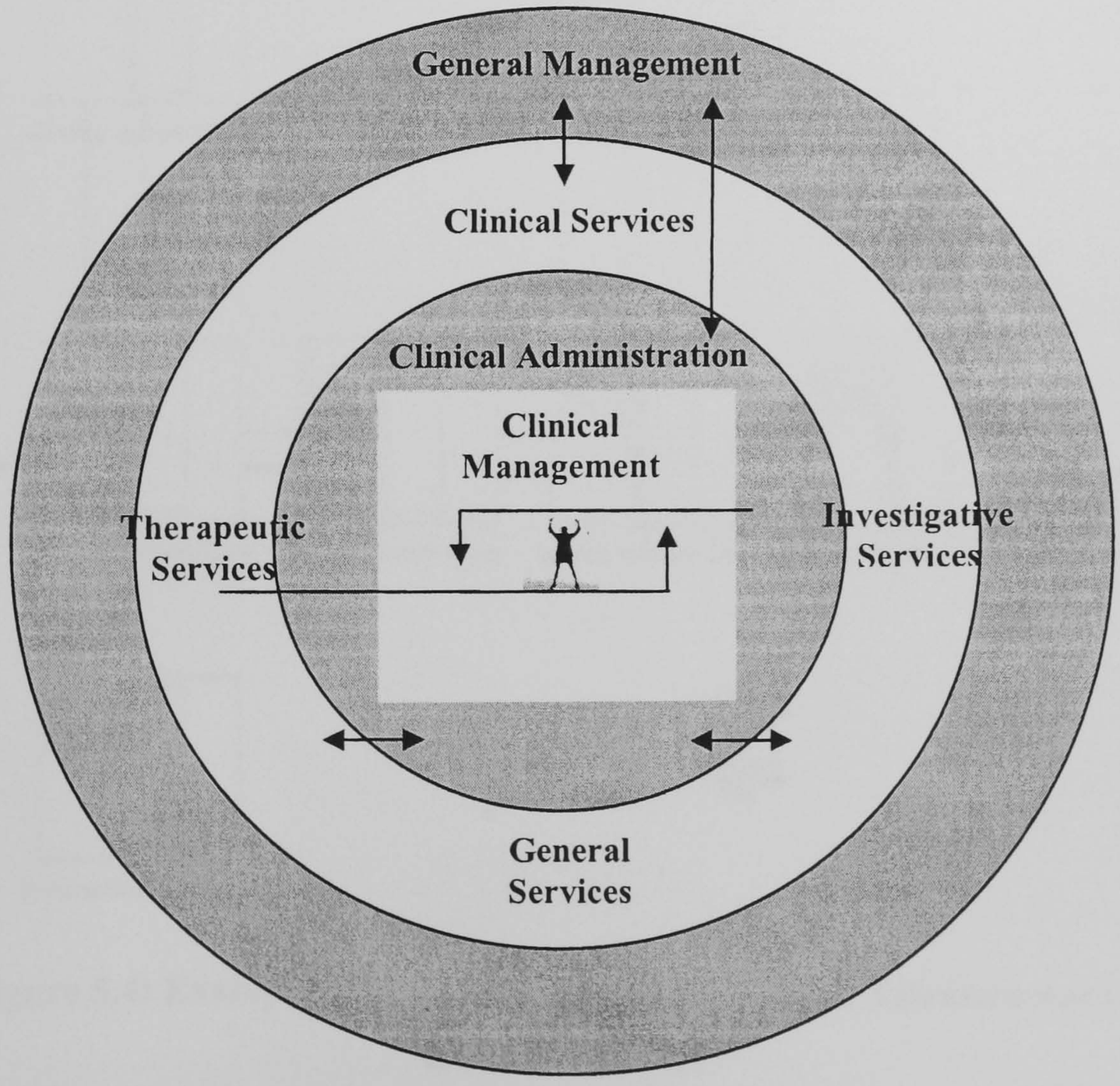


Figure 5.3: Example of Patient-centric Approach in Hospital_GR

It appears that the IS classification (presented in Table 5.8) validates the classification of IS used in healthcare (presented in Section 2.2.1).

Moreover, from the aforementioned comment of the IS Manager, it appears that the Healthcare Information System was designed and implemented based on a patient-centric approach. The information was organised on Electronic Patient Records (Medical, Financial etc) and the management of this information is based on the unique patient's and registration's number. This finding is in accordance to the normative literature, which indicates that the healthcare IT infrastructures developed, should be based on patient centric approach (DoH, 2004; Koutsouris *et al.*, 2005).

Therefore, a patient interacts with multiple systems from admission to discharge, such as Healthcare Information System, Radiology Information System, and Application for Patient Pricing etc. As, these systems are integrated, they exchange information to support medical and administration applications of HOSPITAL_GR (Figure 5.4).

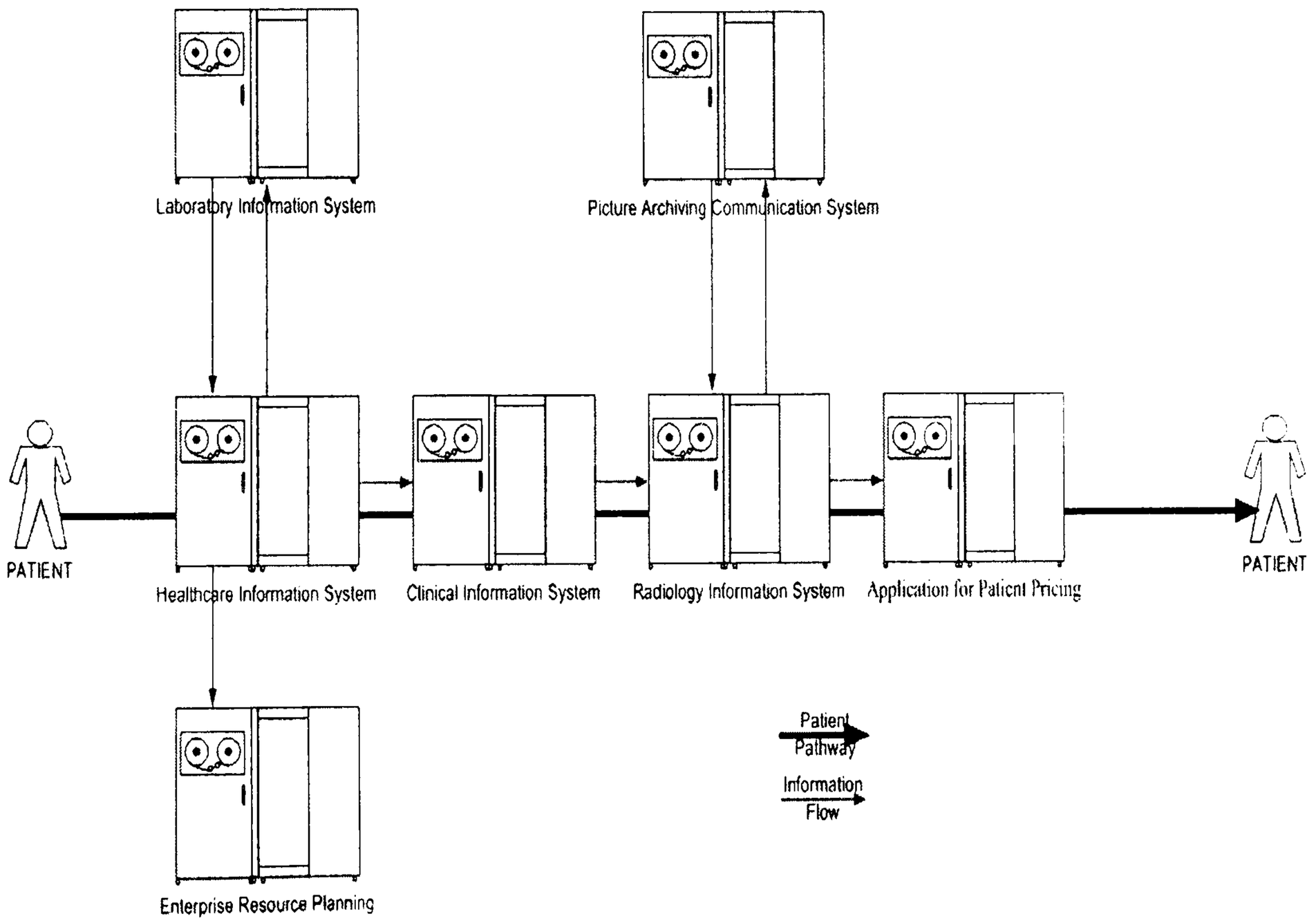


Figure 5.4: Example of Patient Pathway and Basic IT Infrastructure of HOSPITAL_GR

5.3.1.3 Process for EAI Adoption

The purpose of this integrated healthcare IT Infrastructure is to provide reliable and functional access and sharing of information. This should be both on time and on place. To this end, the IS Manager reported that:

> *'...Since the beginning of its operation, HOSPITAL_GR realised that information has no meaning, if the IT Infrastructure is not integrated. Thus, all the implementation of the updates IS was based on this concept. Thus, by realising the need for integrated systems from the beginning, HOSPITAL_GR saved time and money...'*

During the interviews, it was highlighted that the changes associated with the EAI adoption should be communicated to the multiple actors. The actors are not passive acceptors of an innovation, but they are actively involved in the adoption process by seeking for innovations, trying to understand and use them, developing feelings about them, complaining and trying to improve them (Greenhalgh *et al.*, 2004). The actors' beliefs, reaction and attitude towards EAI adoption is crucial and it therefore forms a risk for the project. To this end, the IS Manager reported that:

> *'Multiple actors are playing a critical role during the adoption of EAI...the successful implementation of the new system is based on these actors....'*

It was revealed that the actors have a critical role and can affect the outcome, if they don't adopt the EAI technology. In support of this, the Director of Management mentioned that:

> *'...Since the beginning of the HOSPITAL_GR operation, employers had been trained on the Information Systems developed. In 2000, when the new integrated system was implemented, HOSPITAL_GR realised that without training and education of users, the system will fail. Thus, as the users' adoption is the most critical part (regarding the successful implementation), the adoption of EAI was a well-planned process...the*

users and staff had been trained on the new system for approximately 6 months.'

These concerns indicate that it is of high importance to study and analyse the actors' views since their actions can have a great impact on IS adoption. These comments are in line with the normative literature which highlights that actors' reactions might lead to IS failure (Fitzgerald and Russo, 2005). These views further support the aim of this research and demonstrate that there is scope for timeliness and novel research in this area. Thus, it is important to identify the actors and understand their stances towards EAI adoption.

5.3.2 Testing of Issues under Research in HOSPITAL_GR

To identify the actors the author applied the IGOHcaps method. In doing this, the static step ***(Human and Organisational, Actors' Categorisation*** and ***Actors' Definition Issues)*** should be considered before the dynamic. Then each of the guidelines should be applied to each of the proposed human and/or organisational categories (static step) individually (e.g. human acceptors, human supporters etc).

In doing this, a list of healthcare actors was generated and then evaluated in the HOSPITAL_GR, as the full actors' list depends on the specific context and timeframe. The process for healthcare actors' identification was explained and displayed in Figure 3.4.

The validation of the static step is important for the application of the method as the dynamic approach is grounded on the static step. This means that before the *application and testing of the dynamic step*, the static one should be tested. The application of both static and dynamic steps results in the identification of a list of healthcare actors that are involved in the adoption of EAI. Thus, at the last stages of this research the following are evaluated:

- A list of actors that derived from the IGOHcaps method,
- The guidelines (dynamic step - *Guidelines Issue*) and
- The combination of static and dynamic steps *(Mix Approach Issue).*

Therefore, multiple healthcare actors were identified and interviewed to assess the research issues. Moreover, the results of the method were evaluated, through these interviews and the findings are presented in the next section. The steps followed to evaluate the conceptual model (presented in Figure 3.5) have been summarised in Table 5.9 and will be analysed in the following sections.

Stage of Empirical Investigation	Aim
1	Test ***Human and Organisational Issue***
2	Test ***Actors' Categorisation Issue***
3	Test ***Actors' Definition Issue***
4	Apply IGOHcaps method to HOSPITAL_GR (***Human and Organisational, Actors' Categorisation, Actors' Definition, Guidelines*** and ***Mix Approach Issues***)
5	Propose ***Actors' List Issue***
6	Test ***Mix Approach Issue***
7	Test ***Guidelines Issue***
8	Test ***Actors' List Issue***
9	Test ***Factors and Actors Issue***

Table 5.9: Stages of Empirical Investigation in HOSPITAL_GR

5.3.2.1 Testing *Human and Organisational, Actors' Categorisation and Definition Issues* (Stages 1, 2 and 3)

Initially, the researcher asked the interviewees to validate the use of human and organisational lenses (***Human and Organisational Issue***). From the empirical data retrieved, it appears that the interviewees of HOSPITAL_GR were positive towards this issue. In support of this, the Human Resource Director (Departmental Director B) mentioned that:

> *'The decision towards the EAI adoption is different between human and organisations. Organisations perceive the adoption of an innovation, as a process that will provide competitive advantage, will increase the profit and improve services provided to patients. On the other hand, an individual's decision towards the EAI adoption is affected by the values, norms and needs...Therefore, the fact that you identified these two*

> *lenses is really interesting and important towards the successful adoption'*

During the interviews in HOSPITAL_GR, an interesting issue that came out is the following: '*humans and organisations should not only be seen individually but also as groups (of people or organisations) [Individuals and Groups sub-lenses]'*. Non-Clinician B mentioned that:

> *'The decision of an Individual towards the EAI adoption is rarely independent of other decisions. The decisions that can affect him/her can be either a group's decision or an individual's decision. For example, my decision to adopt EAI, was affected by the decision of my colleagues. Moreover, as I was not familiar with technology, the support from the IT manager, who extensively explained the benefits and functionality of EAI was really useful and motivated me to adopt EAI...'*

This is in accordance to the normative literature, which reports that the decision to adopt an innovation (e.g. EAI) can be contingent (individual is affected by another individual), collective (individual is affected by decision of a group) or authoritative (individual is "told" to adopt) (Greenhalgh *et al.*, 2004; Rogers, 1995; Sarker *et al.*, 2005). As this issue was highlighted by the interviewees in HOSPITAL_UK, the author proposes the ***Individuals and Groups sub-lenses*** issue for further research.

After validating the ***Human and Organisational Issue,*** the interviewees were asked to comment on the proposed actors' classification ***(Actors' Categorisation Issue)***. In doing so, the author tried to evaluate the proposed healthcare actors' definition ***(Actors' Definition Issue)***. Interviewees validated the ***Actors' Categorisation Issue*** which deals with the different categories of actors. It appears that the interviewees could not suggest a different classification for healthcare actors or enrich the proposed one, as it ***(Actors' Categorisation Issue)*** seems to be satisfactory. This validates the proposed ***Actors' Categorisation Issue.***

From the empirical evidences, it appears that the static approach is accurate and sufficiently describes the types (lenses) and categories of healthcare actors involved in the

EAI adoption process. As ***Actors' Definition Issue*** is based on the combination of ***Human and Organisational Issue*** and ***Actors' Categorisation Issue***, the author defines healthcare actors as: *any human and/or organisation that accepts, provides, supports and controls healthcare services (**Actors' Definition Issue**).*

5.3.2.2 Application of IGOHcaps Method (Stages 4 and 5)

The author, in Figure 5.9 describes the stages of empirical investigation that were followed in this HOSPITAL_GR. Having completed stages 1-3 and thus having tested the static step, in the next stage the proposed guidelines were applied individually to the four categories (acceptors, providers, supporters and controllers) of the human and/or organisational lenses (e.g. the guidelines were applied to the human acceptor, organisational acceptor etc).

For instance, the author applied the fifth guideline (related to the nature of IS) to the organisational providers (sub-category). The type of IS to be adopted is an EAI solution that will be used to integrate inter and intra-organisational systems. Therefore, the organisational providers identified are the Hospital and the Hospital Departments and Hospital Office (sub-departments). In addition, the actor Citizen was identified mainly through the application of the first guideline (**G1**) to the human acceptors category, as different European Union (EU) plans mention that the focus of healthcare should not be on *how* to provide treatment to patients but on minimising the percentages of people that need treatment. Thus, as the healthcare organisations should improve citizens' quality of life, the Citizen is considered as an actor.

Therefore, using the proposed guidelines within the specific case context and timeframe the following healthcare actors were identified (Table 5.10). Table 5.10 shows how the guidelines were applied to support healthcare actors' identification. The first column refers to the guidelines and the rest to the actors being identified using these guidelines. The symbol tick (✓) indicates that the specific actor is identified by the specific proposed guideline, where the symbol (✗) shows the opposite.

			Proposed Guidelines								
			G1	G2	G3	G4	G5	G6	G7	G8	G9
Acceptor	H	1. Patients	✓	✓	✓	✓	✓	✓	✓	✓	✓
		2. Next of Kin	✓	✓	✓	×	×	×	×	✓	✓
		3. Citizens	✓	×	×	×	✓	×	✓	×	✓
Provider	H	4. Clinicians	✓	✓	✓	✓	✓	✓	✓	✓	✓
		5. Non-Clinicians	✓	✓	✓	✓	✓	✓	✓	✓	✓
	O	6. Hospital	✓	✓	×	✓	✓	✓	✓	✓	✓
		7. Hospital Department	×	✓	×	✓	✓	✓	✓	✓	✓
		8. Hospital Office (sub-departments)	×	✓	×	✓	✓	✓	✓	✓	✓
Supporter	H	9. Administrators	✓	✓	✓	×	✓	✓	✓	✓	✓
		10. Legal professionals	✓	✓	✓	×	✓	✓	✓	✓	✓
		11. Researchers	✓	×	✓	×	✓	✓	✓	✓	✓
	O	12. Suppliers	✓	✓	✓	✓	✓	✓	✓	✓	✓
		13. Technologists	✓	✓	✓	✓	✓	✓	✓	✓	✓
		14. Research Institutes	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controller	H	15. Departmental Directors	✓	✓	✓	✓	✓	✓	✓	✓	✓
		16. Office Directors	✓	✓	✓	✓	✓	✓	✓	✓	✓
	O	17. Government	×	✓	×	✓	✓	✓	✓	✓	✓
		18. Health Authorities	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 5.10: Actors Identification through the IGOHcaps Method in HOSPITAL_GR

After identifying the list of healthcare actors, a new issue under research, named ***Actors' List Issue*** (Stage 5) has arisen:

Actors' List Issue: *'The list of healthcare actors presented in Table 5.10 is complete and representative, in the specific time frame and context'.*

5.3.2.3 Testing *Actors' List Issue* (Stage 6)

To test the ***Actors' List Issue,*** the interviewees were asked to comment on the proposed list of healthcare actors, presented in Table 5.10. The empirical data revealed that the various actors should be analysed in more detail. For instance, in the proposed taxonomy (in Table 5.10), the actors Office Directors and Departmental Directors (in the category Controller) represents all directors at different offices and departments accordingly. As reported in the previous case study (Section 5.2.2.3), this is not accurate in terms of analysis, as diverse categories of directors exist with different interests (e.g. IS Office Director, Director of Medical and Nursing, Director of Finance, Director of Management, Patient Records Office Director). In addition, it has been reported by the Departmental Director A that:

> *'The Director of Finance is interested in EAI costs, when deciding towards the adoption of EAI, while I [the IS Office Director] am more interested in knowing about the IT Infrastructure, IT sophistication, Benefits, Barriers etc...'*

Clearly, such a statement supports the author's views that various Directors do exist and there is therefore a need to identify all these types of Directors. Having in mind the findings of the previous case study the researcher requested to see business process models in an attempt to better explore the different types of Directors. However, the IDEF0 models viewed were not of any help as they refer to a business sub-process that is not related to Directors. Nonetheless, the author makes the same observation as in the case of HOSPITAL_UK since the IDEF0 models viewed included the actors involved in this sub-process. Due to the limited number of the IDEF0 models that were examined by the author, it is suggested that this issue should be investigated in more detail.

Most of the interviewees mentioned that patients and citizens should have a principal role during the decision-making regarding the EAI adoption. This is in accordance to the normative literature, which indicates that there is a need for the development of an essential patient centric healthcare IT infrastructure (DoH, 2004; Koutsouris *et al.*, 2005). The Human Resource Director (Departmental Director B) mentioned the following:

'Patients and citizens should be organised in groups, so as to put pressure on the adoption of technologies, such EAI, that will improve the healthcare services provided to them...'

5.3.2.4 Testing *Guidelines Issue* (Stage 7)

After validating the ***Actors' List Issue,*** the author tested the proposed guidelines (presented in Table 3.1). As reported in the Section 5.3.2.4 it appears that business process models, *such as IDEF0* that describe healthcare business processes should be considered, when identifying actors.

As a result, the author suggests that the following guideline should be considered and tested: *business processes definitions and especially* business process models, *such as IDEF0 should be considered for the identification of different actors. When* business process *models are considered, actors should be separated from other resources. This finding is significant as: (a) it was highlighted by the HOSPITAL_UK interviewees as well and (b) the literature has not paid attention to this issue.*

5.3.2.5 Testing *Mix Approach Issue* (Stage 8)

As it is explained above, the static and the dynamic steps were validated and the interviewees indicated that the ***Mix Approach*** can enhance the understanding, identification and classification of healthcare actors. Therefore, the ***Mix Approach Issue*** was validated.

5.3.2.6 Testing of *Factors and Actors Issue* (Stage 9)

After testing the ***Human and Organisational, Actors' Categorisation, Definition and List, Guidelines and Mix Approach Issues***, the interviewees were asked to express their views regarding the mapping of actors against the factors that affect the EAI adoption process in healthcare organisations (***Factors and Actors Issue***). The majority of interviewees mentioned that the factors influencing EAI adoption should be presented and explained to the multiple healthcare actors involved in the decision making process. Thus,

it *appears that the various influential factors should be examined in relation to the actors who affect and/or are affected by the EAI adoption.*

In addition, the empirical data indicated that the adoption of EAI technology in healthcare organisations is a process that is highly affected by multiple actors. It is worth reporting the views of the IS Manager, who mentioned that:

> *'It is really important to present and explain to the multiple healthcare actors, the factors related to EAI adoption. The sooner they understand these factors, the easier the EAI adoption will be. Another issue that should be considered and indisputably affects the adoption from individuals is the power...actually the decision of an office's director to adopt or not a technology can formulate the decision of his employee...'*

Thus, the author proposes that the interrelationships between actors and issues, such as power, should be considered during the EAI adoption. This issue has been highlighted in the normative literature (Rogers, 1995) and thus, the author proposes that:

> *'the way that the different levels of actors' power can affect the decision towards the adoption of EAI is of high importance' and should be investigated in depth.'*

In Table 5.11, the author presents the results obtained by the combination of: (a) EAI influential factors and (b) the taxonomy of the healthcare actors (Table 5.10). Such a combination can provide a more detailed level of analysis. Horizontally, Table 5.11 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 lenses. Due to space limitations the author refers to each of the actor using: (a) its initial letter and (b) the corresponding number given to them in Table 5.10. For instance actor number 3 refers to the Citizen (CI) whereas actor number 17 to the Government (G). To better understand the scope of these factors, the interviewees were asked to rank them appropriately. The ranking follows the scale of ranking used by Miles and Huberman, (1994), which represents less important (○), medium important (◒) and most important (●).

		EAI Adoption Actors in HOSPITAL_GR																	
		Acceptor			Provider					Supporter						Controller			
		H			H		O			H			O			H		O	
EAI Adoption Factors		1	2	3	4	5	6	7	8	9	1 0	11	12	13	1 4	15	1 6	17	1 8
		P	NK	CI	C	NC	H	HD	HO	A	L P	R	S	T	R I	DD	OD	G	H A
1	Cost	○	○	○	●	●	●	●	●	○	○	○	●	●	●	●	●	●	●
2	Barriers	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒
3	Benefits	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
4	IT Support	○	○	○	●	●	●	●	●	●	○	○	●	●	●	●	●	●	●
5	Internal Pressures	○	○	○	●	●	●	●	●	◒	○	○	◒	◒	○	●	●	●	●
6	External Pressures	○	○	○	●	●	●	●	●	○	○	○	◒	◒	○	●	●	●	●
7	IT Infrastructure	○	○	○	○	○	○	○	○	○	○	○	◒	●	◒	●	●	○	○
8	IT sophistication	○	○	○	○	○	○	○	○	○	○	○	◒	●	◒	●	●	○	○
9	Evaluation Frameworks	○	○	○	○	○	○	○	○	○	○	○	◒	●	◒	●	●	○	○
10	Organisational Size	○	○	○	○	○	○	○	○	○	○	○	◒	◒	◒	●	●	○	○
11	Telemedicine	●	●	●	●	●	●	●	●	○	○	●	○	○	○	●	●	●	●
12	Patient Satisfaction	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
13	Security and Confidentiality	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
14	Compatibility	○	○	○	○	○	○	○	○	○	○	◒	●	●	●	●	●	◒	◒
15	Physicians and Administrators Relationship	○	○	○	●	●	●	●	●	●	○	○	○	○	○	●	●	○	○
16	Education	◒	◒	◒	●	●	●	●	●	●	○	○	○	○	●	●	●	●	●

Table 5.11: Mapping of Actors and Factors Influencing the EAI Adoption in HOSPITAL_GR

To support the analysis of the results obtained and presented in Table 5.11, the author summarises these results in Table 5.12a, based on those actors (identified by the application of IGOHcaps method) affect each influential factor. The interviewees were

asked to rank the factors, using a less (○), medium (◒) and most important (●) classification with the Table 5.11, presenting the most important factors that affect the actors. Hence, in the following paragraphs, the analysis of the data retrieved for the examination of the ***Factors and Actors Issue*** is presented.

EAI Adoption Factors		Actors Influenced in HOSPITAL_UK
Cost	●	Clinicians, Non-Clinicians, Hospital, Hospital Department, Hospital Office, Suppliers, Technologists, Research Institute, Departmental Directors, Office Directors, Government, Health Authorities
	◒	-
Barriers and Benefits	●	All Actors
	◒	-
IT Support	●	Clinicians, Non-Clinicians, Hospital, Hospital Department, Hospital Office, Administrators, Suppliers, Technologists, Research Institutes, Departmental Directors, Office Directors, Government, Health Authorities
	◒	-
Internal Pressures and	●	Clinicians, Non-Clinicians, Hospital, Hospital Department, Hospital Office, Departmental Directors, Office Directors, Government, Health Authorities
	◒	Administrators, Suppliers, Technologists
External Pressures	●	Clinicians, Non-Clinicians, Hospital, Hospital Department, Hospital Office, Departmental Directors, Office Directors, Government, Health Authorities
	◒	Suppliers, Technologists
IT Infrastructure, IT sophistication and Evaluation Frameworks	●	Technologists, Departmental Directors, Office Directors
	◒	Suppliers, Research Institute
Organisational Size	●	Departmental Directors, Office Directors
	◒	Suppliers, Technologists, Research Institute
Telemedicine	●	Patients, Next of Kin, Citizens, Clinicians, Non-Clinicians, Hospital, Hospital Department, Hospital Office, Researchers, Departmental Directors, Office Directors, Government, Health Authorities
	◒	-
Patient Satisfaction and Security and Confidentiality	●	All Actors
	◒	-
Compatibility	●	Suppliers, Technologists, Research Institutes, Departmental Directors, Office Directors
	◒	Researchers, Government, Health Authorities
Physicians and Administrators Relationship	●	Researchers, Suppliers, Technologists, Insurance companies, Managers
	◒	Government
Education	●	Clinicians, Non-Clinicians, Hospital, Hospital Department, Hospital Office, Administrators, Research Institutes, Departmental Directors, Office Directors, Government, Health Authorities
	◒	Patients, Next of Kin, Citizens

Table 5.12a: Summarising Factors and Actors Influencing the EAI Adoption in HOSPITAL_GR

Cost factor

The empirical data reveals that the Human and Organisational Providers, the Organisational Supporters (Suppliers, Technologists and Research Institutes) and the Human and Organisational Controllers (Departmental Directors, Office Directors, Government, and Health Authorities) are related to this factor (Cost). However, from the data retrieved, it appears that Clinicians and other actors are related to one or more parameters of Cost factor (e.g. training) whereas the actor Directors are interested in the cost savings that the EAI adoption will provide. In addition to this, the IS Manager reported that:

> *'...Due to this interoperable IT Infrastructure, the hospital managed to increase productivity and reduce costs. A characteristic example is that in the laboratories of HOSPITAL_GR, (due to the integration) we need 1/3 of the employees needed in a hospital that does not have an integrated system'*

This statement implies that with EAI there is a reduction of operational costs, an increment of productivity and efficiency. This is in accordance to the normative literature, which indicates that the adoption of EAI increases the productivity and reduce costs (Khoumbati, 2005). However, the above mentioned comment highlights an important barrier that relates to possible resistance to change. Therefore, the management of the organisation should be aware of all these issues, balance them and take appropriate decisions. For instance, literature supports that in similar cases organisations took the decision to either move employees from one department to another or expand their operations using the redundant staff (Themistocleous, 2002). Clearly, these empirical and literature findings further support this research which seeks to better understand and analyse the actors and factors related to EAI in order to speed up its adoption and better manage EAI projects.

Barriers and Benefits factors

The EAI Adoption process in healthcare organisations is affected by multiple Benefits and Barriers. These factors appear to highly affect all the actors interviewed, towards the adoption of EAI. Non-Clinician C mentioned that:

> *'The more informed we are [e.g. through workshops] during the adoption process, the more positive will be towards EAI adoption...'*

As it is extrapolated from the empirical data, the interviewees would like to be aware of the benefits, the barriers, the risks and the potentials associated with EAI. This is also a finding that has been reported in the normative literature (NHS, 1993; Siau, 2003).

From the description of the Cost factor reported above it appears that EAI may benefit specific actors or categories of actors but at the same time it may cause problems to others. Thus:

> *'It is important to investigate the interrelationships among a full range of benefits and barriers with actors involved in EAI adoption in healthcare to facilitate a deeper level of analysis and understanding of these factors.'*

IT Support factor

The IT support is a factor that affects the Providers', Supporters' and Controllers' decision making process towards EAI adoption, as the IS Office provided knowledge, support and training to the multiple actors of HOSPITAL_GR. In support of this, Office Director A mentioned that:

> *'...Since the beginning of the HOSPITAL_GR operation, HOSPITAL_GR realised the importance of the IS Office during the EAI life cycle. HOSPITAL_GR had employed specialised staff to support its IT Infrastructure. These employees provided knowledge, training and support to the multiple users.'*

It appears that due to the complexity of EAI and the multiple actors are seeking for specialised IT support. From the empirical evidence, it appears that the IT Support is of great importance to the following HOSPITAL_GR actors:

- Human and organisational Providers (Clinicians, Non-Clinicians, Hospital, Hospital Department and Hospital Office (sub-departments),

- Administrators,
- Organisational Supporters (Suppliers, Technologists and Research Institutes) and
- Human and Organisational Controllers (Departmental Directors, Office Directors, Government, and Health Authorities).

Internal and External Pressures factors

The interviewees mentioned that the Internal and External Pressures factors are important and highly affect the following actors:

- Human and Organisational Providers (Clinicians, Non-Clinicians, Hospital, Hospital Department and Hospital Office (sub-departments),
- Human and Organisational Controllers (Departmental Directors, Office Directors, Government, and Health Authorities).

Moreover, the Suppliers' and Technologists' decision towards the EAI adoption is influenced (medium importance) by these factors. *This highlights that the aforementioned actors cause or receive Internal and External pressures during the EAI adoption process.*

IT Infrastructure, IT Sophistication, Compatibility and Evaluation Framework of Integration Technologies factors

The empirical data indicates that the factors related to technological issues can be examined and analysed as a group since, they are affect the same set of actors:

- Suppliers, and Research Institutes (medium importance) and
- Technologists, Departmental Directors and Office Directors (high importance).

To the rest of the actors, these factors affect less their decision towards the adoption of EAI. This finding suggests that *the technological factors should be studied in relation to the aforementioned actors to enhance the EAI adoption.*

Organisational Size factor

Although HOSPITAL_GR has 35 offices, it provides specialised services to a large volume of the population geographically dispersed. The empirical data indicates that the

Organisational size affects the Human Controllers (Departmental Directors and Office Directors) decision towards the EAI adoption. Moreover, the Organisational Supporters consider that this factor affects them. It was reported by the Office Director A, that:

> *'...The larger the organisational size, the greater the need for integrating the heterogeneous systems and the propensity of EAI adoption and more difficult the EAI adoption process, as more actors (that should be managed) are involved...'*

This finding is in accordance to the normative literature(Khoumbati *et al.*, 2006b).

Telemedicine factor

Most of the HOSPITAL_GR actors (Acceptors, Providers, Controllers and Supporters) reported that are highly affected by the Telemedicine factor. Despite the fact that telemedicine applications have not yet been implemented in HOSPITAL_GR, the interviewees mentioned that it could affect the EAI adoption. This finding highlights the importance of implementing telemedicine applications, which can support the provision of healthcare services in emergencies or in cases where fast medical response and expert care is needed. Especially in Greece, due to its geographical landscape that includes tens of small islands and isolated areas, there is a high demand for telemedicine applications. Such HIS support communities and individuals in urban or rural areas and islands (Koutsouris *et al.*, 2005).

Patient Satisfaction factor

All the HOSPITAL_GR actors, identified through the IGOHcaps method, reported that the Patients' Satisfaction factor affects the decision towards the EAI adoption. To this end the majority of actors reported that *the improvement of clinical processes and the increase patient satisfaction should be placed at the centre of the EAI solution.* Moreover, the Director of Patients Record Office (Office Director B) stated that:

> *'Always, in the beginning of the EAI adoption process, the patients and citizens are placed in the centre of attention and focus...However, as the process (EAI adoption) continues, the focus shifts from patients/citizens to financial and technical issues...thus, they (patients/citizens) are not anymore the protagonists of this*

> *process...However, it should be highlighted that the EAI adoption and thus the integrated IT infrastructure will enhance the patients' satisfaction, who will get better services in HOSPITAL_GR...patients should be treated as really demanding customers...and their satisfaction should be the main priority of employees'*

This finding is in accordance to the normative literature, which emphasizes the need for the development of a patient-centric healthcare IT infrastructure (Koutsouris *et al.*, 2005; Wanless *et al.*, 2002).

Security and Confidentiality factor

All the actors' decision towards the EAI adoption is affected by the security and confidentiality of the patients' data. This finding emphasises the need for patients' data security and confidentiality. It appears that the success EAI adoption process depends to a large extent on the ability of EAI to protect the individual (patient, citizen, and clinician etc.) against unlawful use of personal information. This is along similar lines with the normative literature that suggests security and confidentiality is critical during the implementation and adoption of integrated solutions in a healthcare setting (Huston, 2001).

Physicians and Administrators Relationship Factor

The physicians and administrators collaboration and close relationship is an important factor influencing the EAI adoption in healthcare organisations. Empirical evidences indicate that the Human Controllers (Departmental Directors and Office Directors) and Human Providers (Clinicians and Non-Clinicians) mainly affected by this factor.

The physicians' role has been characterised as crucial during the adoption of integrated technologies (Chan *et al.*, 2005; Stefanou and Revanoglou, 2006), as it can be a barrier during EAI adoption process. Clinician D reported that:

> *'The communication and collaboration among physicians and administrators is important and can affect the EAI adoption, as both have a crucial role in the system's use and in the hospital's functions'.*

Thus, the author proposes that:

> *'The interrelationships between the different actors might be studied, to enhance the understanding of the way that these interrelationships affect the EAI adoption process.'*

Education factor

HOSPITAL_GR has paid a lot of attention to the education of the multiple users and the employment of specialised staff that can enhance knowledge and support healthcare organisation. The increase of the education can positively affect knowledge and understanding and thus, increase the EAI adoption (Khoumbati, 2005). In support of this, the IS Manager reported that:

> *'The management of HOSPITAL_GR realised from the beginning the importance of the IT Office and has focused on the employment of specialised staff to support the IT Infrastructure...In Greece, only a few hospitals have paid attention to the development of a specialised IT Office'*

From the findings it appears that the following actors' decision towards EAI adoption is highly affected by the Education factor:

- Human and Organisational Providers (Clinicians, Non-Clinicians, Hospital, Hospital Department and Hospital Office (sub-departments),
- Human and Organisational Controllers (Departmental Directors, Office Directors, Government, and Health Authorities) and
- Research Institutes.

The author presented (Table 5.11), summarised (Table 5.12a) and analysed the mapping of factors against the actors that affect the EAI adoption process in HOSPITAL_GR. From the analysis, it *appears that: (a) the various influential factors affect different or (in some cases) the same actors and (b) the various influential factors should be examined in relation to the actors who affect and/or are affected by the EAI adoption.* Such a combination can enhance the level of analysis.

In examining the ***Factors and Actors Issue***, the author realised that the data (presented in Table 5.11) could not only be summarised based on which actors (identified by the application of IGOHcaps method) affect each influential factor (Table 5.12a). The analysis could be based as well on those factors [proposed by (Khoumbati, 2005)] affect each actor. In doing so, this analysis will be based on the actors' list proposed in Table 5.11. However, the author did not use this way to summarise and analyse the data, for the same reasons explained in the Section 5.2.2.6.

Therefore, Table 5.12b horizontally illustrates the healthcare actors and groups them into Acceptors, Providers, Supporters and Controllers. Each of these categories is broken down into Human (H) and Organisational (O) lenses. Due to space limitations the author refers to each of the actor using: (a) its initial letter and (b) the corresponding number given to them in Table 5.11. Vertically, the factors that affect the EAI adoption are presented and are ranked as medium (◒) and high importance (●)]. Therefore, in Table 5.12b the factors that each actor is affected from are displayed.

					FACTORS	
					Most important (●)	Medium important (◒)
ACTORS	Acceptor	H	1	P	Barriers, Benefits, Telemedicine, Patient Satisfaction, Security and Confidentiality	Education
			2	NK		
			3	CI		
	Provider	H	4	C	Cost, Barriers, Benefits, IT Support, Internal Pressures, External Pressures, Telemedicine, Patient Satisfaction, Security and Confidentiality, Physicians and Administrators Relationship, Education	-
			5	NC		
		O	6	H		
			7	HD		
			8	HO		
	Supporter	H	9	A	Barriers, Benefits, IT Support, Patient Satisfaction, Security and Confidentiality, Physicians and Administrators Relationship, Education	Internal Pressures
			10	LP	Barriers, Benefits, Patient Satisfaction, Security and Confidentiality	-
			11	R	Barriers, Benefits, Telemedicine, Patient Satisfaction, Security and Confidentiality	Compatibility
		O	12	S	Cost, Barriers, Benefits, IT Support, Patient Satisfaction, Security and Confidentiality, Compatibility	Internal Pressures, External Pressures, IT Infrastructure, IT sophistication, Evaluation Frameworks, Organisational Size
			13	T	Cost, Barriers, Benefits, IT Support, IT Infrastructure, IT sophistication, Evaluation Frameworks, Patient Satisfaction, Security and Confidentiality, Compatibility	Internal Pressures, External Pressures, Organisational Size
			14	RI	Cost, Barriers, Benefits, IT Support, Patient Satisfaction, Security and Confidentiality, Compatibility, Education	IT Infrastructure, IT sophistication, Evaluation Frameworks, Organisational Size
	Controller	H	15	DD	Cost, Barriers, Benefits, IT Support, Internal Pressures, External Pressures, IT Infrastructure, IT sophistication, Evaluation Frameworks, Organisational Size, Telemedicine, Patient Satisfaction, Security and Confidentiality, Compatibility, Physicians and Administrators Relationship, Education	-
			16	OD		
		O	17	G	Cost, Barriers, Benefits, IT Support, Internal Pressures, External Pressures, Telemedicine, Patient Satisfaction, Security and Confidentiality, Education	Compatibility
			18	HA		

Table 5.12b: Summarising Actors and Factors Influencing the EAI Adoption in HOSPITAL_GR

5.3.3 Summarising Findings Obtained from HOSPITAL_GR

The empirical investigation indicates that the proposed method can be used to identify the healthcare actors involved in the adoption process. From the discussions with the interviewees few additional findings related to the actors' identification arose. These findings are summarised below and presented in Table 5.13.

Table 5.13 summarises the stages of the empirical investigation, and the issues under research. Moreover, the symbol tick (✓) is used to indicate that the specific issue was defined, applied, tested and/or validated. Moreover, the findings and propositions, identified for each research issue, are presented in the last column. For example, the fourth stage of the empirical investigation is related to the application of the IGOHcaps method and Table 5.13 depicts that the IGOHcaps method was applied to HOSPITAL_UK and 18 healthcare actors were identified. More specifically, Table 5.13 indicates that all issues under examination were validated.

Stage of Empirical Investigation	Research Issue	Defined	Applied	Tested	Validated	Findings and Propositions
1	Test ***Human and Organisational Issue***			✓	✓	Humans and organisations should not only be seen individually but also as groups (of people or organisations)
2	Test ***Actors' Categorisation Issue***			✓	✓	
3	Test ***Actors' Definition Issue***			✓	✓	Healthcare actors involved in the adoption of IS can be defined as: 'any individual or group of human and/or organisation that accepts, provides, supports or controls healthcare services'
4	Apply IGOHcaps method in HOAPITAL_GR (***Human and Organisational, Actors' Categorisation, Actors' Definition, Guidelines*** and ***Mix Approach Issues***)		✓			18 actors were identified (see Table 5.10)
5	-	***Actors' List Issue***				18 actors to be tested
6	Propose ***Actors' List Issue***			✓	✓	Diverse types of *Office Directors and Departmental Directors*: The different types of the *Office Directors and Departmental Directors* should be identified and tested
7	Test ***Guidelines Issue***			✓	✓	**1 New Guideline:** *business processes definitions and models, such as IDEF0 should be considered for the identification of different actors. When business process models, such as IDEF0 are considered, actors should be separated from other resources.* This guideline should be tested
8	Test ***Mix Approach Issue***			✓	✓	
9	Test ***Factors and Actors Issue***			✓	✓	Propositions for further research made (presented below)

Table 5.13: Main Findings in HOSPITAL_GR

Moreover, the case data uncovered additional attributes of ***Human and Organisational, Actors' Definition, Guidelines, Actors' List and Factors and Actors Issues***.

Human and Organisational Issue:

Sub-lenses should to be used to distinguish *individuals from groups* of human and organisational actors.

Actors' Definition Issue:

Healthcare actors involved in the adoption of IS can be defined as: *'any individual or group of human and/or organisation that accepts, provides, supports or controls healthcare services'*

Guidelines Issue:

One new guideline derived for healthcare actors identification involved in the adoption of IS: '*Business process definitions and models, such as IDEF0 should be considered for the identification of different actors. When* business process models, *such as IDEF0 are considered, actors should be separated from other resources'*. It seems that this guideline may be used to identify not only the healthcare actors that are involved in the adoption of EAI but it can be used in other environments as well. However, this issue should be further explored and tested.

Actors' List Issue:

In addition to the actors identified in Table 5.10, the actors ***Office Directors*** *and* ***Departmental Directors*** *should be considered as well.* Also, *different types of the actor Manager should be identified and tested.*

Factors and Actors Issue:

Through the empirical investigation, the following issues were identified and proposed for further research:

- *'the way that the different levels of actors' power can affect the decision towards the adoption of EAI is of high importance' and should be investigated in depth.'*

- *'It is important to investigate the interrelationships among a full range of benefits and barriers with actors involved in EAI adoption in healthcare to facilitate a deeper level of analysis and understanding of these factors'* and

- *'The interrelationships between the different actors might be studied, to enhance the understanding of the way that these interrelationships affect the EAI adoption process.'*

5.4 Conclusions

Chapter 5 presented and analysed the EAI adoption practices by two healthcare organisations, namely HOSPITAL_UK and HOSPITAL_GR. Based on the empirical data reported in this chapter, the enquiry is now able to draw conclusions. However, before any conclusions can be presented, it is important to appreciate the positioning of such conclusions within the context of the empirical research methodology presented in Chapter 4.

As a result, Table 5.14 represents the conclusions derived from the stages of the empirical research presented in this chapter. The empirical investigation indicates that the proposed method can be used to: (a) identify the healthcare actors involved in the EAI adoption process and (b) support the EAI adoption process. From the discussions with the interviewees few additional findings related to the actors' identification and some propositions for further research arose. These are summarised below and presented in Table 5.14.

In Table 5.14, the symbol tick (✓) indicates that the specific issue was defined, applied, tested and/or validated. Moreover, the findings and propositions, identified for each research issue, are presented in the last column. For example, the fourth stage of the empirical investigation is related to the application of the IGOHcaps method and Table 5.14 depicts that the IGOHcaps method was applied to HOSPITAL_UK and 18 healthcare actors were identified. More specifically, Table 5.14 indicates that all issues under examination were validated in both cases.

Stage of Empirical Investigation	Research Issue	Defined	Applied	Tested	Validated	Findings and Propositions HOSPITAL_UK	Findings and Propositions HOSPITAL_GR
1	Test ***Human and Organisational Issue***			✓	✓	Humans and organisations should not only be seen individually but also as groups (of people or organisations)	
2	Test ***Actors' Categorisation Issue***			✓	✓		
3	Test ***Actors' Definition Issue***			✓	✓	Healthcare actors involved in the adoption of IS can be defined as: 'any individual or group of human and/or organisation that accepts, provides, supports or controls healthcare services	
4	Apply IGOHcaps method		✓			16 actors were identified (see Table 5.4)	18 actors were identified (see Table 5.10)
5	-	***Actors' List Issue***				16 actors to be tested	18 actors to be tested
6	Propose ***Actors' List Issue***			✓	✓	**2 New Actors:** Banks and Citizens were identified The different types of actors Manager and Researcher should be identified and tested.	Diverse types of *Office Directors and Departmental Directors*: The different types of the *Office Directors and Departmental Directors* should be identified and tested
7	Test ***Guidelines Issue***			✓	✓	**1 New Guideline**: Business process models, *such as IDEF0* should be considered when identifying different actors. *When business process models are considered, actors should be separated from other resources.* This guideline should be tested	**1 New Guideline:** Business process models, *such as IDEF0 should be considered for the identification of different actors. When business process models are considered, actors should be separated from other resources.* This guideline should be tested
8	Test ***Mix Approach Issue***			✓	✓		
9	Test ***Factors and Actors Issue***			✓	✓	Propositions for further research made (presented below)	

Table 5.14: Main Findings

Moreover, the case data uncovered additional attributes of ***Human and Organisational, Actors' Definition, Guidelines, Actors' List and Factors and Actors Issues***.

Human and Organisational Issue:

This issue was validated in both case studies. An interesting issue came out during the interviews is that *Humans and Organisations should not only be seen individually but also as groups (of people or organisations) [Individuals and Groups sub-lenses]*. This issue was highlighted by the interviewees in HOSPITAL_UK and HOSPITAL_GR, the author proposes the ***Individuals and Groups sub-lenses*** issue for further research. In addition, the author suggests that further issues such as power, control and legitimacy might be related to the formulation of opinions of these individuals and groups.

Actors' Definition Issue:

The ***Actors' Definition Issue*** was validated by interviewees in HOSPITAL_UK and HOSPITAL_GR. Moreover, since ***Actors' Definition Issue*** is based on the combination of ***Human and Organisational Issue*** and ***Actors' Categorisation Issue.*** Therefore, healthcare actors involved in the adoption of IS can be defined as: *'any Individual or Group of Human and/or Organisation that Accepts, Provides, Supports or Controls healthcare services'*

Guidelines Issue:

The ***Guidelines Issue*** was explored and validated in both case organisations. Moreover, the author suggested that the following guideline should be considered and tested when identifying actors: '*Business process definitions and models, such as IDEF0 should be considered for the identification of different actors. When business process models, such as IDEF0 are considered, actors should be separated from other resources'*. This issue should be further explored and tested.

Actors' List Issue:

By applying the IGOHcaps method in HOSPITAL_UK a full list of 18 actors and the *Actors' List Issue* (for HOSPITAL_UK) were generated. The *Actors' List Issue* was explored and validated in HOSPITAL_UK. The case data revealed that: (a) two new actors *namely,* Banks *and* Citizens were identified, (b) diverse types of the actors

Manager and Researcher should be considered and (c) the different types of the actors Manager and Researcher should be identified and tested.

By applying the IGOHcaps method in HOSPITAL_GR a full list of 18 actors and the *Actors' List Issue* (for HOSPITAL_GR) were generated. The *Actors' List Issue* was explored and validated in HOSPITAL_GR. The case data revealed that: (a) diverse types of the Office Directors and Departmental Directors should be considered and (b) the different types of the Office Directors and Departmental Directors should be identified and tested.

Factors and Actors Issue:

Through the empirical investigation, the following issues were identified and proposed for further research:

- '*The casual interrelationships that exist among the actors and the factors are of high importance and thus, should be investigated in depth*'

- *'It is important to investigate the interrelationships among a full range of factors (including sub-factors) with actors involved in EAI adoption in healthcare to facilitate a deeper level of analysis.'*

- *'Researchers and Managers should be broken down into subcategories* (e.g. type of manager, researcher [IT manager, financial manager, hospital manager etc]) to better support the analysis of data.'

- '*The interrelationships between a full range of factors (including parameters) with actors might be studied and mapped using modelling techniques (e.g. Fuzzy Cognitive Mapping and Structural Equation Modelling), to enhance the decision making process.'*

- '*The way that the different levels of actors' power can affect the decision towards the adoption of EAI is of high importance' and should be investigated in depth.'*

- *'It is important to investigate the interrelationships among a full range of benefits and barriers with actors involved in EAI adoption in healthcare to facilitate a deeper level of analysis and understanding of these factors'* and

- *'The interrelationships between the different actors might be studied, to enhance the understanding of the way that these interrelationships affect the EAI adoption process.'*

CHAPTER 6

REVISIONS OF THE CONCEPTUAL MODEL

Summary

In Chapter 5, the proposed conceptual model (Figure 3.4) for the EAI adoption in healthcare organisations was explored and tested in the practical arena. In doing so, the case organisations were presented and the data collected were interpreted. The empirical evidences that resulted from the analysis indicate that the proposed model can be used to support the decision-making process during the EAI adoption. Moreover, the findings support modifications to the proposed model and the issues under investigation. In Chapter 6, the author considers the research findings and modifies the conceptual model accordingly. More specifically, one new lens and one new guideline are added to the revised model. These additions enhance the identification of actors involved in the EAI adoption in healthcare organisations. In doing so, satisfying the aim of this dissertation by offering decision-makers and researchers a model for the adoption of Enterprise Application Integration in healthcare organisations.

6.1 Introduction

The heterogeneity of Healthcare Information Systems (HIS) has attracted a lot of research and industrial interest, as it causes multiple problems to healthcare organisations. Nowadays, healthcare organisations have turned to the adoption and implementation of Enterprise Application Integration (EAI), to overcome their integration problems. However, limited research has been conducted in the area of EAI in healthcare organisations, with the majority of this research focusing on the adoption of EAI. As reported in Chapter 1, this dissertation deals with the EAI adoption in healthcare organisations. In Chapter 2 the author, revised the normative literature and analysed and presented in Table 2.8 the main limitation of a healthcare specific model (MAESTRO) that investigates the EAI adoption (Khoumbati, 2005). To overcome the limitation of MAESTRO model, the author suggested that the factor-oriented approach (followed by the MAESTRO model) should be mapped with the multiple healthcare actors, to increase the EAI adoption and better understand this area.

Hence, the main research issues derived from Chapter 2 emphasised that: (a) the research in the area of EAI adoption in healthcare organisations remains limited, (b) the existing work (MAESTRO model) is based on a factor-oriented approach and underestimates the multiple actors affecting the Enterprise Application Integration adoption process and (c) the factor-oriented approach should be combined with an actor-oriented. Thus, to address these issues, Chapter 3 derived and conceptualised a model that can be used to explain the adoption of EAI in healthcare organisations. The proposed model contributes in the EAI adoption area, as it: (a) highlights the role of healthcare actors and attitudes towards EAI adoption, (b) introduces an actor-oriented approach (IGOHcaps method) and (c) combines the factors influencing EAI adoption with the IGOHcaps method, which supports healthcare actors' identification.

Chapter 4 justified the selection of a research methodology that can be used to test the proposed model. In doing so, an interpretivism, qualitative multiple case study approach was selected for this dissertation. Moreover, the empirical research methodology that was used in this research was graphically represented and described in Figure 4.2.

The research methodology described in Chapter 4, was used in Chapter 5 to test the conceptual model. In doing so, Chapter 5 presented and analysed the empirical data collected from two healthcare organisations, namely HOSPITAL_UK and HOSPITAL_GR. The preliminary research findings were described and the data retrieved were used to test the conceptual model and the issues under investigation, as these were summarised in Table 3.3. In doing this, the author tested and evaluated the conceptual model proposed in Chapter 3 (Figure 3.4).

Chapter 6 uses the empirical evidences derived from the case studies (presented in Chapter 5), to: (a) provide the lessons learnt from this research (Section 6.2) and (b) revise the proposed conceptual model (presented in Figure 3.5) for the adoption of EAI in healthcare organisations, (Section 6.3). The empirical findings confirmed that there is an interaction among the influential factors and healthcare actors during the EAI adoption process. The chapter concludes with the development of a revised model for EAI adoption in healthcare organisations that can be used as a decision-making tool by the healthcare organisations. It is not claimed that the proposed model is appropriate for all decision-making situations; however, it can establish itself as being a novel and beneficial approach to study the EAI adoption in those healthcare organisations.

6.2 Lessons Learnt from Case Studies

Through the empirical evidences presented in Chapter 5, the author studied the area of EAI adoption in healthcare by: (a) applying the IGOHcaps method to identify healthcare actors and (b) combining the factor and actor-oriented approaches. A synopsis of the main findings elicited from Chapter 5 is given in this section, allowing others to relate their experiences to those reported in this dissertation. No claim for generalisation is made for interpretive research of this type. It is not the intention of this dissertation to offer prescriptive guidelines for the adoption of EAI in healthcare organisations, but rather to describe case study perspectives that allow others to relate their experiences to those reported. Hence, this dissertation offers a broader understanding of the phenomenon of EAI adoption in healthcare organisations, taking into consideration the actors involved in this process. Therefore, the lessons learnt are a result of the description provided and do not seek to be prescriptive. These lessons might be helpful to healthcare organisations as well as to researchers, integrators and IT practitioners and are summarised below:

Lesson 1

Healthcare actors have an important role during the decision making process for IS adoption. This crucial role has been reported in the literature and was validated through this research. Within the context of healthcare organisations it appears that the role of actors is more significant than expected, as some actors (e.g. nurses, clinicians) seem to have the power to hold back the adoption or even lead to system's failure.

Lesson 2

Since not all the members of one actors' category share the same views, it is suggested that *Individual and Group sub-lenses* should be used in combination to the Human and Organisational lenses to further distinguish actors. This helps organisations to better understand and analyse the reactions of actors.

Lesson 3

When exploring the Individual and Group sub-lenses, issues of *power, control and legitimacy* should be considered. These issues are of high importance, as they influence Individuals and Groups of actors towards the IS adoption.

Lesson 4

The proposed method for the identification of healthcare actors (Figure 3.2) seems to have a limitation as it can not support the identification of sub-categories of some actors. The case data indicated that business processes descriptions and definitions based on business process models, such as IDEF0, can support the identification of healthcare actors. Thus, the author suggests that a new guideline related to the business process should be used to overcome the aforementioned limitation. In doing so, the different sub-categories of actors will be identified (e.g. managers: IT manager, clinicians' managers etc).

Lesson 5

IGOHcaps method proposed and explored in this dissertation provides some advantages when comparing to the guidelines proposed by Pouloudi and Whitley (1997) and Lyytinen and Hirschheim (1987). For instance the proposed IGOHcaps method provides a structured way to identify healthcare actors and classifies them into different categories (e.g. Acceptors) and lenses (Human and Organisational). On the contrary, the guidelines proposed by Pouloudi and Whitley (1997) and Lyytinen and Hirschheim (1987) can be used to identify a laundry list of actors. Furthermore, as proved in this dissertation, more actors can be identified by combining the guidelines proposed by Pouloudi and Whitley (1997) and Lyytinen and Hirschheim (1987) instead of using them individually. Thus, IGOHcaps method leads to a more systematic way to identify healthcare actors and can enhance the level of analysis and understanding.

Lesson 6

The combination of the factor and actor-oriented approaches can support a better realisation and understanding of the factors affecting the EAI adoption in healthcare organisations. This is important as it can support the management actions during the introduction of EAI solutions.

Lesson 7

The proposed approach can support decision-makers and managers to realise to which factors the different actors are mapped. Moreover, it can help them better manage the actors involved in the EAI adoption, as well as the adoption process per se.

Lesson 8

As presented in Table 2.1, HIS can be classified into: (a) clinical, (b) non-clinical - support systems (c) non-clinical – administrative, (d) non-clinical – financial, (e) pharmaceutical and (f) laboratory. The author categorised the HIS of HOSPITAL_UK (Table 5.1) and HOSPITAL_GR (Table 5.8) using the aforementioned classification to better understand the systems implemented. In doing so, the author observed that the categorization of the different types of Healthcare Information Systems (presented in Table 2.1), can be used by healthcare organizations when integrating HIS, to: (a) enhance the understanding and management of Healthcare Information Systems and (b) to support the decision-making towards the adoption of EAI.

Lesson 9

The author attempted to identify and analyse the challenges faced by HOSPITAL_UK, through interviews, documentation and observation. In addition, the author used the literature findings, proposed in Section 2.2.2. According to these findings, the author identified the potential of Healthcare Information Systems, as well as the challenges faced by healthcare organisations. The potential and current challenges were categorised in four main thematic areas, namely: (a) Information Quality, (b) Information Availability, (c) Medical Errors and (d) HIS Integration (as presented in Table 2.2). Therefore, the challenges faced by HOSPITAL_UK were displayed in Table 5.2, and discussed with multiple actors interviewed. In doing so, the author supported the actors in realising the challenges HOSPITAL_UK faced and to realise the need to integrate their healthcare IT Infrastructure. Hence, the author proposes that a similar approach can be adopted by healthcare organisations when they are trying to realise and to overcome the challenges faced.

6.3 The Revised Conceptual Model for EAI Adoption in Healthcare Setting

The findings of the empirical analysis, discussed in Chapter 5, are used in this chapter to extend and modify the conceptual model that was proposed in Chapter 3 (Figure 3.3). Therefore, based on the analysis reported in Chapter 5:

- Section 6.3.1 presents: (a) the findings that derived from the analysis of the two case studies, regarding the IGOHcaps method (summarised in Table 3.2) and (b) the revised IGOHcaps method.

- Section 6.3.2 presents: (a) the findings that derived from the analysis of the two case studies, regarding the conceptual model (summarised in Table 3.4) and (b) the revised conceptual model.

6.3.1 Findings and Revised IGOHcaps Method

In this section, the author presents the findings regarding the IGOHcaps methods (Table 3.2), which derived from the two case studies conducted. In doing so, in Table 6.1 the issues under research and the main findings (related to the IGOHcaps method) are displayed. Thus, Table 6.1 confirms the validation of the IGOHcaps method. Moreover, the issues for further research that derived from the empirical investigation are presented. The empirical investigation indicates that the proposed method can be used to identify the healthcare actors involved in the adoption process. From the discussions with the interviewees few additional findings related to the actors' identification arose.

These findings are summarised below and presented in Table 6.1.

Issues	Validated	Findings from HOPSITAL_UK	Findings from HOPSITAL_GR
Human and Organisational	✓	Humans and organisations should not only be seen individually but also as groups (of people or organisations) Issues, such as power, control, and legitimacy might be related to the formulation of opinions of these individuals and groups	Humans and organisations should not only be seen individually but also as groups (of people or organisations)
Actors' Categorisation	✓	-	-
Actors' Definition	✓	Healthcare actors involved in the adoption of IS can be defined as: 'any individual or group of human and/or organisation that accepts, provides, supports or controls healthcare services'	'Healthcare actors involved in the adoption of IS can be defined as: 'any individual or group of human and/or organisation that accepts, provides, supports or controls healthcare services'
Actors' List	✓	Application of IGOHcaps method: 16 actors were identified (see Table 5.4) Testing the *Actors' List Issue:* • **2 New Actors:** Banks and Citizens were identified • The different types of actors Manager and Researcher should be identified and tested.	Application of IGOHcaps method: 18 actors were identified (see Table 5.10) Testing the *Actors' List Issue:* •Diverse types of Office Directors and Departmental Directors: •The different types of the Office Directors and Departmental Directors should be identified and tested
Mix Approach	✓	-	-
Guidelines	✓	**1 New Guideline identified:** *Business processes definitions and especially business process models, such as IDEF0, should be considered for the identification of different actors. When business process models, such as IDEF0 are considered, actors should be separated from other resources.* *This guideline should be tested*	**1 New Guideline identified:** *Business processes definitions and especially business process models, such as IDEF0, should be considered for the identification of different actors. When business process models, such as IDEF0 are considered, actors should be separated from other resources.* . *This guideline should be tested*

Table 6.1: Main Findings Regarding IGOHcaps method

From the empirical data, it was revealed that all issues under examination were validated. Moreover, the case data uncovered additional attributes of ***Human and Organisational,***

Actors' Definition, Guidelines **and** ***Actors' List Issues***, as presented in Table 6.1. These are analysed in the following paragraphs.

Human and Organisational Issue

This issue was validated in both case studies. An interesting issue came out during the interviews is that *Humans and Organisations should not only be seen individually but also as groups (of people or organisations) (Individuals and Groups sub-lenses).* This is in accordance to the normative literature (Sarker *et al.*, 2005). For example, a Clinician might have a different stance towards the adoption of a system, than a Group of Clinicians (or different groups). As this issue was highlighted by the interviewees in HOSPITAL_UK and HOSPITAL_GR, the author proposes the ***Individuals and Groups sub-lenses*** issue for further research. In addition, the author suggests that further issues such as power, control and legitimacy might be related to the formulation of opinions of these individuals and groups.

Actors' Definition Issue

The ***Actors' Definition Issue*** was validated by interviewees in HOSPITAL_UK and HOSPITAL_GR. Moreover, since ***Actors' Definition Issue*** is based on the combination of ***Human and Organisational Issue*** and ***Actors' Categorisation Issue.*** Therefore, it can be extrapolated that healthcare actors involved in the EAI adoption can be defined as: *'Any Individual or Group of Human and/or Organisation that Accepts, Provides, Supports or Controls healthcare services'*

Guidelines Issue

The ***Guidelines Issue*** was explored and validated in both case organisations. Moreover, the author suggested that the following guideline should be considered and tested when identifying actors: *Business process definitions and especially business process models, such as IDEF0, should be considered for the identification of different actors. When business process models, such as IDEF0, are considered, actors should be separated from other resources.* The reason behind this suggestion is that the adoption of EAI aims to automate and integrate business processes. Thus, human and organisational actors (internal or external) related to these processes should be studied as they affect or are affected by the adoption of a system. *This finding is significant as the literature has not paid attention to this issue.*

Actors' List Issue

By applying the IGOHcaps method in HOSPITAL_UK a full list of 18 actors and the ***Actors' List Issue*** (for HOSPITAL_UK) were generated. The ***Actors' List Issue*** was explored and validated in HOSPITAL_UK. The case data revealed that: (a) two new actors *namely,* Banks *and* Citizens were identified, (b) diverse types of the actors Manager and Researcher should be considered and (c) the different types of the actors Manager and Researcher should be identified and tested.

By applying the IGOHcaps method in HOSPITAL_GR a full list of 18 actors and the ***Actors' List Issue*** (for HOSPITAL_GR) were generated. The ***Actors' List Issue*** was explored and validated in HOSPITAL_GR. The case data revealed that: (a) diverse types of the Office Directors and Departmental Directors should be considered and (b) the different types of the Office Directors and Departmental Directors should be identified and tested.

The author considered the aforementioned issues that emerged from the case data and were explained in this section. In doing so, a revised method for the identification of healthcare actors is proposed. The revised IGOHcaps method is illustrated in Figure 6.1. IGOHcaps method makes novel contribution at both practical and conceptual level. At a practical level, the method contributes towards a deeper understanding of the actors in healthcare organisations. At a conceptual level, it proposes a method for healthcare actors' identification that should be considered during the adoption of IS in healthcare.

The IGOHcaps method increases the level of the analysis and contributes towards a more detailed and systematic study of the adoption of IS in healthcare sector. Moreover, it supports managers and researchers in: (a) understanding the importance and effect of healthcare actors, (b) supports the identification of the multiple healthcare actors and (c) might increase the adoption of IS in healthcare. Consequently, it is suggested that this approach might reduce the resistance to change and speed up the adoption of IS.

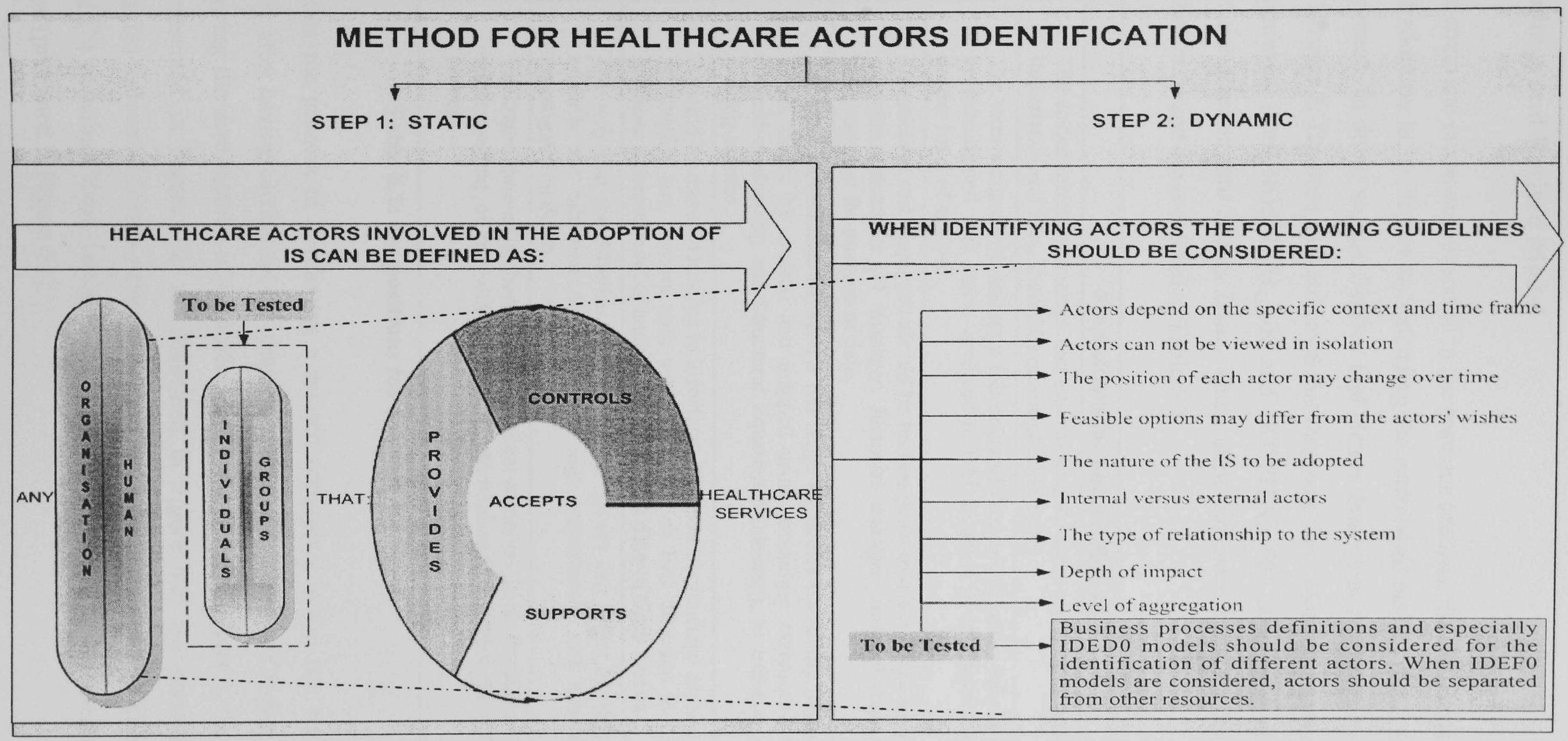


Figure 6.1: The Revised IGOHcaps Method

6.3.2 Findings and Revised Model

Through the empirical evidences presented in the previous sections, the author studied the area of EAI adoption in healthcare by extending the established norms, using an actor-oriented approach. In doing so, the ***Factors and Actors Issue*** was proposed for further research in Chapter 3. The case data indicated that this issue was validated. Moreover, the case data retrieved from HOSPITAL_UK and HOSPITAL_GR uncovered additional attributes of the ***Factors and Actors Issue.*** These attributes were proposed for further research (Chapter 5) and are presented in Table 6.2.

		Propositions for Further Research
Case Study	**HOSPITAL_UK**	The casual interrelationships that exist among the actors and the factors are of high importance and thus, should be investigated in depth.
		The interrelationships among a full range of factors (including sub-factors) should be investigated with actors involved in EAI adoption in healthcare to facilitate a deeper level of analysis.
		Researchers and Managers should be broken down into subcategories (e.g. type of manager, researcher (IT manager, financial manager, hospital manager etc)) to better support the analysis of data.
		The interrelationships between a full range of factors (including parameters) with actors might be studied and mapped using modelling techniques (e.g. Fuzzy Cognitive Mapping and Structural Equation Modelling), to enhance the decision making process.
	HOSPITAL_GR	It would be more interesting to investigate the interrelationships among a full range of benefits and barriers with actors involved in EAI adoption in healthcare to facilitate a deeper level of analysis and understanding of these factors.
		The way that the different levels of actors' power can affect the decision towards the adoption of EAI is of high importance' and should be investigated in depth.
		The interrelationships between the different actors might be studied, to enhance the understanding of the way that these interrelationships affect the EAI adoption process.

Table 6.2: Propositions for Further Research

It appears that the process of developing a revised conceptual model has been made possible only after having carried out the empirical research reported in Chapter 5. As a result, following the investigation of research issues identified in Chapter 3, the revised model is presented in Figure 6.2. As illustrated in Figure 6.2, the revised model incorporates: (a) influential factors reported in previous studies (proposed by Khoumbati, (2005)) and (b) combines these factors with the revised method for healthcare actors identification (presented in Figure 6.1).

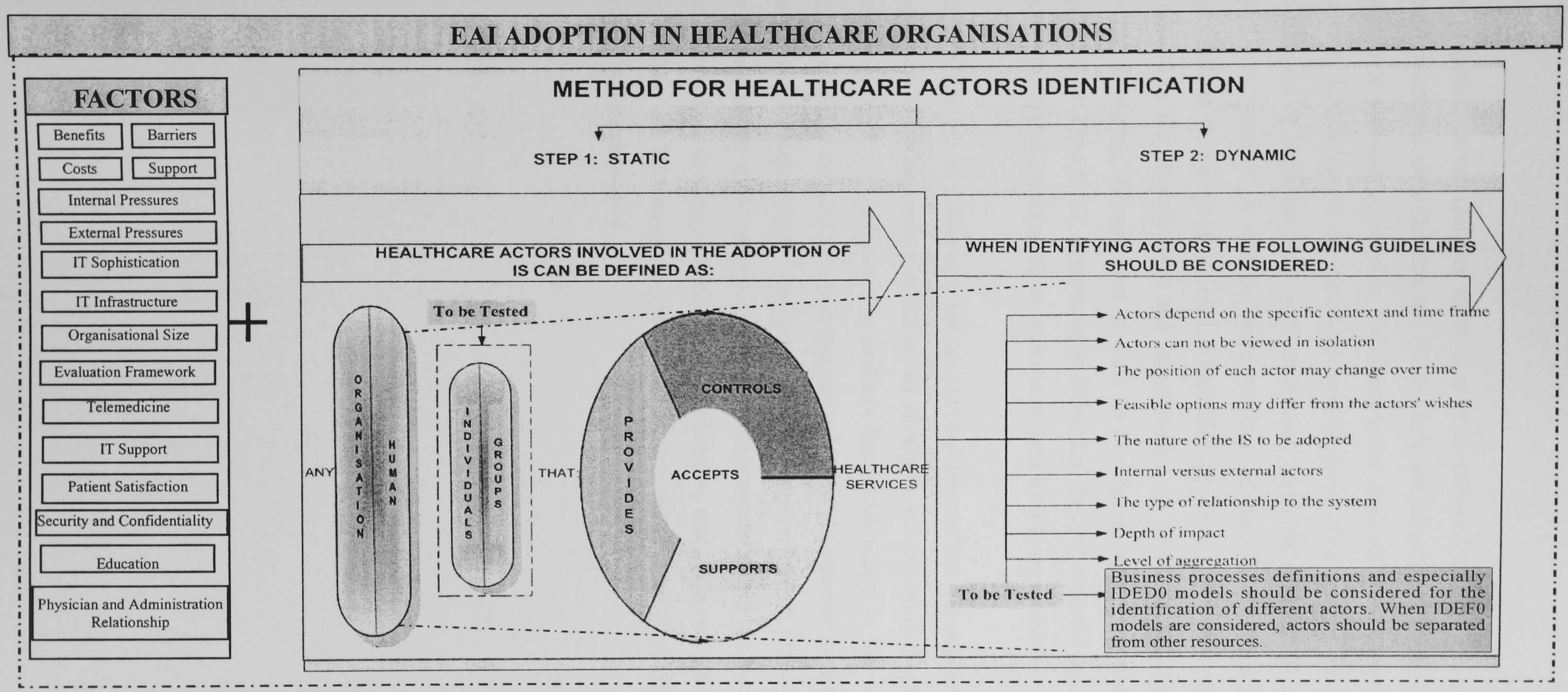


Figure 6.2: The Revised Conceptual Model

The proposed model clarifies much confusion surrounding: (a) the healthcare actors' classification and identification and (b) the EAI adoption in healthcare organisations. In doing so, it provides answers to the issues under research identified from the literature regarding EAI adoption in healthcare organisations. The revised model makes novel contribution at both practical and conceptual level. At a practical level, the model contributes towards a deeper understanding of the EAI adoption in healthcare organisations. At a conceptual level, it identifies, proposes and revises IGOHcaps method (Figure 6.1) for classification and identification of healthcare actors that should be considered during the adoption of EAI in healthcare. Moreover, the revised model, presented in Figure 6.2, incorporates influential factors reported in previous studies (MAESTRO) and combines them with the revised IGOHcaps method.

The combination of actors and factors-oriented approaches: (a) supports managers and researchers in understanding which actors should be considered during the study of EAI adoption factors, (b) supports the multiple healthcare actors in the realization of the factors related to the EAI adoption process and (c) might increase 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. The conceptual model can be used as a tool for decision-making to support healthcare organisations, and allow researchers to apprehend and analyse the EAI adoption process. Therefore, the services provided to patients and citizens will be improved.

6.4 Conclusions

The author proposed that healthcare organisation should consider both the influential factors of MAESTRO model (Figure 2.5), as well as the IGOHcaps method for healthcare actors' identification (Figure 3.2), when taking decisions for the EAI adoption process. In doing so, the author proposed and validated in the practical arena the model presented in Figure 3.4. The empirical investigation indicated that the proposed model can be used to identify the healthcare actors involved in the adoption process and can support the EAI adoption process in healthcare organisations. The case data indicated that few additional findings and propositions for further research related to the actors' identification arose, which were presented in this chapter.

Therefore, in Chapter 6, the modifications to the conceptual IGOHcaps method and model were imposed by empirical data presented and analysed in Chapter 5, as well as the further analysis reported in this chapter. With regards to the revised conceptual model (Figure 6.2), the empirical evidence suggests among others that: (a) sub-lenses should to be used to distinguish *individuals from groups* of human and organisational actors and (b) *business processes definitions and especially business process models, such as IDEF0, should be considered for the identification of different actors. When business process models, such as IDEF0, are considered, actors should be separated from other resources.*

Thus, contributing to better decision-making and understanding during the EAI adoption in healthcare organisations. The novelty of the conceptual model presented in Figure 6.2 lies in the following:

- The IGOHcaps method supports the classification, definition and identification of healthcare actors that should be considered during the adoption of EAI. The identification of the actors is based on the theoretical works conducted by others in this area. As a result, the justification and identification of actors is grounded in the normative literature.

- The revised model, presented in Figure 6.2, incorporates influential factors reported in previous studies (MAESTRO) and combines them with the revised IGOHcaps method for healthcare actors' identification (Figure 6.1).

- The proposed model clarifies much confusion surrounding: (a) the healthcare actors' classification and identification and (b) the EAI adoption in healthcare organisations. In other words, provides answers to the issues under research identified from the literature regarding EAI adoption in healthcare organisations.

- Moreover, the proposed model contributes towards a better understanding of the EAI adoption in healthcare organisations, as it facilitates: (a) multiple healthcare actors in realizing the factors related to the EAI adoption and (b) healthcare organisations in making robust decisions for EAI adoption.

- The revised model can be used as a tool for decision-making to support healthcare organisations, and allow researchers to apprehend and analyse the EAI adoption process.

CHAPTER 7

CONCLUSIONS AND FURTHER RESEARCH

Summary

This chapter concludes the research reported in this dissertation, presents its achievements and contribution, and proposes areas of further work. Chapter 7 begins by summarising the dissertation and drawing conclusions that derived from both the literature and empirical research reported in this dissertation. The limitations of the research undertaken are identified and presented, and the author proposes that these limitations should be considered when interpreting results. Thereafter, a critical evaluation of the research process is presented. The novelty claimed in this dissertation is then summarised. Finally, this last chapter concludes with the identification and discussion of further research directions, in this challenging and fast-evolving research area of EAI adoption in healthcare organisations.

7.1 Research Overview

In Chapter 2, the author reviewed the normative literature and classified Healthcare Information Systems (HIS). Despite HIS have the potential to enhance services, healthcare organisations face multiple challenges, as HIS implementations are disparate, heterogeneous and function in an independent manner (Section 2.2). HIS heterogeneity affects the quality of services provided to patients and citizens (Anyanwu *et al.*, 2002). This heterogeneity of Healthcare Information Systems has attracted a lot of research and industrial interest, as it causes multiple problems to the healthcare organisations. To overcome these problems, various integration technologies have been implemented in the healthcare sector. Yet, these technologies have not provided the expected level and quality of integration that is required by the healthcare sector. As a result, the need for a more advanced integration technology, like EAI, has been highlighted in the normative literature.

Enterprise Application Integration is relatively a new research topic and thus, its literature is limited in many areas including EAI implementations in healthcare sector. The majority of the research that has been conducted in the area of EAI in healthcare organisations focuses on its adoption. Since this dissertation investigates this area, the MAESTRO model proposed by Khoumbati, (2005), was described and critically discussed in Chapter 2. MAESTRO model has a main limitation, as it is based on a factor-oriented approach and underestimates the crucial role of actors during the adoption process. Nevertheless, the healthcare actors should be managed, as their role is important during the introduction of a new IS technology (Chen, 2003).

The author pointed out throughout this dissertation that *a better awareness and communication between the various actors and management will reduce the risk caused by the limitations of EAI adoption models.* Among others, attention should be given to the factors' realisation since the various healthcare actors can better understand them and thus might resist less to the EAI adoption. Hence, the aim of this dissertation, as stated in Chapter 1 was to *investigate the adoption of Enterprise Application Integration in healthcare organisations, by extending the established norms (MAESTRO model), using an actor-oriented approach.*

Thus, to extend the established norms and to overcome the limitations of MAESTRO, in Chapter 3, the author proposed that an actor-oriented approach should be combined with the factor-oriented one introduced by Khoumbati, (2005). To better understand healthcare actors, it was suggested that they should be classified and identified. However, it was highlighted that this is an area that requires further research (Vos and Achterkamp, 2006), as the literature remains limited and there are no *structured methods* that support the identification and classification of actors in healthcare organisations or other settings. Hence, the author conceptualised a structured method to support healthcare actors' identification, named IGOHcaps (Section 3.3). The IGOHcaps method consists of a static and dynamic step with the former defining and categorising the healthcare actors into Human and Organisational Acceptors, Providers, Controllers and Supporters. The dynamic step consists of a set of guidelines that can be used to systematically refine the actors.

In Section 3.4, the author attempts to piece together the factor and actor-oriented approaches and proposes a conceptual model to study the EAI adoption in healthcare organisations (Figure3.2). This model combines the influential factors of MAESTRO model (Figure 2.4) with the IGOHcaps method for healthcare actors' identification (Figure 3.2). The proposed model attempts to contribute in the EAI adoption area, as it: (a) highlights the role of healthcare actors and attitudes towards EAI adoption, (b) introduces an actor-oriented approach and (c) combines the factors influencing EAI adoption with an actor-oriented approach.

Chapter 4 justifies the selected research methodology used in this dissertation. An interpretivism, qualitative multiple case study approach was selected, to test the conceptual model. Initially, the quantitative and qualitative research approaches and the various research strategies were analysed and discussed and appropriate ones were adopted. Moreover, the empirical research methodology that was used in this research was graphically represented and described in Figure 4.2.

The research methodology described in Chapter 4, was used in Chapter 5 to test the conceptual model (Figure 3.4). In doing so, Chapter 5 presented and analysed the empirical data collected from two healthcare organisations, namely HOSPITAL_UK and HOSPITAL_GR. In Chapter 5, the preliminary research findings, the data retrieved to explore the conceptual model and the issues under investigation (Table 3.3) were

described. Thereafter, Chapter 6 used the empirical data derived from the case studies to: (a) provide the lessons learnt from this research (Section 6.2) and (b) revise the proposed conceptual model (presented in Figure 3.5) for the adoption of EAI in healthcare organisations (Section 6.3). The empirical findings confirmed the interplay among influential factors and healthcare actors during the adoption process. Based on the empirical findings and lessons learnt Chapter 6 revised the model for EAI adoption in healthcare organisations and presented it in Figure 6.2. Such a model can be used by the healthcare organisations as a decision-making tool during the EAI adoption process. It is not claimed that the proposed model is appropriate for all decision-making situations; however, it can establish itself as being a novel and beneficial approach to study the EAI adoption in healthcare organisations.

7.2 Meeting the Objectives of this Dissertation

In order to achieve the aim of this dissertation, a number of objectives were defined in Chapter 1 and have been accomplished as discussed in the previous chapters. These objectives are summarised in Table 7.1 and analysed in the following paragraphs.

Objective	Section/Chapter
Objective 1	Chapter 1 and Chapter 2
Objective 2	Chapter 2 (Section 2.5.2) and Chapter 3
Objective 3	Chapter 3
Objective 4	Chapter 4 and Chapter 5
Objective 5	Chapter 6 and Chapter 7

Table 7.1: Meeting the Objectives of this Dissertation

Objective 1: To conduct a literature review in the area of HIS integration and the issues related to the adoption of Enterprise Application Integration in healthcare organisations.

Based on the literature review, a number of research gaps had been identified and had been further examined and investigated by the researcher (met in Chapter 1 and Chapter 2).

Objective 2: To critically evaluate literature that is relevant to EAI adoption in healthcare organisations. In doing so, it will identify issues for research regarding the EAI adoption for further investigation.

Based on the literature review, limited research has been conducted in the area of EAI in healthcare organisations, with the majority of this research focusing on the adoption of EAI. The MAESTRO model proposed by Khoumbati (2005), was described and critically discussed. As reported in Chapter 2, MAESTRO model has a main limitation, as it is based on a factor-oriented approach that underestimates the crucial role of actors during the EAI adoption process.

Objective 3: To study relevant models of the EAI adoption in healthcare organisations. Therefore, it will develop a conceptual model for the EAI adoption. The latter might be used as a decision-making tool by healthcare organisations.

To overcome the limitations of MAESTRO model, Chapter 3 proposed that MAESTRO should be combined with an actor-oriented approach. To better understand the healthcare actors, it is proposed that they should be classified and identified. In doing so, the author conceptualised a structured method to support healthcare actors' identification, named IGOHcaps. In Section 3.4, the author attempted to piece together the factor (MAESTRO model) and actor-oriented (IGOHcaps method) approaches and proposed a conceptual model to study the EAI adoption in healthcare organisations (Figure3.4).

Objective 4: To test and evaluate the proposed conceptual model, within a case-based setting.

In order to test the proposed model, an appropriate research methodology was justified and explained in Chapter 4. Thereafter, Chapter 5 presented and analysed the empirical data collected from two healthcare organisations, namely HOSPITAL_UK and HOSPITAL_GR. The preliminary research findings were described and the data retrieved were used to test the conceptual model (Figure 3.4) and the issues under investigation, as these were summarised in Table 3.3. In doing this, the author tested and evaluated the conceptual model proposed in Chapter 3.

Objective 5: To extrapolate conclusions and provide a novel contribution to the domain of healthcare organisations and EAI.

In Chapter 6, the research findings derived from the case studies were considered and used to modify the conceptual model accordingly. The revised model supports decision-makers and researchers when adopting EAI in healthcare organisations. Moreover, Chapter 7 begins by summarising the dissertation and drawing conclusions that derived from both the literature and empirical research reported in this dissertation. In addition to this the novel contribution is stated.

The accomplishment of the above objectives has been made possible through the development of a novel conceptual model for the examination of issues related to the EAI adoption in healthcare organisations. This was demonstrated by examining the limitations of the established norms in EAI adoption and addressing open issues in the practice of EAI adoption in healthcare organisations. Thus, this research has contributed to both theory and practice. The individual elements of the contribution made by this work stem from different components in this dissertation: from the contextual information provided in Chapters 1, 2 and 3, to the research methodology reported in Chapter 4, through the design and the conduct of the case studies reported in Chapters 4 and 5, and finally, the empirical analysis of the cases and the development of the revised model presented in Chapters 5 and 6.

7.3 Main Findings

The main findings derived from the work presented in this dissertation are presented below:

Finding 1 By reviewing the normative literature, the author suggested that HIS should be classified as follows: (a) clinical, (b) non-clinical - support systems (c) non-clinical – administrative, (d) non-clinical – financial, (e) pharmaceutical and (f) laboratory (as presented in Table 2.1). This classification was applied and proved to be supportive for the analysis of the case organisations.

Finding 2

The author reviews the normative literature, identified the potential of Healthcare Information Systems, as well as the challenges faced by healthcare organisations. These (potential and current challenges) were categorised into the following four thematic areas: (a) Information Quality, (b) Information Availability, (c) Medical Errors and (d) HIS Integration (as presented in Table 2.2). This categorisation of potential and challenges was applied and proved to be supportive for the analysis of HOSPITAL_UK.

Finding 3

The literature review indicated that there is limited research in the area of EAI adoption in healthcare organisations.

Finding 4

Moreover, the literature review identified that there is a main limitation of the established norms that describe the adoption of EAI in healthcare organisations. The reason for this is attributed to the fact that the MAESTRO model, proposed by Khoumbati, (2005) is based on a *factor-oriented approach* and *underestimates the multiple actors affecting the EAI adoption process.*

Finding 5

To address these limitations, the literature reveals that the factors identified in the past as influential to EAI adoption in healthcare organisations (MAESTRO model) as well as the healthcare actors that have been stated to be critical in studying this area (Somers and Nelson, 2004) should be investigated. Even if this issue has been highlighted before, there is a void in the relative literature related to the definition and identification of the healthcare actors (as discussed in Section 2.5.2).

Finding 6

To address the limitation of MAESTRO model, Chapter 3 conceptualised a model that can be used to explain the adoption of EAI in healthcare organisations. This was done with a particular focus on the research aim of this dissertation, as stated in Section 1.3. The proposed model contributes in the EAI adoption area, as it: (a) highlights the role of healthcare actors and attitudes towards EAI adoption, (b) introduces an actor-oriented approach and (c)

combines the factors influencing EAI adoption with an actor-oriented approach.

Finding 7

A structured method that supports the healthcare actors' identification (IGOHcaps) is derived, conceptualised and proposed for further investigation (Figure 3.2). IGOHcaps method is grounded on literature and consists of two steps, namely static and dynamic to support the healthcare actors' identification. IGOHcaps is expected to significantly increase the level of understanding and improve the adoption process.

Finding 8

In piecing together the factor and actor-oriented approaches, a conceptual model to study the EAI adoption in healthcare organisations is proposed (Figure 3.4). This model combines the influential factors of MAESTRO model (Figure 2.5) with the IGOHcaps method for healthcare actors' identification (Figure 3.3). In testing this model in the practical arena, the author proposed six research issues as presented and summarised in Table 3.3.

Finding 9

From the empirical data and the theoretical analysis, the issues proposed for further research (Table 3.3) and the conceptual model (Figure 3.4) were examined and validated.

Finding 10

The conceptual model can be used as a tool for decision-making to support organisations, and to allow researchers to apprehend and analyse the EAI adoption process in healthcare organisations.

7.4 Statement of Contribution and Research Novelty

The individual elements of the contributions made by this work stem from different components in this dissertation. From the contextual information provided in Chapters 1, 2 and 3, to the research methodology reported in Chapter 4, through the design and the conduct of the case studies reported in Chapters 4 and 5 and finally the empirical analysis

of the cases and the development of conceptual model presented in Chapter 5 and 6. The work presented in this dissertation has made novel contribution to the area of EAI adoption in healthcare organisations and has extended the boundaries of knowledge.

The author claims that this research has novel contribution in the following three main areas: (a) Novel Interpretation of Normative Literature, (b) Novel Model for EAI Adoption in Healthcare Organisations and (c) Novel Method for Healthcare Actors Identification (IGOHcaps). Table 7.2 summarises the research novelty and contribution of this dissertation.

		Research Novelty	**Research Contribution**
Novel Interpretation of Normative Literature	Novel Classification of HIS (Table 2.1)	✓	✓
	Novel Classification of HIS Potential and Challenges (Table 2.2)	✓	✓
	Categorisation of healthcare actors' (Figure 3.1)		✓
Novel Method for Healthcare Actors Identification (IGOHcaps)	Novel definition of healthcare actors	✓	✓
	Novel guidelines for the identification of healthcare actors	✓	✓
	Novel combination of static and dynamic approaches in IGOHcaps method	✓	✓
Novel Model for EAI Adoption in Healthcare Organisations	Novel combination of MAESTRO model with IGOHcaps method to study EAI adoption in healthcare organisations	✓	✓

Table 7.2: Research Novelty and Contribution

The following is a review of what is sustained to be the main contribution and research novelty of the dissertation.

7.4.1 Novel Interpretation of Normative Literature

Initially the author contributed to the interpretation of the literature, as this dissertation achieved the following:

Novel Classification of HIS (Table 2.1)

Table 2.1 presented that HIS can be classified into: (a) clinical, (b) non-clinical - support systems (c) non-clinical – administrative, (d) non-clinical – financial, (e) pharmaceutical and (f) laboratory. The author categorised the HIS of HOSPITAL_UK (Table 5.1) and HOSPITAL_GR (Table 5.8) using the aforementioned classification to better understand the systems implemented. In doing so, it was observed that the categorisation of the different types of Healthcare Information Systems (presented in Table 2.1), can be used by healthcare organizations when integrating HIS, to: (a) enhance the understanding and management of Healthcare Information Systems and (b) to support the decision-making towards the adoption of EAI.

Novel Classification of HIS Potential and Challenges (Table 2.2)

The author reviewed the normative literature, identified the potential of Healthcare Information Systems, as well as the challenges faced by healthcare organisations. The potential and current challenges were categorised in four main thematic areas, namely: (a) Information Quality, (b) Information Availability, (c) Medical Errors and (d) HIS Integration (as presented in Table 2.2). This categorisation of potential and challenges was applied and proved to be supportive for the analysis of HOSPITAL_UK.

Categorisation of Healthcare Actors (Figure 3.1)

The author reviewed the normative literature and proposed that *healthcare actors can be categorised into: (a) Acceptors, (b) Providers, (c) Supporters and (d) Controllers' **(Actors' Categorisation Issue).*** The interviewees validated the ***Actors' Categorisation Issue*** and they found it sufficient and accurate.

7.4.2 Novel Method for Healthcare Actors Identification (IGOHcaps)

To overcome the void of the MAESTRO model (analysed Section 2.5.2), the author reviewed the normative literature and proposed that the MAESTRO model should be mapped with the multiple healthcare actors, to increase the EAI adoption and understanding in this area. Even if this issue has been highlighted before, there is a void in the relative literature related to the deficient involvement and identification of healthcare actors in the adoption process. Thus, a novel structured method that supports

the healthcare actors' identification (IGOHcaps) was conceptualised and proposed for further investigation (Part A of Conceptual Development). This method is novel as it achieves the following:

Novel Definition of Healthcare Actors

The author proposed and validated in both case studies, the following novel definition for healthcare actors: *The healthcare actors involved in the adoption of IS can be defined as: any human and/or organisation that accepts, provides, supports or controls healthcare services'.*

Novel guidelines for healthcare actors' identification

The author validated the dynamic step of the IGOHcaps method that consists of the following guidelines (**G1-G10**):

G1: Actors depend on the specific context and time frame

G2: Actors can not be viewed in isolation

G3: The position of each actor may change over time

G4: Feasible options may differ from the actors' wishes

G5: The nature of the IS to be adopted

G6: Internal versus external actors

G7: The type of relationship to the system

G8: Depth of impact

G9: Level of aggregation

G10: Business processes definitions and especially business process models, such as IDEF0, should be considered for the identification of different actors. When business process models, such as IDEF0, are considered, actors should be separated from other resources.

These guidelines support the identification of healthcare actors and are grounded on the published literature. In doing this, the author reviewed the normative literature and identified that during the last two decades few efforts have been made to identify healthcare actors. Therefore, the aforementioned guidelines are novel and are based on the *principles* introduced by Pouloudi and Whitley (1997) and the *dimensions* proposed by Lyytinen and Hirschheim (1987).

Novel Combination of Static and Dynamic Approaches in IGOHcaps method

IGOHcaps method consists of a static and dynamic step. The ***static*** step identifies a standard number (four) of Human and Organisational categories of healthcare actors. The author combined the ***static*** with the ***dynamic step*** to support the identification of the actors participating to the IS adoption process. According to Pouloudi, (1998), actors' identification should be dynamic, iterative and interpretive. Such a dynamic approach will address the unsteadiness of organisational reality, the changing roles of actors and the multiple perceptions about actors and their roles respectively. Therefore, the ***Mix Approach Issue*** that is related to the combination of the static and dynamic approaches is proposed and validated. In doing so, the author contributes to the body of knowledge.

IGOHcaps method was grounded on literature and consists of two steps, namely static and dynamic to support the healthcare actors' identification. The IGOHcaps method supports the classification, definition and identification of healthcare actors that should be considered during the adoption of EAI.

IGOHcaps method makes novel contribution at both practical and conceptual level. At a practical level, the method contributes towards a deeper understanding of the actors in healthcare organisations. At a conceptual level, it proposes a method for healthcare actors' identification that should be considered during the adoption of EAI. The IGOHcaps method increases the level of the analysis and contributes towards a more detailed and systematic study of the adoption of EAI in healthcare organisations. Moreover, it supports managers and researchers in: (a) understanding the importance and effect of healthcare actors, (b) supports the identification of the multiple healthcare actors and (c) might increase the adoption of IS in healthcare. Consequently, it is suggested that this approach might reduce the resistance to change and speed up the adoption of IS.

7.4.3 Novel Model for EAI Adoption in Healthcare Organisations

Furthermore, in piecing together the factor (MAESTRO model) and actor-oriented (IGOHcaps method) approaches, a conceptual model to study the EAI adoption in healthcare organisations is proposed (Part B of Conceptual Development). This model is novel, as it combines the influential factors of MAESTRO model (Figure 3.1) with the

IGOHcaps method for healthcare actors' identification (Figure 3.3). The novelty of this model will be explained in the following paragraphs.

Combination of MAESTRO model with IGOHcaps method to study EAI adoption in healthcare organisations

The model, presented in Figure 6.2, incorporates influential factors reported in previous studies (MAESTRO) and combines them with the revised IGOHcaps method for healthcare actors' identification (Figure 6.1). The revised model clarifies much confusion surrounding: (a) the healthcare actors' classification and identification and (b) the EAI adoption in healthcare organisations. In doing so, it provides answers to the issues under research identified from the literature regarding EAI adoption in healthcare organisations.

The proposed model in Figure 3.4 makes a novel contribution at two levels. Firstly, at a conceptual level, it identifies and proposes a classification of healthcare actors that should be considered during the adoption of EAI. The identification of the actors is based on the theoretical works conducted by others in this area. As a result, the justification and identification of actors is grounded in the normative literature. In addition to this, the model incorporates influential factors reported in previous studies (MAESTRO) and combines them with the IGOHcaps method. Secondly, at a practical level, the proposed model contributes towards a better understanding of the research area (EAI adoption in healthcare).

The combination of actors and factors-oriented approaches: (a) supports managers and researchers in understanding which actors should be considered during the study of EAI adoption factors, (b) supports the multiple healthcare actors in the realization of the factors related to the EAI adoption process and (c) might increase 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. The revised model can be used as a tool for decision-making to support healthcare organisations, and allow researchers to apprehend and analyse the EAI adoption process. Therefore, the services provided to patients and citizens will be improved.

This dissertation makes a step forward and contributes to the body of knowledge as it: (a) highlights the role of healthcare actors and attitudes towards EAI adoption, (b) introduces

an actor-oriented approach, (c) identifies those actors involved in this process and (d) combines the actor-oriented approach with the factors influencing EAI adoption. The author believes that such an approach is significant and novel as it: (a) facilitates the multiple healthcare actors in the realization of the factors related to the EAI adoption, (b) enhances existing EAI adoption models by incorporating an actor-oriented analysis and (c) facilitates healthcare organisations in making robust decisions for EAI adoption.

7.5 Research Limitations

As described and justified in Chapter 4, to collect and interpret the data, a qualitative, interpretive multiple case studies method was used. This method has been proved to provide significant benefits, as it allows generalisation of soft, rich contextual data, which is associated with human and organisational issues. However, this research method has some limitations, with a number being encountered in this research. Initially, the collection and analysis of qualitative data has proved time consuming and demanding. Moreover, the interpretation of events from the subject point of view without some degree of bias, can be considered as a limitation. The interpretive research is often criticised for the subjective influence the researcher's interpretation might have on the findings. However, to address these limitations, the author used a multi-method approach (data triangulation) to data gathering.

In addition, the relationship between theory and research might be considered weak and unstructured, as qualitative approaches may be criticised for not instilling theoretical elements. However, in the case of this research, the author sought to partially address this concern through developing a conceptual model that incorporates influential factors reported in previous studies (MAESTRO) and combines them with the revised IGOHcaps method for healthcare actors' identification. This model consisted of issues under research identified from the literature regarding EAI adoption in healthcare organisations and thus, it was grounded on literature. To minimise the aforementioned limitation, resource-based and theories were used to interpret and analyse the issues under research. As a result, the appropriateness of this approach is now appreciated and acknowledged as a suitable research methodology for investigating EAI adoption in healthcare organisations.

Finally, there is much concern regarding the extent that qualitative research can be generalised beyond the confines of the inquiry, as the sample of companies are often relatively few. Even though two healthcare organisations were used during this study, to extent this inquiry further would not have increased its external validity. Indeed, qualitative case study research does not offer the pretence of replication, as controlling the research setting destroys the interaction of variables, and therefore, affects the underline philosophy of interpretivism. In re-assuring sceptics of interpretivism, the study was conducted within a structured methodology, and guided by theoretical concepts and models, with a number of data gathering methods and processes having been used. However, the methodology presented in Chapter 4 was developed as it was considered safer to identify and investigate independent variables following a review of literature. Having now evaluated the research process, such concern needed not of been considered important, as this approach may also have been suitable, and yet, still provided 'freedom' and scope for: (a) discovery and theory building and, (b) discovery, theory building and testing.

The main difficulty the researcher faced was the restricted access to information, such as hospital documents, which was due to confidentiality reasons. Moreover, due to privacy and confidentiality reasons, the researcher could only interview one patient and one next-of-kin. Finally, the researcher failed to arrange appointments with some clinicians and top executives, since they had demanding schedules.

7.6 Avenues for Further Research

Although the case data validated the proposed method, the following propositions have been made for further research:

- The revised IGOHcaps method presented in Figure 6.1 should be tested. In doing so the issues resulted from this research such as the sub-lenses and the new guideline (related to business processes) should be examined. In doing so, a more detailed list of healthcare actors will be identified.

- The interrelationships between the different actors might be studied, to enhance the understanding of the way that these interrelationships affect the EAI adoption process.

In doing so, this research proposed that issues, such as power, legitimacy and control should be considered.

- In addition, this research proposed that the interrelationships among a full range of factors (including parameters) should be investigated with the multiple actors involved in EAI adoption in healthcare to facilitate a deeper level of analysis. Moreover, these interrelationships should be mapped using modelling techniques (e.g. Fuzzy Cognitive Mapping and Structural Equation Modelling), to enhance the decision making process.

- The research has found that the benefits and barriers realisation is extremely important to all actors identified through the IGOHcaps method, in both case studies. Thus, it is recommended to transform the EAI benefits and barriers (including their sub-factors) into a large-scale survey questionnaire. In doing so, it will contribute in: (a) better realisation of which benefits and barriers affect each actor and (b) in enhanced decision making regarding EAI adoption.

- Since the combination of an actor and factor oriented approaches has been proved successful for the adoption of EAI in healthcare organisations, it is suggested to investigate this combined approach in other sectors.

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APPENDIX A:

EVALUATING INTEGRATION APPROACHES

Evaluating Benefits and Barriers of Integration Approaches

Multiple approaches can be used for the integration of the HIS. Each of them provides specific solutions and has different benefits and barriers (Khoumbati, 2005). The evaluation of the benefits and barriers of IT is considered to be a complex process (Irani and Love, 2001), as evaluation happens in many ways (e.g. formally, informally) and uses several criteria such as financial, technical and social (Serafeimidis and Smithson, 2003). Khoumbati (2005) has classified the benefits and barriers of the integration approaches in the healthcare sector and these classifications are presented in Table A.1 and Table A.2 accordingly.

The evaluation of the integration approaches will support the healthcare managers and researchers to overcome the confusion that exists regarding the adoption of the integration approaches. Thus, the selection of a suitable integration approach will become an easier task and less time will be spent on this. According to Khoumbati (2005), through the adoption of integration approaches, the healthcare organisations will gain numerous advantages such as: (a) operational, (b) managerial, (c) strategic, (d) IT Infrastructure and (e) organisational. In Table A.1, the benefits of integration approaches in healthcare organisations are presented.

		Integration Approaches							
		EDI	ERP	HL7	DICOM	COBRAMED	SYNEX	SYNERGY	CEN/TC 251
Benefits	**Operational**								
	Reduce medical errors	✓	✓	✓		✓	✓		
	Reduce paper work processes	✓	✓	✓					
	Reduce operational cost	✓		✓					
	Reduction of personnel cost	✓	✓						
	Managerial								
	Improve quality of patients care	✓		✓			✓	✓	✓
	Improve work efficiency	✓	✓	✓	✓	✓			
	Improve managerial control		✓						
	Strategic								
	Increase patients' satisfaction			✓		✓	✓	✓	✓
	Increase collaboration of hospitals	✓		✓			✓	✓	✓
	Improves decision support			✓		✓	✓		
	IT Infrastructure								
	Reusability of objects					✓			✓
	Achieve data integration	✓	✓	✓	✓	✓	✓	✓	✓
	Integrate packaged applications								
	Reduced development risk	✓							
	Organisational								
	Reduce hospitalisation			✓			✓	✓	✓
	Improve accessibility of data				✓		✓	✓	✓
	Achieve effective clinical and administrative management		✓	✓	✓				
	Increase business efficiency	✓	✓					✓	✓

Table A.1: Benefits of Integration Approaches – Source Khoumbati (2005)

Each approach has been developed to provide different solutions to the HIS integration problem. For example, DICOM allows the exchange of medical images and related information between systems from different manufacturers (Neri *et al.*, 1998) and HL7 approach is not appropriate for the description of clinical signs (Khoumbati, 2005). Moreover, some of these approaches do not provide confidentiality to patients' data, which is one of the primary and most important needs in the healthcare sector (Huston, 2001). Many other barriers of these technologies do exist, with Table A.2 evaluating and classifying them using the same categories as the ones used in Table A.1.

		Integration Approaches							
		EDI	**ERP**	**HL7**	**DICOM**	**COBR-MED**	**SYNEX**	**SYNERGY**	**CEN/TC251**
Barriers	**Operational**								
	High integration cost	✓	✓	✓		✓	✓	✓	✓
	Shared care	✓	✓	✓	✓	✓	✓	✓	✓
	Physician-patients' relationship	✓	✓						
	Return of investment	✓	✓	✓	✓				
	Managerial								
	Lack of political will	✓		✓			✓	✓	✓
	Lack of procedure and policies		✓						
	Strategic								
	Quality of patients' care	✓	✓	✓		✓	✓	✓	✓
	Confidentiality of patients' data	✓	✓	✓		✓	✓	✓	✓
	IT Infrastructure								
	Interoperability	✓	✓	✓		✓	✓	✓	✓
	Peer to peer connectivity	✓	✓	✓	✓	✓	✓	✓	✓
	Lack of integration and flexibility								
	Accesses of patients' data				✓				
	No plug-and-play solution			✓			✓	✓	✓
	Organisational								
	Resistance to change				✓		✓	✓	✓
	Lack of leadership and training			✓	✓		✓	✓	✓

Table A.2: Barriers of Integration Approaches - Source Khoumbati [2005]

From the evaluation of the barriers and the benefits of the integration approaches, it appears that each approach has been developed to provide specific solutions and there is a need for the use of more than one approach to get satisfactory integration outcomes (Khoumbati, 2005). Nonetheless, EAI is a relatively new integration technology that is used to incorporate custom applications, packaged systems and e-business solutions into a flexible and manageable business infrastructure (Themistocleous *et al.*, 2004).

However, it has not been implemented and evaluated in the healthcare sector, but in the private and public sector, in which it has been proved to provide satisfactory integration solutions (Themistocleous, 2004). According to Themistocleous and Irani, (2001) EAI offers multiple benefits to organisations such as: (a) reduces operational costs, (b) increases productivity, (c) improves planning in supply chain management and (d) increases collaboration among trading partners.

Nevertheless, the author suggests that EAI that should offer significant benefits, if it had been used evaluated in the healthcare field. Khoumbati (2005) identified and analysed the factors that motivate the use of the EAI technology in the healthcare sector. According to this classification, these factors are the following: (a) technical, (b) cost, (c) medical errors, (d) decision support system, (e) collaboration, (f) access of patients' data and (g) security and confidentiality of patients' data.

B

APPENDIX B:

INTERVIEW AGENDA USED IN HOSPITAL_UK

INTERVIEW AGENDA

The following questionnaire consists of four Sections.

SECTIONS

Section A: General Company Information

Section B: General Interviewee Information

Section C: Integration of Healthcare Information Systems (HIS) Information

Section D: Enterprise Application Integration (EAI) Adoption Information

Section E: Healthcare Actors Identification Information

Section F: Healthcare Actors and Factors Information

Section G: Comments

Section A: General Company Information

A.1 Company's Name and Address

.....

.....

.....

.....

.....

A.2 Approximately how many employees work at this company?

- ☐ < 5
- ☐ 5 - 10
- ☐ 11 - 50
- ☐ 51 - 500
- ☐ 501 - 1000
- ☐ 1000 - 5000
- ☐ 5000 or more

A.3 Approximately how many and what clinical departments does this company have?

.....

.....

.....

.....

.....

Section B: General Interviewee Information

B.1 Interviewee's Name and Contact Details

Full Name:

.....

Telephone Number:

.....

Fax Number:

.....

E-mail address:

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B.2 Interviewee's Age

- ☐ 18 - 25
- ☐ 26 - 35
- ☐ 36 - 45
- ☐ 46 - 55
- ☐ 56 - 65
- ☐ 66 - 75
- ☐ 76 or more

B.3 Interviewee's Gender

- ☐ Female
- ☐ Male

B.4 Interviewee's Role

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Section C: Integration of Healthcare Information Systems Information

C.1 We have categorised the Information Systems of your healthcare organisations as presented in the following Table. Can you please comment on this classification?

Healthcare Information Systems in HOSPITAL_UK			
Process Supported		**Healthcare IS**	**Description**
Clinical		Galaxy Theatre System	Records all clinical incidents
		Syslogic Laser System	Supports the use of lasers by registering doctors and issuing smartcards
		Radiology IS	Stores, captures, manipulates, retrieves, and transmits data about patients' radiological examinations
		Nursing IS	Records all nursing activities
Pharmaceutical		Cortex Pharmacy IS	Keep records about drugs' ordering, stocking and distribution
Laboratory		Laboratory IS	Physicians or nurses use devices at the point of-care to provide lab results (blood gasses, glucose), thus assisting physicians in ordering medications right at the point of care.
Non-Clinical	Support Systems	Management IS	Manages drugs resource and receives demographic patient data, via daily download, from the Patient Administration IS
		Scheduling IS	Supports booking processes and manages human resource
		Locally developed database systems	Stores information
	Administrative	Patient Administration IS	Holds all patient demographics, such as address, date of birth and admission details
	Financial	Logistic IS	Support financial transactions with patients, employees, suppliers, insurance companies etc and accounting processes

C.2 The efforts to modernise the healthcare services have resulted in the development of disparate, incompatible and heterogeneous systems. Have you ever come across the need to integrate the aforementioned systems?

If yes, what were the challenges that made you integrate you systems?

C.3 If you have come across the need for integration of these systems, can you please describe what was the process towards integration?

C.4 If you have come across the need for integration of these systems, can you please describe the integration project?

Section D: Enterprise Application Integration Adoption Information

D.1 It has been reported that in the healthcare sector, the adoption of IS and EAI has been a slow and not always successful process. While adopting EAI, did u face any kind of problems? Which factors do u believe affect the EAI adoption process?

YES	
NO	

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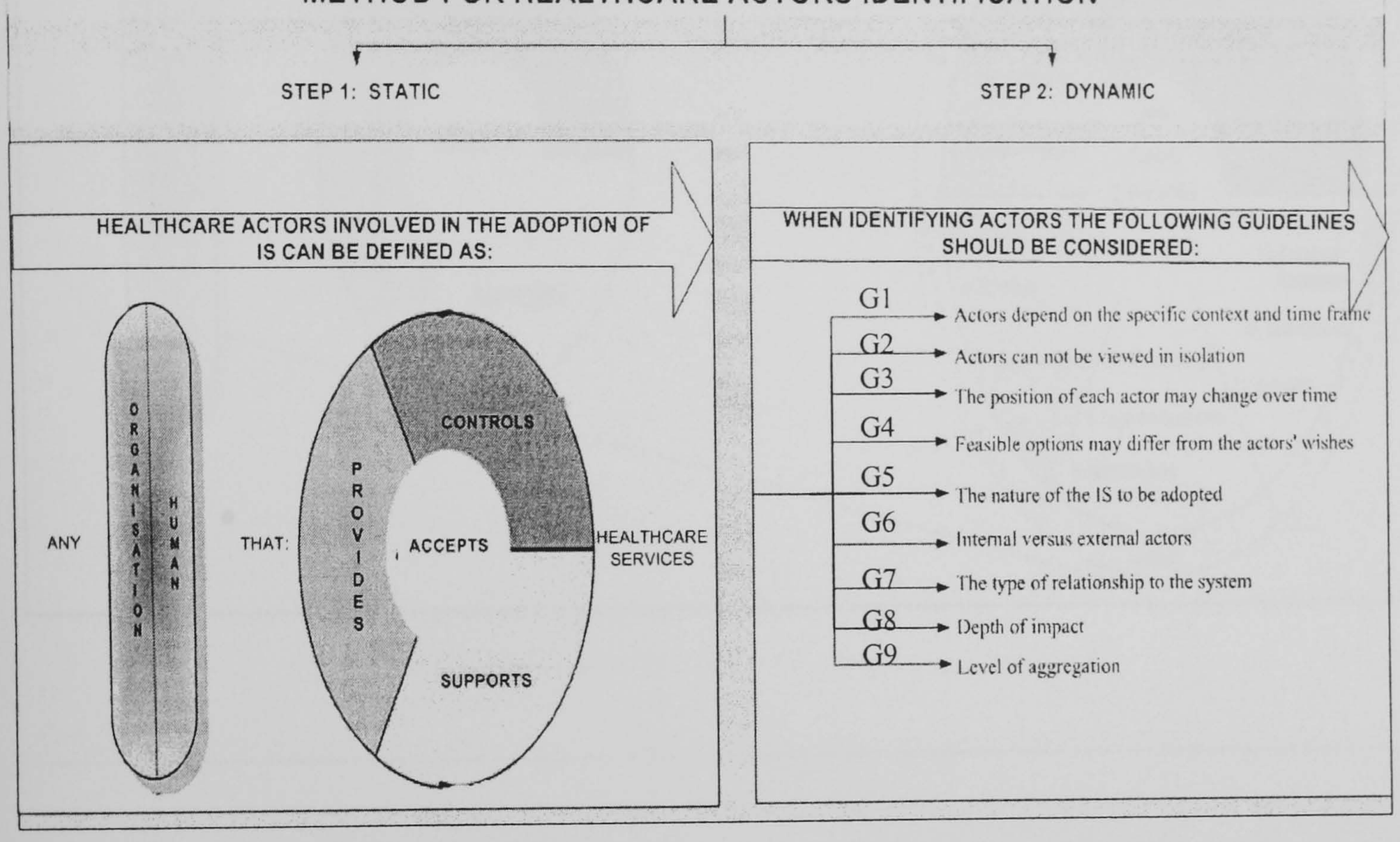
D.2 The normative literature indicates that the EAI adoption in healthcare organisations is affected by multiple factors (Khoumbati, 2005). These factors are presented in the following table. Which of these factors affected you, while adopting EAI technology?

Factors Affecting the EAI Adoption	Tick	Comment
Benefits		
Barriers		
Costs		
Internal Pressures		
External Pressures		
IT Sophistication		
IT Infrastructure		
IT Support		
Evaluation Frameworks		
Organisation Size		
Telemedicine		
Physician and Administrators Relationship		
Patient Satisfaction		
Security and Confidentiality		
Education		
Compatibility		

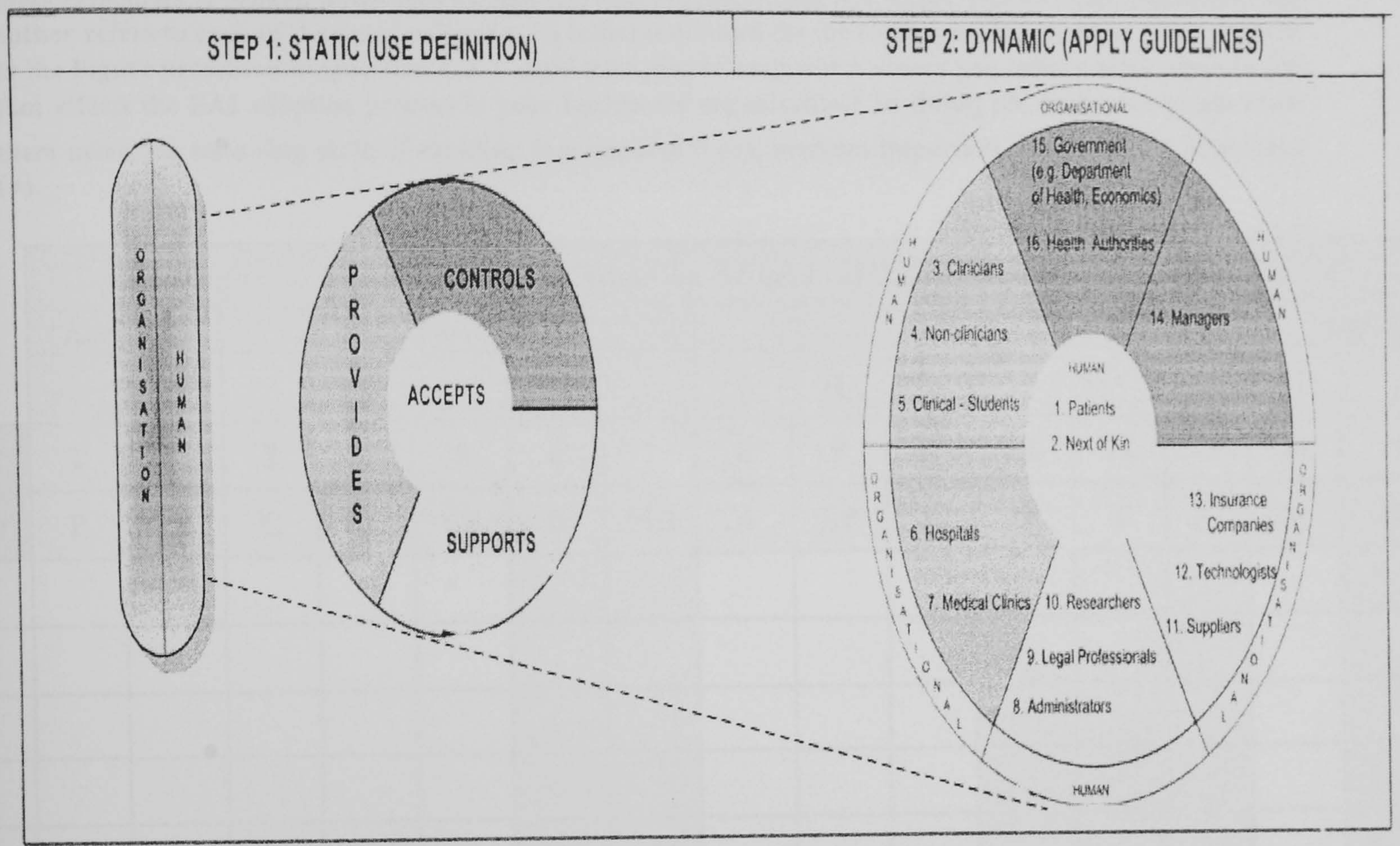
D.3 Can you think of any other factors that affected you during the EAI adoption process?

Section E: Healthcare Actors Identification Information

E.1 The author has proposed a method that supports healthcare actors' identification, namely IGOHcaps. IGOHcaps method is presented in the following Figure and indicates that healthcare actors involved in the adoption process can be defined as any human and/or organisation that accepts, provides, supports and controls healthcare services (static step). This static step should be combined with the dynamic to enhance the actors' identification process. The dynamic step consists of a set of guidelines that can be used to identify a full range of actors. Can you please comment on this method?



E.2 By applying the IGOHcaps method in your organisation, we identified the following full list of healthcare actors. Can you please comment on this list?



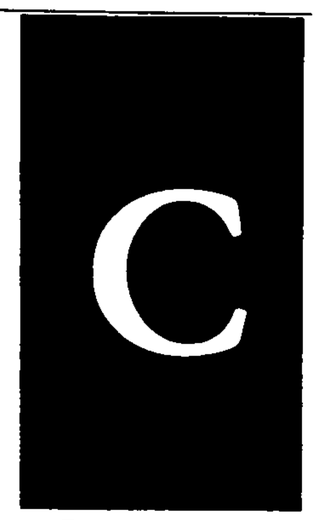
Section F: Healthcare Actors and Factors Information

F.1 Horizontally, Table 5.5 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 (H) and organisational (O) lenses. Due to space limitations the author refers to each of the actor using: (a) its initial letter and (b) the corresponding number given to them in the Figure presented in Question E.2. Could you please map which actors you believe affect each factor that affects the EAI adoption process in your healthcare organisation? In doing so, could you please rank them using the following scale of ranking: less important (○), medium important (◒) and most important (●).

	EAI Adoption Actors in HOSPITAL_UK															
	Acceptor		Provider					Supporter						Controller		
	H		H			O		H			O			H	O	
EAI Adoption Factors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	P	NK	C	NC	CS	H	MD	A	LP	R	S	T	IC	M	G	HA
Cost																
Barriers																
Benefits																
IT Support																
Internal Pressures																
External Pressures																
IT Infrastructure																
IT Sophistication																
Evaluation Frameworks																
Organisational Size																
Telemedicine																
Patient Satisfaction																
Security and Confidentiality																
Compatibility																
Physicians and Administrators Relationship																
Education																

Section G: Comments

G.1 Would you like to make any further comments about this research?



APPENDIX C:

INTERVIEW AGENDA USED IN HOSPITAL_GR

INTERVIEW AGENDA

The following questionnaire consists of four Sections.

SECTIONS

Section A: General Company Information

Section B: General Interviewee Information

Section C: Integration of Healthcare Information Systems (HIS) Information

Section D: Enterprise Application Integration (EAI) Adoption Information

Section E: Healthcare Actors Identification Information

Section F: Healthcare Actors and Factors Information

Section G: Comments

Section A: General Company Information

A.1 Company's Name and Address

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A.2 Approximately how many employees work at this company?

- ☐ < 5
- ☐ 5 - 10
- ☐ 11 - 50
- ☐ 51 - 500
- ☐ 501 - 1000
- ☐ 1000 - 5000
- ☐ 5000 or more

A.3 Approximately how many and what clinical departments does this company have?

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Section B: General Interviewee Information

B.1 Interviewee's Name and Contact Details

Full Name:

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Telephone Number:

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Fax Number:

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E-mail address:

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B.2 Interviewee's Age

- ☐ 18 - 25
- ☐ 26 - 35
- ☐ 36 - 45
- ☐ 46 - 55
- ☐ 56 - 65
- ☐ 66 - 75
- ☐ 76 or more

B.3 Interviewee's Gender

- ☐ Female
- ☐ Male

B.4 Interviewee's Role

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Section C: Integration of Healthcare Information Systems Information

C.1 We have categorised the Information Systems of your healthcare organisations as presented in the following Table. Can you please comment on this classification?

Healthcare Information Systems in HOSPITAL_GR			
Process Supported		**Healthcare IS**	**Description**
Clinical		Clinical IS	Records all clinical incidents
		Healthcare IS	Manages information related to patient (e.g. booking appointments, financial, clinical etc)
		PACS	Stores, retrieves, manages radiological pictures
		Radiology IS	Stores, captures, manipulates, retrieves, and transmits data about patients' radiological examinations (e.g. X-rays, Ultrasound etc) - (exchanges data with PACS
Pharmaceutical		Drugstore IS	Keep records about drugs' ordering, stocking and distribution
Laboratory		Laboratory IS	Physicians or nurses use devices at the point of-care to provide laboratory results
Non-Clinical	Support Systems	Electronic medical libraries IS	IS that communicates with electronic medical libraries
		ERP	Manages Financial Transactions and Warehouses
		Personnel Management IS	Manages human resource
		Internal Business-to-business Network	Supports Business-to business transactions.
	Administrative	Administrative IS	Holds all patient demographics, such as address, date of birth and admission details)
	Financial	Patient Pricing IS	Support financial transactions with patients

C.2 The efforts to modernise the healthcare services have resulted in the development of disparate, incompatible and heterogeneous systems. Have you ever come across the need to integrate the aforementioned systems?

If yes, what were the challenges that made you integrate you systems?

C.3 If you have come across the need for integration of these systems, can you please describe what was the process towards integration?

C.4 If you have come across the need for integration of these systems, can you please describe the integration project?

Section D: Enterprise Application Integration Adoption Information

D.1 It has been reported that in the healthcare sector, the adoption of IS and EAI has been a slow and not always successful process. While adopting EAI, did u face any kind of problems? Which factors do u believe affect the EAI adoption process?

YES	
NO	

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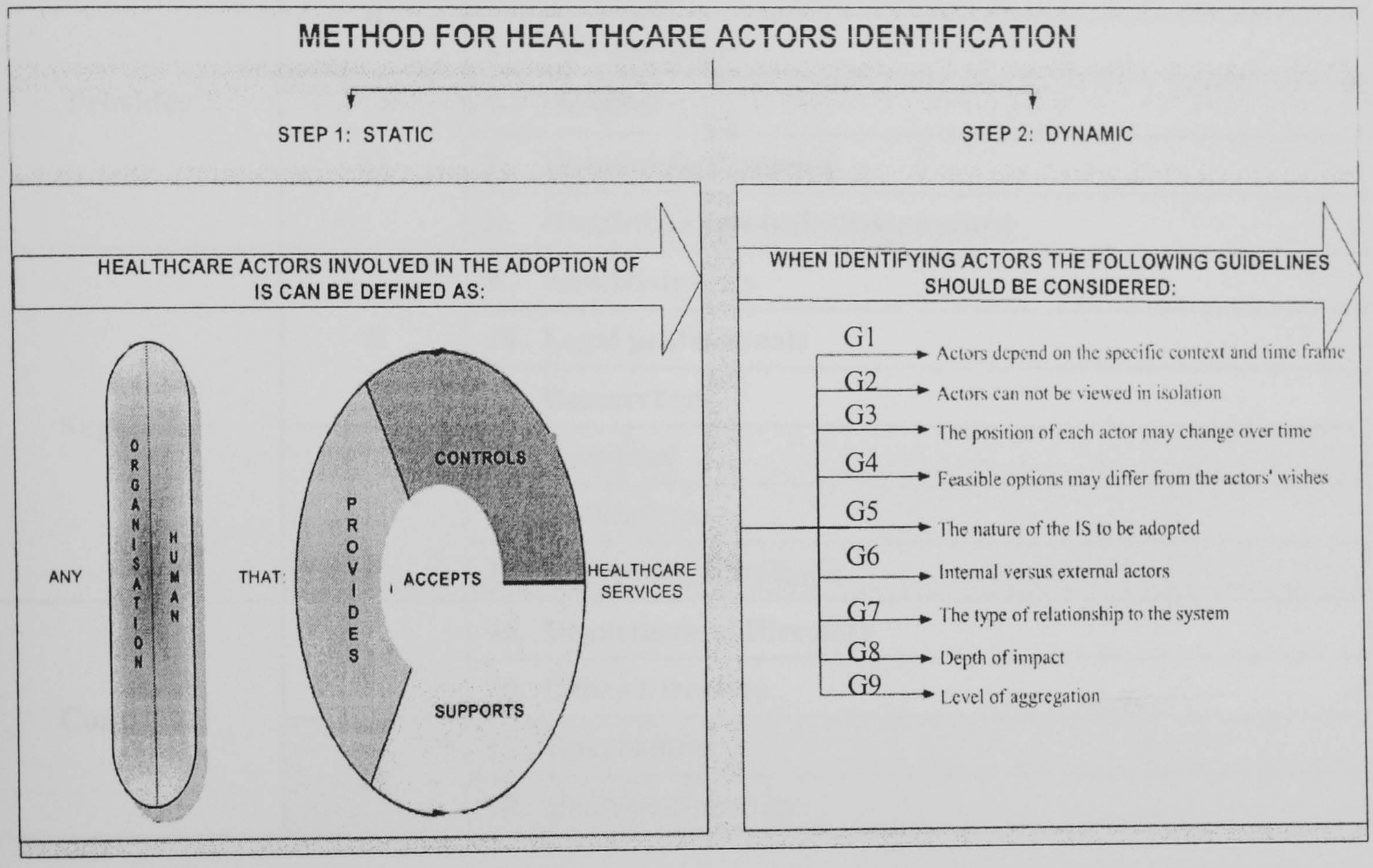
D.2 The normative literature indicates that the EAI adoption in healthcare organisations is affected by multiple factors (Khoumbati, 2005). These factors are presented in the following table. Which of these factors affected you, while adopting EAI technology?

Factors Affecting the EAI Adoption	Tick	Comment
Benefits		
Barriers		
Costs		
Internal Pressures		
External Pressures		
IT Sophistication		
IT Infrastructure		
IT Support		
Evaluation Frameworks		
Organisation Size		
Telemedicine		
Physician and Administrators Relationship		
Patient Satisfaction		
Security and Confidentiality		
Education		
Compatibility		

D.3 Can you think of any other factors that affected you during the EAI adoption process?

Section E: Healthcare Actors Identification Information

E.1 The author has proposed a method that supports healthcare actors' identification, namely IGOHcaps. IGOHcaps method is presented in the following Figure and indicates that healthcare actors involved in the adoption process can be defined as any human and/or organisation that accepts, provides, supports and controls healthcare services (static step). This static step should be combined with the dynamic to enhance the actors' identification process. The dynamic step consists of a set of guidelines that can be used to identify a full range of actors. Can you please comment on this method?



E.2 By applying the IGOHcaps method in your organisation, we identified the following full list of healthcare actors. Can you please comment on this list?

Actors Identified Through the Application of IGOHcaps Method		
Acceptor	H	1. Patients
		2. Next of kin
		3. Citizens
Provider	H	4. Clinicians
		5. Non-clinicians
	O	6. Hospital
		7. Hospital Department
		8. Hospital Office (sub-departments)
Supporter	H	9. Administrators
		10. Legal professionals
		11. Researchers
	O	12. Suppliers
		13. Technologists
		14. Research Institutes
Controller	H	15. Departmental Directors
		16. Office Directors
	O	17. Government
		18. Health authorities

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Section F: Healthcare Actors and Factors Information

F.1 Horizontally, Table 5.5 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 (H) and organisational (O) lenses. Due to space limitations the author refers to each of the actor using: (a) its initial letter and (b) the corresponding number given to them in the Table presented in Question E.2. Could you please map which actors you believe affect each factor that affects the EAI adoption process in your healthcare organisation? In doing so, could you please rank them using the following scale of ranking: less important (○), medium important (◒) and most important (●).

		EAI Adoption Actors in HOSPITAL_GR																		
		Acceptor			Provider					Supporter						Controller				
		H			H		O			H			O			H		O		
	EAI Adoption Factors	1 P	2 NK	3 CI	4 C	5 NC	6 H	7 HD	8 HO	9 A	10 LP	11 R	12 S	13 T	14 RI	15 DD	16 OD	17 G	18 HA
1	Cost																		
2	Barriers																		
3	Benefits																		
4	IT Support																		
5	Internal Pressures																		
6	External Pressures																		
7	IT Infrastructure																		
8	IT sophistication																		
9	Evaluation Frameworks																		
10	Organisational Size																		
11	Telemedicine																		
12	Patient Satisfaction																		
13	Security and Confidentiality																		
14	Compatibility																		
15	Physicians and Administrators Relationship																		
16	Education																		

Section G: Comments

G.1 Would you like to make any further comments about this research?

D

APPENDIX D:

ABBREVIATIONS

CEO	Chief Executive Officer
CHI	Commission for Health Improvement
DoH	Department of Health
EAI	Enterprise Application Integration
EKAB	Greek National Centre of Emergency Care
ERP	Enterprise Resource Planning
ESY	Greek National Health System
EU	European Union
HIS	Healthcare Information Systems
IGOHcaps	Individual, Group, Organisational, Human, Controllers, Acceptors, Providers, Supporters
IKA	Greek Social Security Institution
IS	Information Systems
IT	Information Technology
LIS	Laboratory Information Systems
NHS	National Health System
NHSIA	NHS Information Authority
PACS	Picture Archiving and Communication Systems
PAS	Patient Administration Systems
UK	United Kingdom
HL7	Health Level 7
EDI	Electronic Data Interchange
DICOM	Digital Imaging Communications in Medicine and Common Object Broker Architecture in Medicine
CDSSs	Clinical Decision Support Systems
SynEx	Synergy Extranet
Hansa	Healthcare Advanced Networked System Architecture Project
GPs	General Practitioners
SMEs	Small and Medium Enterprises
EHCR	Electronic Health Care Records

E

APPENDIX E:

MAESTRO MODEL

In Figure 2.5, MAESTRO model that consists of 16 influential factors was presented. In the following paragraphs a detailed description of the factors of MAESTRO model is provided, as described by Khoumbati (2005, p.212-223) and illustrated.

"IT Infrastructure

The evidence from the empirical data suggests that the IT implementation decision in the hospitals went through several phases. The existing IT infrastructure of all the case hospitals, along with primary care providers and social services department was heterogeneous and consisted of several incompatible systems. Consequently, the hospitals faced significant integration problems while working with other hospitals, primary healthcare providers, government bodies and other stakeholders. Thus, it was very difficult for these hospitals to integrate all the applications that run on the mainframe and the non-mainframe platforms. In addition, there was a redundancy of data and functionality as many applications stored similar data or ran systems overlapping in functionality. As a result, the hospitals could not take the advantage of IT and support closer collaboration with their various stakeholders and consequently, they faced significant integration problems. Since integration could not be achieved, the limitations of the existing IT infrastructure motivated the case hospitals for adoption of EAI. Thus, the existing IT infrastructure represents an influencing factor for the adoption of EAI in all three case hospitals. Therefore, the exiting IT infrastructure represented an influencing factor for the adoption of EAI in these hospitals. These findings are in accordance with the literature findings such as Iacovou et al., (1995), Heck and Ribbers (1999), Martinez and Redondo (2001), Waarts et al.,(2002), Bradford and Florin (2003), and Themistocleous (2004), which presents existing IT infrastructure as a factor for the adoption of different integration technologies in various types of organisations such as from public sector to private sectors and SMEs to large organisations.

Organisation Size

The organisational size factor is represented in healthcare organisations by bed capacity, provision of healthcare services, centres for the treatment of special diseases, number of primary healthcare providers and number of employees. Based on these characteristics the empirical data collected from the three case hospitals indicated that the NWE-HOSPITAL has a greater volumes of the transactions, geographically dispersed by having three different sites along with 65 GPs and a social services department, and thus having the largest number of IT applications (see Section 5.2.2). WEST-HOSPITAL has almost the same situation with a great number of primary healthcare providers (i.e. 72, all of them using different types of IT applications (see Section 5.3.2). Although the CENTRAL-HOSPITAL is a small size hospital having 40 departments with small bed capacity, it however, provides services for special diseases treatment to a large volume of the population geographically dispersed over the 11 different sites. Therefore, this has validated that the organisation size factor in the process of EAI implementation has an important role. This confirms the literature findings which suggest that the larger size of organisation structure results in the need for integrating its distributed IT infrastructure.

External Pressures

The empirical data collected from the case hospitals indicates that external pressures represent an influencing factor for the adoption of EAI. In this context, the pressures from government organisations (e.g. NHS) for the provision of better healthcare services to the citizens and from partner organisations for improvement in close collaboration represent the external pressures. The pressures from local health authority members such as primary care services providers and social services providers for the sharing of patient information also represent external pressures. In addition, the pressures from citizens for the improvement of healthcare facilities such as availability of their healthcare records wherever and whenever required to the healthcare services providers for better healthcare also represent external pressures. All these external pressures influenced the adoption of EAI in these case hospitals and represented a decisive factor for EAI adoption. This confirms the previous literature findings such as Iacovou et al., (1995), Heck and Ribbers (1999), Martinez and Redondo (2001), Waarts et al.,(2002), Bradford and Florin (2003) and Themistocleous (2004), which present external pressures as a factor for the adoption of different integration technologies such as EDI, EAI and web services.

Internal Pressures

From the empirical findings, it appears that internal pressures such as pressures from the physicians influenced the adoption of EAI in these case hospitals. Theses Physician pressures arose from problems in the provision of better decision-making due to non-availability of required timely clinical information such as laboratory and radiology results. For example in the context of the CENTRAL-HOSPITAL the internal systems integration was based on traditional interfaces. This was causing several problems such as increased complexity, and maintenance of these interfaces was costing a huge amount. Therefore, there was an increasing demand from the hospital management of to solve this problem. In the context of the WEST-HOSPITAL, the non-integrated IT infrastructure was causing problems for provision of better healthcare services as the patient information was distributed over several systems, with very limited links. Thus, the relevant information was not accessible to the physicians at the required time and it was therefore causing a problem to them in better decision-making regarding treatment protocols. From the empirical data it appears that the internal pressure from the various stakeholders of the NEW-HOSPITAL was one of the factors that initiated for the adoption of EAI in the hospital. Most of the pressures were for the better utilisation of the existing IT infrastructure and getting the maximum benefits from IT for the provision of better healthcare services. Therefore, all the above evidence confirms that the internal pressures represent a factor that influences EAI adoption in these case hospitals. The previous literature findings of Themistocleous (2004) and Chen (2003) also confirm that the internal pressures are influencing factor in the adoption of integration technologies.

IT Sophistication

Themistocleous (2004) reports that IT sophistication is related to the level of understanding and addressing technical problems within the organisation. The empirical data show that the level of IT sophistication in the case hospitals affected the adoption of EAI. The case studies analysed in Chapter 5 indicate that there was a lack of skilled employees to understand integration problems or technologies. As a result, the hospitals hired the services of an external consultant and the vendor organisation to improve the IT sophistication. Thus, IT sophistication is an influencing as a factor for the adoption of EAI. The case data findings confirm IT sophistication as a factor for EAI adoption and literature findings such as Chwelos et al., (2001) and Themistocleous (2004) reports IT

sophistication as a factor for the adoption of integration technologies such as EDI and EAI.

IT Support

In the literature, several authors such as Themistocleous (2004) identified support as factor during the adoption of various integration technologies like EAI. The case studies data analysed in Chapter 5 shows that the case hospitals' IT departments were lacking skilled staff with knowledge of EAI. The reasons are firstly that EAI is a new emerging technology, and secondly there is a market place confusion regarding this emerging technology. Thus, the WEST-HOSPITAL and NWE-HOSPITAL hired the services of the external consultant to support them in the selection of a particular technology suitable for their integration problem. The CENTRAL-HOSPITAL developed partnerships with a software company and the software vendor invested in this project. Therefore, the software vendor provided all the support in deciding the right integration technology. Therefore, these findings confirm the literature findings of Themistocleous (2004) which suggest that during the EAI adoption process organisations get outside support such as consultant and vendors support for the selection of the right integration solutions suitable for their integration problem.

Evaluation Frameworks

Empirical evidence from the case hospitals indicates that the evaluation frameworks for the assessment and the selection of integration technologies and packages represent an influencing factor for the adoption of EAI. Case study data indicate that the case hospitals went through several criteria for the assessment of EAI technologies and packages. Further, with the help of the external consultant and vendors they identified different technologies that best supported their integration need.

WEST-HOSPITAL hired the services of an external consultant to provide technical support regarding the decision of selecting the right integration technology. In doing so, WEST-HOSPITAL IT department worked on the evaluation of integration technologies with the support of external consultant and solution provider vendor. Empirical data indicate that a specific framework to support assessment of the integration technologies and packages was not developed. However, the WEST-HOSPITAL IT services department and external consultants formulated several specific criteria that best met the

requirements of the integration problem. Those included security, real time support, integration of custom to packaged application and custom to package to e-business.

According to the empirical evidence derived from data analysis, NWE-HOSPITAL owing the market place confusion regarding the EAI products, decided to study the available EAI products in the market specifically for healthcare organisations. The analysis of interviews shows that NWE-HOSPITAL has working relationships with the SeeBeyond company. Thus, while taking the decision for the adoption of integration technology NWE-HOSPITAL consulted with SeeBeyond and decided to evaluate the integration technologies. The company has already developed its evaluation framework for the assessment of the particular integration technologies. Due to mutual agreement between the hospital and vendor it was not possible for the interviewees to share the evaluation framework. The analysis of the interviewees revealed that the evaluation framework developed by the Themistocleous and Irani (2002) consists of the broad scope of parameters necessary for the evaluation of such technologies.

The analysis of the empirical evidence indicates that CENTRAL-HOSPITAL IT department itself did not go through the evaluation of the integration technologies, as the vendor organisation implemented the EAI project based on the mutual benefits. Therefore, all the evaluation work for the selection of the particular integration technology and packages was carried out by the vendor organisation. However, the interviewees of the vendor organisations were share their views regarding the EAI evaluation frameworks for EAI packages and technologies developed by Themistocleous and Irani (2002). The data analysis from the interviews reports that there is no single technology that supports the integration of all applications. Thus, these frameworks represent an important tool for the selection of EAI technologies and packages. Therefore, all these findings confirm that the EAI evaluation frameworks represent a factor during the selection and assessment process of EAI technologies and packages. Findings from these case hospitals are along similar lines to Themistocleous and Irani (2004) who also highlight the importance of these frameworks during the EAI adoption process and which are thus considered as a factor in its adoption.

Benefits

This factor refers to the level of the benefits that EAI can provide to the hospitals. The findings of the normative literature indicate that Iacovou et al., (1995), Martinez and Redondo (2001), Kuan and Chau (2001), Chen (2003), Themistocleous (2004) and Wu (2004) presented benefits as a factor during the adoption of various integration technologies such as EDI, EAI and Web services. The empirical data from the analysis of the case hospitals suggested and validated many EAI benefits that were analysed from the literature and reported in Chapter 2. However, many of the new benefits are derived with particular focus on the healthcare context. In Chapter 5 these benefits were classified using the model proposed by Shang and Seddon (2002) into: (a) operational; (b) managerial; (c) strategic; (d) technical and (e) organisational factor as illustrated in Tables 5.2, 5.15 and 5.25. However, Table 6.2 shows a taxonomy of the most important benefits derived from these the case hospitals.

Categories	
Operational	*Reduces information losses*
	Increases performance
	Improves data quality
	Improves quality of patients care
Managerial	*Reduces complexity*
	Improves doctor-patient relationship
	Improves clinical decision- making
	Improves quality of patient care
Strategic	*Supports to handle emergencies in time*
	Improves discharge reporting process
	Avoids repeated tests and appointments
Technical	*Supports reducing medical errors*
	Simplifies referrals process
Organisational	*Improves patient satisfaction*
	Improves monitoring of drug usage
	Achieves clinical process integration

Table 6.2: EAI Adoption Benefits

Barriers

Empirical evidence gathered from the case hospitals indicates that these hospitals have experienced several barriers during the implementation of EAI. This supports the literature findings that suggest that introduction of new technologies often presents several barriers which the organisation needs to estimate (Davenport, 1998; Themistocleous 2004). As discussed in Chapter 2, EAI presents several barriers which the organisation needs to consider before proceeding to EAI adoption. The case study data analysis in Chapter 5 supported this perspective and confirmed that the barriers factor was one of the most significant issues during the EAI implementation process in these case hospitals. All the hospitals were experiencing several barriers. The WEST-HOSPITAL had experienced several barriers, for example, the security and confidentiality concerns, thus WEST-HOSPITAL formulated its own strategy and introduced the biometric keyboards mechanism to provide security features during the authentication process. It appears from the empirical data that in the NEW-HOSPITAL case the willingness of physicians and GPs was an important concern. It is not possible to adopt integration technologies without the support of the clinicians and especially GPs. For example several concerns regarding the adoption of the new system, such as the improvements in the repeat prescription process leading to concern about the loss of contact with patients. In the case of CENTRAL-HOSPITAL political issues, such as the internal politics in the departments were experienced as the most important concern (e.g. physicians concerns about monitoring of practices as a medical-legal issue, and changes that result in the care process).

The empirical data derived from the analysis of case hospitals suggested several barriers to EAI adoption. Table 6.3 shows a taxonomy of EAI barriers are derived from case studies.

Categories	
Operational	*Data authentication and consent issues*
	Lack of specific security policy
	Design of clinical process
	Lack of common integration standards
	Lack of EAI skills
Managerial	*Lack of standard medical terminologies*
	Resistance to share information
	Lack of security rules
	Security and confidentiality concerns
Strategic	*Cultural issues*
	Lack of awareness of technology
	Lack of clinicians' and GPs' willingness
	Lack of communication between NHS and suppliers
Technical	*Lack of EAI adoption benefits' realisation*
	Difficulty in migrating from paper-work to electronic
	Physicians concerns about monitoring of practices as medical-legal issue
Organisational	*High cost of security measures*
	Threats from hackers
	Loss of autonomy fears of physicians

Table 6.3: EAI Adoption Barriers

Costs

The empirical evidence gathered from the case hospitals indicates costs as an important factor for EAI adoption. This is according to the literature findings of Iacovou et al., (1995), Kuan and Chau (2001), Marttinez et al., (2001) and Themistocleous (2004) which show costs as a factor for the adoption of various integration technologies such as EDI and EAI. Interviewees of case hospitals reported costs as an influencing factor during the decision making process. As mentioned in Chapter 5 these costs are classified according to the taxonomy developed by Irani and Love (2001). The empirical evidence gathered from the three hospitals identified that software, communication and consultancy costs as the major direct costs. In addition, hardware and communication costs were reported as less important direct costs for EAI adoption. The most significant indirect costs identified were education cost and training cost for the IT staff, clinicians

and other administrative staff. Moreover, management time, project team time and external consultant were experienced as significant indirect costs. However, the maintenance and staff-related costs were ranked relatively lower. In interpreting from the empirical data, it appears that the costs for the security and confidentional equipment were identifed as additional costs. The emprical data from the case hospitals show cost as an importnat factor for EAI adoption.

Patient Satisfaction

The rapid changes taking place in the healthcare sector have prompted healthcare organisations to pay more attention to the satisfaction of their patients. In the literature, the implementation of new IT applications has been considered as a means for enhancing patient satisfaction. The findings from the case hospitals in Chapter 5 indicate that patient satisfaction also has influence as an important factor for the adoption of EAI. It has been identified that the integrated IT infrastructure has resulted in improvements in physician and staff working, such as the availability of the patient's medical record, pathology and radiology results at the point of click which aids in reducing medical errors by providing the appropriate medication, which results in better care services. These findings are according to the literature findings of Zabada et al., (2001) which suggest that emerging IT tools can help to improve patient satisfaction. Nevertheless, it also suggests that it all depend how the hospital information systems are integrated. Furthermore, it suggests that the more integrated systems will result in the higher rating of hospital in patient's satisfaction.

Physicians and Administrators Relationships

The relationship between administrators and physicians is being considered as most beneficial in achieving long-term goals and objective in hospitals development. From the data, it appears that the relationships between the administrators and the physicians have important role. During the EAI implementation process the physicians were actively consulted in the systems evaluation and selection process. These findings confirmed the literature findings of Kim and Michelman (1990) that suggest during healthcare systems integration the role of the physicians is very important, and the hospital administrators thus need to involve the physicians during the integration process. It therefore presents an important factor for the adoption of EAI technology.

Telemedicine

The empirical evidence derived from the findings shows that the integration of telemedicine applications with the other clinical information systems of the hospital represents an important factor during the EAI adoption process. The literature findings of Tan (2002) also support the importance of integration of telemedicine application as an important element in the modernisation and restructuring process of the healthcare organisations. Each of the case hospitals has planned to integrate the telemedicine applications with rest of the other healthcare information systems. As discussed in Chapter 5, the WEST-HOSPITAL trust board realised that the successful implementation of telemedicine depends not just on installing a simple piece of equipment, but a properly integrated telemedicine system is also required. The evident support that for future hospital plans was motivated to integrate its telemedicine applications with clinical systems. In the case of NWE-HOSPITAL the importance of telemedicine applications was also outlined in the future plans for the integration of these applications with the rest of the information systems. In the context of CENTRAL-HOSPITAL it was also decided to integrate its telemedicine system with the EAI applications. Therefore, this has validated the implication of the telemedicine factor in the process of EAI implementation.

Compatibility

This factor has been frequently discussed in the literature, and it is stated that compatibility can occur on several dimensions, such as existing values, past experiences, and needs of the adoption (Roger, 1983; Chen, 2003; Wu, 2004). In the context of EAI adoption the empirical evidence presented in Chapter 5 has reflected these dimensions. For example, physicians believe that improvements in the quality of medical care can only occur when required information is available regarding the treatment protocols, which can support them in a better decision-making process. Therefore, it is considered that EAI adoption is compatible. Another dimension of the compatibility is linked to the previous experience, for example in this context the empirical data shows that physicians and other clinical staff found this system more compatible with their prior experience. Finally, compatibility addresses the key needs addressed by the decision makers. In this context the empirical data shows that EAI adoption has achieved this. For example, the administration of the hospitals were having concerns such as the provision of better healthcare services, integration of different systems in a more flexible and manageable way, reduced complexity, data redundancy, medical errors and reduced integration costs.

Thus, all these findings show that EAI is compatible with the existing values, past experiences and needs. Therefore, compatibility represents a factor for EAI adoption in healthcare organisations.

Security and Confidentiality

This is the new factor derived from the empirical data, and refers to the security and confidently concerns about the patients data. In the literature these have always been considered important in the distributed processing environment (Huston, 2001). Empirical data have shown that security and confidentiality comprise a factor that affects the adoption of EAI. The analysis of the case studies shows that WEST-HOSPITAL realised the importance of their security and confidentiality for patient data. Thus, they identified several privacy and security mechanisms that include the password, smart card and biometrics authentication equipment, in which fingerprinting is used. The biometrics authentication equipment mechanism is used for patient data security and confidentiality.

In the context of NEW-HOSPITAL, security and confidentiality were considered an issue, since patients and GPs have the same degree of concern for security, such as access to important information. Patients and clinical professionals were worried that making personal health information more widely available may endanger its confidentiality. Therefore, they agreed on ways of enforcing security by ensuring rigorous methods of encryption and signature authentication. Thus, apart from the technical measures, they took several other steps as well. CENTRAL-HOSPITAL also observed the access to patient information in a distributed environment as a problem, and thus raised serious questions about who has access to this information, and how it is protected. As the technology is threatened by potential unauthorised access, such as by computer hackers who have been known to tap illegally into private information on computer networks, and who could possibly gain access to and even alter patient records. Therefore, the CENTRAL-HOSPITAL also went through several processes to cover the security and confidentiality issues. All these reasons represent security and confidentiality as an important factor during the EAI adoption process in all these case hospitals.

Education

The analysis of the empirical data indicated that case hospitals identified the need of education for their clinical staff and patients during the EAI implementation process.

This was for several reasons. For example, in the context of WEST-HOSPITAL it has identified that due to several problems such as the resistance to change from the clinical staff, confidentiality and security issues and patient consent, the hospital started the campaign to educate the entire stakeholders of the hospital. The benefits of EAI adoption were revealed to all the stakeholders. In particular, NWE-HOSPITAL launched an awareness campaign throughout the borough. In doing so, briefing leaflets were distributed to every household and in addition, posters were displayed in libraries, pharmacies, hospitals, clinics and opticians' practices. Moreover, interviews about the project on local radio stations and advertisements in the area's newspapers explained the project objectives. These efforts make it possible for the hospital to get the consent of the people of the borough for the integration efforts. The resistance to change was also an issue from the staff of the CENTRAL-HOSPITAL in particular loss of their jobs. Thus, the motivation efforts by the management of the hospital form support to overcome this problem. All these case findings support education as factor for the adoption of EAI in healthcare organisations. The literature (e.g. Irani, 2002; Themistocleous 2002) also highlighted the need of education during the adoption of process of integration technology (e.g. MRPII and EAI)."