



**ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΩΣ
ΤΜΗΜΑ ΨΗΦΙΑΚΩΝ ΣΥΣΤΗΜΑΤΩΝ**

ΔΙΔΑΚΤΟΡΙΚΗ ΔΙΑΤΡΙΒΗ

**ΜΕΛΕΤΗ ΤΗΣ ΔΙΑΚΥΒΕΡΝΗΣΗΣ ΥΠΗΡΕΣΙΟΣΤΡΕΦΩΝ
ΑΡΧΙΤΕΚΤΟΝΙΚΩΝ ΣΤΟΥΣ ΟΡΓΑΝΙΣΜΟΥΣ ΥΓΕΙΑΣ**

**INVESTIGATING SERVICE ORIENTED ARCHITECTURE GOVERNANCE
IN HEALTHCARE ORGANISATIONS**



**ΚΩΝΣΤΑΝΤΙΝΟΣ Χ. ΚΟΥΜΑΔΙΤΗΣ
ΠΕΙΡΑΙΑΣ 2013**

PhD Abstract

This dissertation focuses on SOA Governance in healthcare organisations. SOA has emerged to support organisations overcoming their integration problems and it has been adopted by many organisations in various sectors, including healthcare. Despite SOA benefits, many organisations claim they face problems and will not expand SOA use. This reveals that even though SOA is considered a valuable architectural paradigm it still has factors that affect its applicability. This is extremely important as investments of hundreds of thousands of Euros do not lead to the expected outcomes and in some cases result in failure. A failure in a healthcare organisation's IT infrastructure is not an option as the literature is full of cases where healthcare IT failures cost patients' lives. So the researcher investigated the SOA Critical Success Factors (CSF) in healthcare and identified that SOA Governance is depicted as a critical dimension to SOA that is required from an early stage. The top priority given to SOA Governance is in accordance with the views of many researchers who report that SOA implementations require governance mechanisms to excel, otherwise the architecture will end up complex, uncontrolled, brittle and eventually discarded. To this end, the researcher focused the research on the role of SOA Governance in healthcare organization and explained the main concepts of SOA Governance providing a detailed description of the theoretical approaches surrounding this research area. The identified SOA Governance models shared common issues, but also hold differences (scale, detail and analysis) and limitations (confusion, overlapping, lack of testing and healthcare aspects). Thus, to extend the established norms and to overcome the limitations identified in literature, the researcher proposed a SOA Governance framework integrated with nine elements, such as (a) Organisational Structures, (b) Roles, (c) Maturity Model, (d) Roadmap, (e) SOA Governance Infrastructure, (f) Policies, (g) Metrics, (h) Best Practices, and (i) Governance Processes. This conceptualisation pinpointed attributes and guidelines for each element, required successfully governing a SOA and tackling longstanding Healthcare Information Systems (HIS) challenges. The researcher claims that such an approach is significant and novel as: (a) it incorporates a unique formulation combining the identified common elements of SOA Governance, the SOA CSFs and HIS challenges and (b) the framework could be used as a decision making tool for SOA Governance. 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 SOA Governance and indicates that it is acceptable by the organisations and the interviewees that participated in this research. Despite these results, the approach cannot be generalised, but it is the researcher intention to allow others to relate their views with the ones reported in this dissertation. This dissertation introduces, tests and presents a novel SOA Governance Framework in healthcare and contributes to the body of knowledge by extending the literature.

Acknowledgements

One of the joys of completion is to look over the journey past and remember all the friends and family who have helped and supported me along this long but fulfilling road.

Firstly, I would like to thank my supervisor Associate Professor Marinus Themistocleous for his enthusiastic support and advice, patience and constant energy for ideas' sharing throughout the research effort. His influence is inherited in both the theoretical and practical aspects of this work. Also, many thanks are due to the other two member of my supervisory committee Professor George Vassilacopoulos and Professor Socratis Katsikas for their support and constructive feedback.

In terms of exchange of ideas, support, criticisms and intellectual stimulation, I am indebted to my many student colleagues for providing a stimulating and fun environment in which to learn and grow. I am especially grateful to all the members of academic staff and my fellow PhD students in the Network Oriented Systems and Services Laboratory (NSS) and Digital Health Services Laboratory (DHSL) in the Department of Digital Systems, University of Piraeus.

I would also like to thank my good friends for their understanding and patience through the years. Especially Dr Lise Jönsson for her support and encouragement. Thank you for being there for me.

Lastly, and most importantly, I wish to thank my family, for their unconditional love and support in this journey. To them I dedicate this thesis.

Table of Contents

PhD Abstract.....	i
Acknowledgements	ii
CHAPTER 1: INTRODUCTION	1
SUMMARY	1
1.1 INTRODUCTION	2
1.2 RESEARCH AIM AND OBJECTIVES	9
1.2.1 Research Aim.....	9
1.2.2 Research Objectives	9
1.3 INTRODUCTION TO RESEARCH METHODOLOGY	10
1.4 THESIS OUTLINE	10
CHAPTER 2: LITERATURE REVIEW	14
SUMMARY	14
2.1 INTRODUCTION	15
2.2 HEALTHCARE INFORMATION SYSTEMS: CHALLENGES	17
2.3 SERVICE ORIENTED ARCHITECTURE (SOA)	24
2.3.1 Enterprise Service Bus	26
2.3.2 Web-Services.....	28
2.4 SERVICE ORIENTED ARCHITECTURE: BENEFITS AND CRITICAL SUCCESS FACTORS	30
2.4.1 Service Oriented Architecture: Benefits.....	31
2.4.2 Service Oriented Architecture: Critical Success Factors.....	38
2.5 SOA GOVERNANCE	48
2.5.1 SOA Governance Definition.....	49
2.5.2 Service Oriented Architecture Governance Research	52
2.5.3 Introduction to SOA Governance Literature Review Methodology and Plan	52
2.5.4 Analysis of SOA Governance Literature Review Methodology and Plan	54
2.5.5 SOA Governance Literature Review Primary Cases	58
2.5.5.1 Beimborn <i>et al.</i> , (2009) Model	60
2.5.5.2 Bernhardt and Seese (2009) Model.....	61
2.5.5.3 Hojaji and Shirazi Model.....	64
2.5.5.4 Janiesch <i>et al.</i> , (2010; 2009a) Model	68
2.5.5.5 Niemman <i>et al.</i> , (2008; 2010) Model.....	70
2.5.5.6 Schepers <i>et al.</i> , (2008b) Model.....	73
2.5.6 A Governance Literature Review – Concept Map	74
2.5.7 SOA Governance Literature Review Critical Analysis	78
2.6 CONCLUSIONS	80
CHAPTER 3: CONCEPTUAL DEVELOPMENT	82
SUMMARY	82
3.1 INTRODUCTION	83
3.2 PART A - RESEARCH ISSUES DERIVED FROM LITERATURE REVIEW	85
3.2.1 SOA Governance Organisational Structure (OS)Element.....	87
3.2.2 Roles (RL) Element.....	90
3.2.3 SOA Maturity Model (MM) Element	92
3.2.4 Roadmap (RD) Element	94
3.2.5 SOA Governance Infrastructure (SGI) Element	95
3.2.6 Policies (PO) Element	97
3.2.7 Metrics (ME) Element.....	99
3.2.8 Best Practices (BB) Element.....	100

3.2.9	Governance Processes (GP) Element.....	102
3.3	PART B - ADDITIONS FOR SOA GOVERNANCE ELEMENTS.....	103
3.3.1	Additional Guidelines for Organisational Structure (OS) Element.....	103
3.3.2	Additional Guidelines for Roles (RL) Element.....	105
3.3.3	Additional Guidelines for Roadmap (RD) Element.....	110
3.3.4	Additional Guidelines for Metrics (ME) Element.....	111
3.3.5	Additional Guidelines for Best Practices (BB) Element.....	112
3.3.6	Additional Guidelines for Governance Processes (GP) Element.....	113
3.4	PART C – HEALTHCARE SPECIFIC ATTRIBUTES.....	115
3.5	SOA GOVERNANCE FRAMEWORK AND RESEARCH ISSUES.....	120
3.6	CONCLUSIONS.....	127
CHAPTER 4:	RESEARCH METHODOLOGY.....	129
SUMMARY.....		129
4.1	INTRODUCTION.....	130
4.2	RESEARCH APPROACH.....	130
4.2.1	Qualitative and Quantitative Research Approaches.....	131
4.2.2	Justifying the Selection of a Qualitative Research Approach.....	132
4.3	PHILOSOPHICAL STANCE.....	134
4.3.1	Types of Philosophical Stances.....	134
4.3.2	Justifying the Selection of the Interpretive Stance.....	135
4.4	RESEARCH STRATEGY.....	137
4.4.1	Selecting and Justifying the Use of Case Study Strategy.....	138
4.4.2	Justifying the Cases Selection.....	140
4.5	EMPIRICAL RESEARCH METHODOLOGY.....	144
4.5.1	Research Design.....	146
4.5.2	Data Collection.....	146
4.5.2.1	Interviews.....	147
4.5.2.2	Observations and Archival Data.....	152
4.5.3	Data Analysis.....	152
4.5.3.1	Trustworthiness.....	153
4.5.3.2	Validity.....	154
4.6	CASE STUDY PROTOCOL.....	155
4.6.1	Case Study Overview.....	156
4.6.2	Fieldwork Research Procedures.....	158
4.6.3	Case Study Questions and Output of Study.....	159
4.7	CONCLUSIONS.....	159
CHAPTER 5:	SOA GOVERNANCE FRAMEWORK.....	161
SUMMARY.....		161
5.1	INTRODUCTION.....	162
5.2	OVERVIEW OF THE GREEK NATIONAL HEALTHCARE SYSTEM.....	162
5.3	CASE STUDY ONE: PUBHEALTHORG.....	165
5.3.1	PUBHEALTHORG: Organisation.....	165
5.3.2	PUBHEALTHORG: Information Technology.....	166
5.3.3	PUBHEALTHORG: Challenges.....	167
5.3.4	PUBHEALTHORG: Integration Approach.....	168
5.3.5	PUBHEALTHORG: Integration Process and SOA.....	169
5.3.6	Testing the Proposed SOA Governance Framework in PubHealthOrg.....	170
5.3.6.1	Testing the Organisational Structure (OS) Element.....	170
5.3.6.2	Testing Roles (RL) Element.....	180
5.3.6.3	Testing SOA Maturity Model (MM) Element.....	185
5.3.6.4	Testing Roadmap (RD) Element.....	190
5.3.6.5	Testing SOA Governance Infrastructure (SGI) Element.....	194
5.3.6.6	Testing Policies (PO) Element.....	197

5.3.6.7 Testing Metrics (ME) Element.....	201
5.3.6.8 Testing Best Practices (BP) Element.....	203
5.3.6.9 Testing SOA Governance Processes (GP) Element	206
5.3.6.10 Testing the SOA Governance Framework and Elements' Relations.....	209
5.3.6.11 Summarising Findings Obtained from PubHealthOrg.....	211
5.4 CASE STUDY TWO: PRIHEALTHORG	214
5.4.1 PRIHEALTHORG: Organisation	214
5.4.2 PRIHEALTHORG: Information Technology.....	215
5.4.3 PRIHEALTHORG: Challenges	216
5.4.4 PRIHEALTHORG: Integration Approach	218
5.4.5 PriHealthOrg: Integration Process and SOA	222
5.4.6 Testing the Proposed SOA Governance Framework in PriHealthOrg.....	223
5.4.6.1 Testing the Organisational Structure (OS) Element	223
5.4.6.2 Testing the Roles (RL) Element.....	233
5.4.6.3 Testing SOA Maturity (MM) Model Element	238
5.4.6.4 Testing Roadmap (RD) Element	242
5.4.6.5 Testing SOA Governance Infrastructure (SGI) Element	245
5.4.6.6 Testing Policies (PO) Element.....	248
5.4.6.7 Testing Metrics (ME) Element.....	253
5.4.6.8 Testing Best Practices (BP) Element.....	257
5.4.6.9 Testing SOA Governance Processes (GP) Element	260
5.4.6.10 Testing the SOA Governance Framework and Elements' Relations.....	266
5.4.6.11 Summarising Findings Obtained from PriHealthOrg	268
5.5 CONCLUSIONS.....	270
 CHAPTER 6: REVISIONS OF THE CONCEPTUAL FRAMEWORK	 275
SUMMARY.....	275
6.1 INTRODUCTION.....	276
6.2 LESSONS LEARNT FROM CASE STUDIES	277
6.3 THE REVISED CONCEPTUAL MODEL FOR SOA GOVERNANCE IN HEALTHCARE.....	279
6.3.1 Findings and Revised Elements for SOA Governance Framework.....	279
6.3.2 Findings and Revised Model	285
6.4 CONCLUSIONS.....	293
 CHAPTER 7: CONCLUSIONS AND FURTHER RESEARCH	 294
SUMMARY.....	294
7.1 RESEARCH OVERVIEW.....	295
7.2 MAIN FACTS.....	298
7.3 MEETING THE OBJECTIVES OF THIS DISSERTATION.....	300
7.4 STATEMENT OF CONTRIBUTION AND RESEARCH NOVELTY	302
7.4.1 Novel Method for SOA Governance Elements' Structure	302
7.4.2 Novel SOA Governance Framework in Healthcare Organisations.....	303
7.5 RESEARCH LIMITATIONS	304
7.6 RECOMMENDATIONS FOR FURTHER WORK.....	305
REFERENCES	307
 ANNEX I: HIS INTEGRATION STANDARDS AND APPROACHES.....	 327
ANNEX II: SOA MATURITY MODEL.....	329
ANNEX III: INTERVIEW AGENDA.....	331
ANNEX IV: TYPES OF INVOLVMENT.....	345
ANNEX V: ABBREVIATIONS	346
ANNEX VI: ΕΚΤΕΝΗΣ ΠΕΡΙΛΗΨΗ ΣΤΗΝ ΕΛΛΗΝΙΚΗ ΓΛΩΣΣΑ	347

List of Figures

Figure 1.1: HIS Level of Integration over Time	4
Figure 1.2: Thesis Outline.....	13
Figure 2.1: SOA Participants [Source: Papazoglou (2008)]	26
Figure 2.2: Web-Services Technology Stack [Adapted from Papazoglou (2008, p.33)]	30
Figure 2.3: Governance Plan.....	51
Figure 2.4: A Systematic Literature Review Plan [Adapted from Brereton <i>et al.</i> , (2007)]	54
Figure 2.5: Concept Map Blueprint.....	75
Figure 2.6: Concept Map of the SOA Governance Literature Review.....	77
Figure 3.1: Proposed SOA Roadmap's Based on SOA Maturity Levels.....	111
Figure 3.2: Proposed SOA Governance Process (GP) Element.....	114
Figure 3.3: SOA Governance Framework Synthesis	120
Figure 3.4: Proposed SOA Governance Framework.....	126
Figure 4.1: Research Timeline.....	144
Figure 4.2: Research Methodology	145
Figure 5.1: PubHealthOrg Hierarchy	166
Figure 5.2: iServ Integration Approach	168
Figure 5.3: PubHealthOrg's Organisational Structure	171
Figure 5.4: Maturity Levels in PubHealthOrg	189
Figure 5.5: SOA Roadmap as Identified in PubHealthOrg.....	193
Figure 5.6: Example of the Goal/Question/Metric (GQM) Method in PubHealthOrg	203
Figure 5.7: Hospital IT Infrastructure	215
Figure 5.8: Integration Approach for PriHealthOrg.....	218
Figure 5.9: PriHealthOrg's Organisational Structure.....	224
Figure 5.10: Maturity Levels of PriHealthOrg.....	240
Figure 5.11: SOA Roadmap as Identified in PriHealthOrg	244
Figure 5.12: Example of the Goal/Question/Metric (GQM) Method in PriHealthOrg.....	257
Figure 6.1: SOA Roadmap New Design Guidelines	283
Figure 6.2: Revised SOA Governance Framework	292

List of Tables

Table 2.1: HIS Challenges.....	18
Table 2.2: Categorisation of Benefits [Source: Shang and Seddon (2000b)]	31
Table 2.3: SOA Benefits.....	34
Table 2.4: SOA Benefits in Healthcare	36
Table 2.5: Classification of SOA Critical Success Factors.....	42
Table 2.6: Classification of SOA Critical Success Factors in Healthcare	47
Table 2.7: Literature Review Methodology Used for SOA Governance Literature Review [Source: Cooper (1988)].....	53
Table 2.8: Literature Review Research Findings	56
Table 2.9: Literature Review Primary Cases	59
Table 2.10: Elements of Beimborn <i>et al.</i> , (2009) Model	61
Table 2.11: Elements of Bernhardt and Seese (2009) Model	63
Table 2.12: Elements of Hojaji and Shirazi (2010a) Model	65
Table 2.13: AUT SOA Governance Model Hojaji and Shirazi (2010b; 2010c)	67
Table 2.14: Janiesch <i>et al.</i> , (2010; 2009a) Model.....	69
Table 2.15: Elements of Niemman <i>et al.</i> , (2008; 2010) Model.....	72
Table 2.16: Elements of Schepers <i>et al.</i> , (2008) Model.....	74
Table 3.1: Summary of SOA Governance OS Element Derived From Normative Literature.....	89
Table 3.2: Organisational Structure (OS) as Identified in Normative Literature	89
Table 3.3: Roles (RL) as Identified in Normative Literature.....	92

Table 3.4: SOA Maturity Model (MM) as Identified in Normative Literature.....	93
Table 3.5: Roadmap (RD) as Identified in Normative Literature	95
Table 3.6: Proposed Technology Solutions for the SOA Governance Infrastructure (SGI).....	96
Table 3.7: SOA Governance Infrastructure (SGI) as Identified in Normative Literature	97
Table 3.8: Policies (PO) as Identified in Normative Literature	99
Table 3.9: Metrics (ME) as Identified in Normative Literature	100
Table 3.10: Best practices (BB) as Identified in Normative Literature	101
Table 3.11: SOA Governance Processes (GP) as Identified in Normative Literature.....	103
Table 3.12: Proposed Engagement of SOA Governance Organisational Structure	104
Table 3.13: Proposed SOA Roles [Adapted by:Strandl (2007), Biske (2008) and Kajko- Mattsson <i>et al.</i> , (2007)]	109
Table 3.14: Example of Metrics Framework	112
Table 3.15: Best Practices Categories [O'Dell & Grayson (1998)]	113
Table 3.16: Healthcare Additions to SOA Governance Elements.....	119
Table 3.17: Proposed SOA Governance Elements.....	124
Table 3.18: Proposed Issues for Further Investigation	128
Table 4.1: Qualitative vs. Quantitative Research Method [Source: Pope & Mayes (1995) and Mack <i>et al.</i> , (2005)]	132
Table 4.2: Interpretive Stance [Source: Fossey <i>et al.</i> , (2002)].....	137
Table 4.3: Relevance of the Criteria Proposed by Miles and Huberman (1994) to Select Case Studies.....	144
Table 4.4: Data Collection Techniques Employed in this Dissertation	147
Table 4.5: Interview Issues [In Similar Lines With: Myers & Newman (2007) and Fontana & Frey (2000)].....	149
Table 4.6: Interview Agenda Overview.....	150
Table 4.7: Interviewees for PubHealthOrg and PriHealthOrg	151
Table 4.8: Questioning Levels in Multiple Case Enquiries	156
Table 4.9: Case Study Overview	157
Table 4.10: Proposed Issues for Investigation	159
Table 5.1: Testing Organisational Structure Element in PubHealthOrg – Findings for Attributes.....	176
Table 5.2: Testing Organisational Structure Element in PubHealthOrg – Findings for Guidelines.....	176
Table 5.3: Testing Organisational Structure Element in PubHealthOrg – Findings for Additional Guidelines	177
Table 5.4: Testing Organisational Structure Element in PubHealthOrg – Findings for Healthcare Aspects.....	180
Table 5.5: Testing Roles Element in PubHealthOrg – Findings for Attributes.....	182
Table 5.6: Testing Roles Element in PubHealthOrg – Findings for Guidelines	183
Table 5.7: Testing SOA Roles List	184
Table 5.8: Testing Maturity Model Element in PubHealthOrg – Findings for Attributes.....	187
Table 5.9: Testing Maturity Model Element in PubHealthOrg – Findings for Guidelines.....	189
Table 5.10: Testing Roadmap Element in PubHealthOrg – Findings for Attributes.....	191
Table 5.11: Testing Roadmap Element in PubHealthOrg – Findings for Guidelines	193
Table 5.12: Testing SOA Governance Infrastructure Element in PubHealthOrg – Findings for Attributes.....	195
Table 5.13: Testing SOA Governance Infrastructure Element in PubHealthOrg – Findings for Sub-elements	196
Table 5.14: Testing Policies Element in PubHealthOrg – Findings for Guidelines.....	200
Table 5.15: Testing Policies Element in PubHealthOrg – Findings for Healthcare Aspects.....	200
Table 5.16: Testing Metrics Element in PubHealthOrg – Findings for Sub-Elements	202
Table 5.17: Testing Metrics Element in PubHealthOrg – Findings for Healthcare Aspects	203
Table 5.18: Testing Best Practices in PubHealthOrg – Findings for Attributes	204
Table 5.19: Testing Best Practices Element in PubHealthOrg – Findings for Healthcare Aspects.....	205

Table 5.20: Testing Governance Processes Element in PubHealthOrg – Findings for Attributes.....	207
Table 5.21: Testing Governance Processes Element in PubHealthOrg – Findings for Governance Processes Phases.....	208
Table 5.22: Testing Governance Processes Element in PubHealthOrg – Findings for Healthcare Aspects.....	209
Table 5.23: Proposed SOA Governance Elements & Findings for PubHealthOrg Case.....	212
Table 5.24: Testing Organisational Structure Element in PriHealthOrg – Findings for Attributes.....	228
Table 5.25: Testing Organisational Structure Element in PriHealthOrg – Findings for Guidelines.....	229
Table 5.26: Testing Organisational Structure Element in PriHealthOrg – Findings for Additional Guidelines.....	230
Table 5.27: Testing Organisational Structure Element in PriHealthOrg – Findings for Healthcare Aspects.....	233
Table 5.28: Testing Roles Element in PriHealthOrg – Findings for Attributes.....	234
Table 5.29: Testing Roles Element in PriHealthOrg – Findings for Guidelines.....	235
Table 5.30: Identified SOA Roles in PriHealthOrg.....	236
Table 5.31: Testing the Maturity Model Element in PriHealthOrg – Findings for Attributes.....	239
Table 5.32: Testing the Maturity Model Element in PriHealthOrg – Findings for Guidelines.....	241
Table 5.33: Testing the Roadmap Element in PriHealthOrg – Findings for Attributes.....	243
Table 5.34: Testing the Roadmap Element in PriHealthOrg – Findings for Guidelines.....	245
Table 5.35: Testing the SOA Governance Infrastructure Element in PriHealthOrg – Findings for Attributes.....	247
Table 5.36: Testing the SOA Governance Infrastructure Element in PriHealthOrg – Findings for Attributes.....	247
Table 5.37: Testing the Policies Element in PriHealthOrg – Findings for Guidelines.....	251
Table 5.38: Testing the Policies Element in PriHealthOrg – Findings for Policies Types.....	253
Table 5.39: Testing the Policies Element in PriHealthOrg – Findings for Healthcare Aspects.....	253
Table 5.40: Testing the Metrics Element in PriHealthOrg – Findings for Attributes.....	254
Table 5.41: Testing the Metrics Element in PriHealthOrg – Findings for Metrics Categories.....	255
Table 5.42: Testing the Metrics Element in PriHealthOrg – Findings for Healthcare Aspects.....	257
Table 5.43: Testing the Best Practices Element in PriHealthOrg – Findings for Attributes.....	259
Table 5.44: Testing the Best Practices Element in PriHealthOrg – Findings for Healthcare Aspects.....	260
Table 5.45: Testing the Governance Processes Element in PriHealthOrg – Findings for Attributes.....	262
Table 5.46: Testing the Governance Processes Element in PriHealthOrg – Findings for Governance Phases.....	264
Table 5.47: Testing the Governance Processes Element in PriHealthOrg – Findings for healthcare Aspects.....	266
Table 5.48: Proposed SOA Governance Elements & Findings for PriHealthOrg Case.....	269
Table 5.49: Proposed SOA Governance Elements & Findings for C1 (PubHealthOrg) & C2 (PriHealthOrg).....	272
Table 6.1: Main Findings Regarding SOA Governance Elements.....	280
Table 6.2: Communication Element.....	281
Table 6.3: New Role on Roles Element – SOA Evangelist.....	282
Table 6.4: Governance Process (GP) Element – New Attributes for the Measurement Phase.....	285
Table 6.5: Proposed SOA Governance Elements.....	290

CHAPTER 1

INTRODUCTION

Summary

During the last decades various integration technologies have been used to integrate Healthcare Information Systems (HIS) (Khoubati *et al.*, 2007). In many cases integration efforts have resulted in heterogeneous and fragmented systems, or systems that still have challenges in terms of interoperability, safety and management (Maenpaa *et al.*, 2009; Mantzana, 2006). Thus, the need for integrated HIS in a safer, interoperable and more manageable environment motivated organisations to consider the adoption of advanced paradigms such as Service Oriented Architecture (SOA).

SOA is an architectural paradigm that supports reusability and emphasizes on breaking business processes into smaller blocks of functionality (e.g. services). These small blocks are well defined, self-contained modules that provide standard business functionality and linked together to build an integrated business process (Papazoglou *et al.*, 2008). An organisation implementing SOA can: (a) reduce costs, (b) provide higher return on investment (c) reuse and integrate services and legacy systems, (d) reduce time to market and (e) better align business with Information technology (IT) (2011; Marks, 2008; Mueller Benjamin, 2010).

Despite SOA benefits Forrester (2009) indicates that, 41% of SOA users in the Global 2000 firms believe that (a) SOA has delivered less benefit than expected, (b) 17% claim they face problems and (c) will not expand SOA use (Heffner, 2009). This reveals that even though SOA is considered a valuable architectural paradigm it still has factors that affect its applicability.

In order, to fully utilise SOA capabilities and benefits, research has focused beyond the technical parts of the architecture, such as governance (Marks, 2008). SOA Governance can be characterised as a continuous control process that guarantees sufficient adaptability and integrity of an SOA system in issues like: (a) capability, (b) security and (c) strategic business alignment. Its overall goal is the compliance of legal, technical and intercompany regulations, respectively. In particular, it ensures the reliable long-term operation of an SOA (Niemann *et*

al., 2009). Only recently, SOA Governance came to the top of the research agenda and therefore, scientific research and literature around it, remains limited. Yet, SOA Governance on healthcare organisations remains under explored and reported.

This dissertation investigates and analyses the SOA Governance in healthcare organisations, with this chapter introducing the research presented hereunder. The chapter begins with Section 1.1 introducing the problem area and highlighting the importance of SOA Governance. Section 1.2 presents the aims and the objectives of the dissertation, Section 1.3 provides an overview of the research methodology adopted in this research, and Section 1.4 presents the outline of the dissertation.

1.1 Introduction

During the last decades, the need for integrated Healthcare Information Systems (HIS) has been amplified for many reasons. In this research, the focus is drawn on two key issues: (a) to reduce medical errors that cost human lives and (b) to support the provision of healthcare services at a global scale.

The first key issue is initiated by the requirements of consistent and accurate medical information exchange, a process directly linked to patients' treatment (e.g. allergies alert, patients history, medical conditions) (Anderson and Aydin, 2005). Despite the advancements made in improving the quality and exchange of medical information, it has been estimated that 5% of hospital admissions experience adverse errors with 30% of them causing consequential harm (Wachter, 2008). Medical errors, as reported in the USA's Healthcare reform plan are responsible for the death of 98,000 people (US Department of Health & Human Services., 2010). In addition to this, medical errors that occur through the non-integrated HIS are estimated to have resulted in the loss of 64 persons per day in United Kingdom (UK) (Khoumbati *et al.*, 2006b). Most of these errors are preventable with 44% technical errors, 17% diagnosis, 12% failure to prevent injury and 10% errors in the use of a drug (Kohn and Corrigan, 2000). Many organisations suggested the minimization of medical errors. In this respect, the European Consumers Organisation (2007) proposed a medical error minimization plan, in which the use of advanced integration technologies is proposed as a possible solution to this problem (Blumenta, 2009). Information System (IS) integration can play a vital role in the enhancement of medical data quality and the reduction of medical errors (Chiasson *et al.*, 2007). As a result the integration of HIS can be considered as a strategic necessity that will significantly improve healthcare services and reduce medical errors (Mantzana *et al.*, 2008).

The second key issue deals with the mission of healthcare organisations to utilize services of high quality and profound safety through healthcare systems beyond the narrow boundaries of a clinic or hospital (Haux, 2006). In recent years, medical information and services are shared at national, continent and global level (Watson, 2010). Many patients tend to use healthcare services provided by organisations other than their country of residence due to: (a) long waiting lists, (b) high cost of healthcare services, (c) specialized treatment and (d) fewer barriers to travel (Horowitz *et al.*, 2007). Thus, new developments in healthcare such as medical tourism, cross boarder and global healthcare emerged to describe the phenomenon (Connell, 2006). At international level, the facilitation of foreign patients is an industry sustained by millions of individuals (617 millions in 2006) with an annual growth of 3.9% and worth US\$513 billions (Percivil and Bridges, 2006). In order to support this growing demand integration at many levels is needed between countries, government bodies and healthcare organisations. The integration is required as travelling patients may carry, to the country they seek treatment, the regulations, expectations, standards and medical information used and established in their residential country (Goene *et al.*, 2009). From a technical perspective, most of these services are provided by autonomous, isolated and in many cases not compatible Information Systems. Thus, the integration of HIS and services is required since HIS should automate common processes, deliver similar services and exchange compatible and relevant information.

The issues reported in the previous paragraphs influence both organisation's strategy and IT infrastructures (Rada, 2008) and: (a) lead to changes on organisations' strategy towards integration and (b) influence the development of integrated IT architectures. Attempts to address integration issues in healthcare have been employed in the past and focused on Enterprise Application Integration (EAI) (Khoumbati *et al.*, 2006a). In more detail, EAI provided valuable lessons in the development of integration mechanisms such as: (a) the separation of business process from business applications and (b) the integration of business processes instead of business applications (Khoumbati *et al.*, 2007; Marks and Bell, 2006; Themistocleous and Mantzana, 2010). Nevertheless, EAI has its own limitations as: (a) high cost, (b) resistance to change, (c) organisational issues, (d) high complexity, (e) scale of change, (f) duration of implementation and (g) politics (Marks and Bell, 2006). All these issues are related to governance and resulted in low adoption rates in EAI due to the lack of governance (Themistocleous and Mantzana, 2010). Moreover, EAI focused mainly on resolving the integration issues from a technical perspective and little attention was given on "soft" issues such as governance.

Based on the lessons learnt from EAI technology the focus has shifted towards Service Oriented Architecture. SOA is an extension of EAI and is based on common principles. It can provide accurate, fast and functional data exchange incorporating integrated infrastructure with interoperable services (Mantzana *et al.*, 2010). Even though, SOA deals with governance and attempts to resolve the limitations found in EAI projects, many organisations are struggling, with a reported 17% of firms' considering not to expand its use (Heffner, 2009). This reveals that even though SOA is considered as a valuable architectural paradigm it still has issues that affect its applicability (Jeng and Lianjun, 2007). Despite the emphasis placed on technical aspects of SOA a research gap regarding SOA Governance exists in literature. In more detail, Viering (2009) reports that only 4 out of 175 articles of the normative literature address "governance and organisational" parameters (Viering *et al.*, 2009). Moreover, SOAs' potential can be utilized, when a broader understanding is gained, as its building blocks extend beyond technological elements to governance issues (Bieberstein *et al.*, 2005). Thus, in an attempt to enhance the understanding in the area of SOA Governance in Healthcare, an analysis of HIS integration and emphasis on SOA Governance in a healthcare organisation, is presented.

1.1.1 Healthcare Information Systems Integration

Many researchers have underlined the use of secure, flexible and integrated HIS (Beyer, 2004; Boochever, 2004; Gleave, 2009; Mass and Suomi, 2004; Strandberg-Larsen and Krasnik, 2009). The implementation of integrated HIS has the potential to shrink cost, while reducing morbidity and mortality (Basit *et al.*, 2006). In recent years, healthcare shifts from institution-centered clinical-hospital information systems towards regional and global HIS, (Haux, 2006), as seen in Figure 1.1. The development of global integration supports a cross-border environment, in which the patient can receive healthcare treatment in various institutions around the world under the same umbrella of quality, safety and data availability.

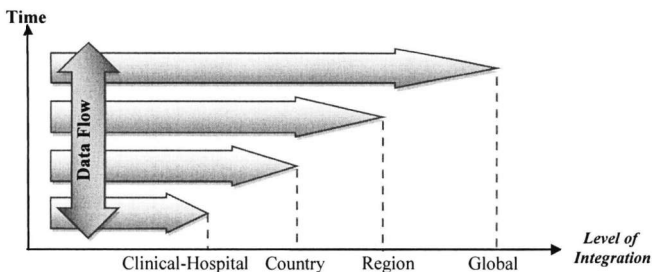


Figure 1.1: HIS Level of Integration over Time

At a **Clinical-Hospital level**, many efforts, towards the integration of HIS have been reported such as: (a) system integration (Clifford *et al.*, 2008; Menachemi *et al.*, 2009; Stefanou and Revanoglou, 2006), electronic prescribing (Franklin *et al.*, 2007; van Rosse *et al.*, 2009), (b) communication through departments and labs (Piva *et al.*, 2009), (c) the operation of the pharmacy (Poon *et al.*, 2006), and (d) the utilization of Healthcare Electronic Records (Gaunt, 2009).

At a **Country level**, many nations are increasing their healthcare spending towards the integration of their HIS. For example, United States of America with their reform plan (2009) for the rearrangement and the automation of healthcare system, attempt to convert a system that is still impressively based on paper and pen. The plan attempts to adopt advanced electronic healthcare services that will render healthcare more efficient, limiting unusable processes and harmful interactions of medicines. In summary, the fundamental base of the \$871 billion plan consist of the adoption and integration of advanced HIS (US Government., 2009). The same effort can be seen also in European countries like Sweden, Germany, Greece, etc. where the expenditure of HIS covers a big percentage of their healthcare budget (European Observatory on Health Systems Policies., 2008).

At a **Regional level**¹, there is a growing need for integrated HIS as citizen's travel through borderlines to seek healthcare. Even though, neighboring or common market countries (e.g. Europe) share similar interests and policies as in professional training, medical information and HIS quality their national healthcare systems vary widely in terms of accessibility, quality and affordability (Garrido *et al.*, 2008; Wolf, 2008). A World Healthcare Organisations's (WHO) survey, reports that countries in the high- and upper-middle income groups are more advanced in their HIS development than those in the lower-middle and low-income groups (World Health Organisation, 2006). Each country has autonomous isolated and in many cases not compatible HIS. Taking as an example the European region, there are differences in HIS integration from Northern to Southern countries. In more detail, Denmark (high- and upper-middle income) is one of the world's leaders in: (a) primary care physicians that use Electronic Healthcare Record systems with a 95% implementation rate and (b) e-Prescriptions with a 100% of physicians using it (Bhagat *et al.*, 2010). On the contrary, Greece (lower-middle income) shows: (a) partial development of HIS, (b) small percentage of integration efforts between peripheral hospitals and (c) the importance of integrated and interoperable local IS (Greek Chapter of European Observatory., 2008). Thus, it is evident that inequalities between countries even in a common market exist and the need for integration of systems at regional level is essential.

¹ Where region is a vast area including two or more countries

At a *Global level*, the main stakeholder is WHO, with its initiatives not focusing directly on the integration of HIS, but assisting member states by providing basic integration requirements (e.g. legislation, coding, and guidelines). WHO provides guidance and advice to member states so as to draw up long-term strategic plans for the integration of healthcare services (World Health Organisation, 2006). In more detail, WHO has synthesized many valuable mechanisms, such as:

- The eHealth Standardization Coordination Group (eHSCG) a platform to promote stronger coordination amongst the key players in all technical areas of e-health standardization,
- The Health Metrics Network (HMN) to help Ministries of Health, stakeholders and partners improve global health by improving the availability and use of health information to advance evidence-based decision-making,
- The HMN Framework and Standards for Country Health Information Systems (HMN Framework) which defines the systems and standards needed at both national and global levels for HIS strengthening,
- The Global Observatory for eHealth (GOe), an initiative dedicated to the study of eHealth its evolution and impact on health in countries.

Furthermore, the same need for global healthcare service delivery led private organizations, such as, the Joint Commission International (JCI) and John Hopkins Medical International, to address the integration problem, JCI provides standards, training and processes in its credited partners (375 hospitals in 47 countries), thus keeping a uniform level of quality of care. In more detail, through JCI accreditation and certification, health care organisations have access to a variety of resources and services that connect them with the international community (JCI, 2012). Additionally, John Hopkins Medical International provides affiliations and strategic collaborations that provide services as remote medical second opinions (JohnHopkins, 2010). Both initiatives require high level of integration between HIS, to implement their functions. Thus, the need for accurate, fast and functional data exchange incorporating integrated infrastructure with interoperable service, led to the adoption of SOA in healthcare.

1.1.2 Service Oriented Architecture (SOA)

Previous approaches to systems integration (e.g. EAI) have been proved significant. Among other benefits, EAI supported organisations to automate their business processes, integrate their IT infrastructures and reduce data and applications' redundancy by withdrawing numerous IS (Kamal *et al.*, 2008). Reusability is another EAI benefit, but not much attention

was given on it. The reason for this was that the primary scope of EAI was to integrate and automate business processes and not to create reusable IT infrastructures. Nevertheless, reusability has been a critical success factor for the dissemination of EAI, as lower attention on it resulted in lower adoption rates. Thus, literature indicates that software reusability affects the adoption of integration technologies and EAI (Themistocleous and Mantzana, 2010). Another issue that led to low adoption rates was EAI governance. EAI is associated with enormous change, but only few organisations realized its impact and govern it in an appropriate way (Khoubati *et al.*, 2006b). In an attempt to address these limitations EAI evolved, transformed, extended and renamed to SOA. SOA extend EAI concepts to create reusable integrated IT infrastructures.

In order, to support reusability emphasis was given on breaking business processes into smaller blocks of functionality (e.g. services). These small blocks are automated through reusable web-services and linked together to build an integrated business process. In a SOA, software resources are a collection of services. These services are well defined, self-contained modules that provide standard business functionality and are independent of the state or context of other services (Papazoglou *et al.*, 2008). This new architectural paradigm is known as Service Oriented Architecture. According to Erl (2005) SOA is defined as:

“SOA represents an open, extensible, federated, composable architecture that promotes service-orientation and is comprised of autonomous, QoS [Quality-of-Service] capable, vendor diverse, interoperable, discoverable and potentially reusable services, implemented as Web-Services.”

Erl (2005) p.54.

In an attempt to overcome the second limitation of EAI and address issues of change and complexity, SOA proposes governance mechanisms. SOA Governance is defined by Marks (2008):

“SOA Governance is the definition, implementation and ongoing execution of an SOA stakeholder decision model and accountability framework that ensures an organisation is pursuing an appropriate SOA strategy aligned with business goals, and is executing that strategy in accordance with guidelines and constraints defined by a body of SOA principles and policies.”

Marks (2008) p.7

Despite numerous SOA projects have been implemented, the vast majority of organisations have not paid attention to SOA Governance, due to: (a) speed of change, (b) time pressure (c) scale of SOA project and (d) frequency of SOA project.

In more detail, organisations face pressures from stakeholders (competitors, shareholders and customers) to improve their IT infrastructures and adopt the SOA paradigm in a quick pace. As the time frame of the projects is restricted there is no time left to introduce the changes required and adapt organisation to SOA paradigm. Organisations focus their attention on the technical side of SOA in an attempt to deploy and use SOA faster than their competitors. Thus, the changes caused by this adoption is introduced rapidly and in many cases met with lack of the appropriate: (a) knowledge, (b) culture and (c) IT sophistication, parameters that can be addressed by SOA Governance (Baskerville *et al.*, 2005). In addition, organisations tend to start their SOA projects from small-size pilots and extend them. In small-size projects, the scale of change and IT solution is small, thus governance is not perceived as an issue (Schepers *et al.*, 2008). When the scale and frequency of SOA projects increases, complexity increases too. Large-scale SOA projects implicitly contribute towards system complexity (Niemann *et al.*, 2008). Complexity relates to further requirements i.e. more installations of interacting feedback processes, new roles and responsibilities, etc (Jeng and Lianjun, 2007). Thus, organisations usually realise the importance of governance mechanisms in a later stage when they try to overcome complexity issues.

Therefore, either organisations are aware of SOA Governance but they do not focus on it, or they decided not to include in their initial plans due to time constraints. Either way the result is the creation of IS with low levels of governance, which are difficult to adopt, extend and maintain. In the past, failures in the adoption of IT systems in healthcare, has caused human lives (Fitzgerald and Russo, 2005). Thus, the development and use of HIS requires thorough attention from researchers and practitioners, especially the governance issues.

The aforementioned need for SOA utilization led many researchers and practitioners to focus their interest on several aspects of SOA (Brown, 2007; Demirkan and Gouly, 2006; Franzen, 2008; Hareesh and Fethi, 2009). While the importance of governance is reflected in the views of many researchers and practitioners (Biske, 2008; Josuttis, 2007; Marks, 2008; Niemann *et al.*, 2008), there is still a small number of SOA applications in healthcare that has resulted in limited research in this area.

1.2 Research Aim and Objectives

1.2.1 Research Aim

The development of Service Oriented Architecture in healthcare organisations is a critical process, and governance issues (e.g. organisational, managerial, human etc.) need to be considered. Despite, the importance of SOA Governance only recently, SOA Governance models were proposed (e.g. (Bernhardt and Seese, 2009; Hojaji and Shirazi, 2010; Schepers *et al.*, 2008). Although, these models are helpful they are not designed for healthcare and do not adequately cover all healthcare SOA Governance aspects as healthcare is a unique sector with many differences from other industries (Beratarbide and Kelsey, 2011). Thus, SOA Governance in healthcare remains unexplained. The way that healthcare organisations take decisions differ from other type of organisations or enterprises (Khoubati *et al.*, 2006a). Frameworks and models that were not designed for healthcare cannot be adopted “as-is” in healthcare organizations (Yusof *et al.*, 2008). To the best of the researcher’s knowledge, at the time of this research, there is an absence of a dedicated SOA Governance model for healthcare organisations and (b) no study of the governance that such a model may apply in a healthcare organisation. In addition, not only there is not a wide accepted model for SOA Governance but also the existing models are contradicting and have many differences. Therefore, a documented study in healthcare organisations that investigates the aforementioned issues is needed. In doing so, the researcher suggests that *a better understanding of SOA Governance in healthcare is required.*

Hence, the aim of this dissertation is to:

“Study SOA Governance in healthcare organisations. In doing so, resulting in the development of a framework that can be used to support decision-making on SOA Governance issues”.

1.2.2 Research Objectives

Reflecting the research aim, below the research objectives are presented

Objective 1: To conduct a literature review in the area of SOA in healthcare with special interest in SOA Governance.

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

- Objective 3:** To study relevant models of SOA Governance. Therefore, it will develop a conceptual framework for SOA Governance. 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 SOA Governance.

1.3 Introduction to Research Methodology

To study the different aspects of SOA Governance in HIS, the qualitative research method was adopted. As it gives details, reasons and explanations why things are done in particular way, something that cannot be measured in statistics (Strauss and Corbin, 1998). The utilisation of SOA in HIS it is a relatively new research agenda and even more new is the attempt to introduce a SOA Governance Framework. Thus, the qualitative research method seems to be the appropriate approach to investigate and analyze in depth this little known phenomenon. Alongside, the underlined searching epistemology of this research is interpretational. This is suitable for the framework under research, due to the complex and interrelated nature of the proposed questions regarding SOA Governance.

Furthermore, the research will be based on an interpretivism stance which proposes that there are multiple realities, not single realities or phenomena, and these realities can differ across time and place. Therefore, there is no overarching framework for how qualitative research should be conducted but research is guided by particular philosophical stances that are taken in relation by the research to each phenomenon (Gall *et al.*, 2006). Hence, a multiple case study strategy will be employed to explore and understand the proposed SOA Governance Framework in a healthcare organisation. In doing so, various data collection methods such as interactive interviewing, documentation and observation will be used. The favouritism that participants may include is considered to be an unwanted parameter for the research approach and will be overcome by data triangulation.

1.4 Thesis Outline

The structure of this PhD thesis follows the methodology described by Phillips and Pugh (2010) and consists of four elements namely: (a) background theory; (b) focal theory; (c) data theory

and (d) novel contribution. Background theory focuses on discussing the case in point (see Chapter 1). Also, 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). In (Chapter 7), the author has summarised the research presented in this thesis with a brief outline of contributions and discusses the potential areas for further research. The thesis is composed of seven chapters with each of the chapters providing an understanding to various issues viewed to be critical for this research. The thesis outline is illustrated in Figure 1.2 and is explained in the following paragraphs.

Chapter 1: Introduction

Chapter 1 introduces the focal points of this thesis and explains the research issue. Accordingly, the need for eliminating medical errors that are produced due to inaccurate or incomplete information is presented, in conjunction with the need to integrate HIS. Moreover, the research aim and objectives are presented and the summary of thesis is explained and is demonstrated diagrammatically.

Chapter 2: Literature Review

In the second chapter, a review of the normative literature is provided. More specifically, the issues related to HIS integration and the challenges faced in the healthcare sector are explained. Additionally, SOA (benefits and Critical Success Factors) and SOA Governance are analysed and discussed. Furthermore, an analytical and critical review of the existing SOA Governance research (propositions, models, and elements) is identified and highlighted and propositions are made. Chapter 2, addresses the objectives 1 and 2, reported in Section 1.2.2.

Chapter 3: Conceptual Development – Focal Theory

Chapter 3 presents a conceptual framework for SOA Governance. The proposed framework can be used as a decision-making tool and thus, support management when taking decisions regarding SOA Governance. Additionally, the framework may be used by researchers and practitioners to analyse and understand SOA Governance in healthcare organisations. To this end, the frameworks elements (as these were derived from Chapter 2) are analysed, adding detailed definition and examples where relevant. This analysis provides insights and guidelines of the proposed framework's functionality. In addition, the associations of the elements are discussed and are positioned to form a unified proposition, as seen in Figure

3.14. Thus, achieving objective 3 of this dissertation, to propose a SOA Governance Framework, this may be used as a decision-making tool by healthcare organisations.

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 researcher 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. Additionally 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

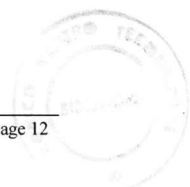
In Chapter 5, the researcher provides a detailed description of the case studies (PHOrg and HGr) carried out to test the conceptual SOA Governance Framework. In doing this, the following information for each case study is presented: (a) the background to the healthcare system and healthcare organisation, (b) healthcare organisation's integration problems, (c) the SOA involvement of the case 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 1.2.2.

Chapter 6: Revisions to Conceptual Method SOA Governance Framework for Healthcare Organisations - Novel Contribution

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 SOA Governance Framework in healthcare organisations. The revised framework is presented in Figure 6.2. This proposition 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 1.2.2.



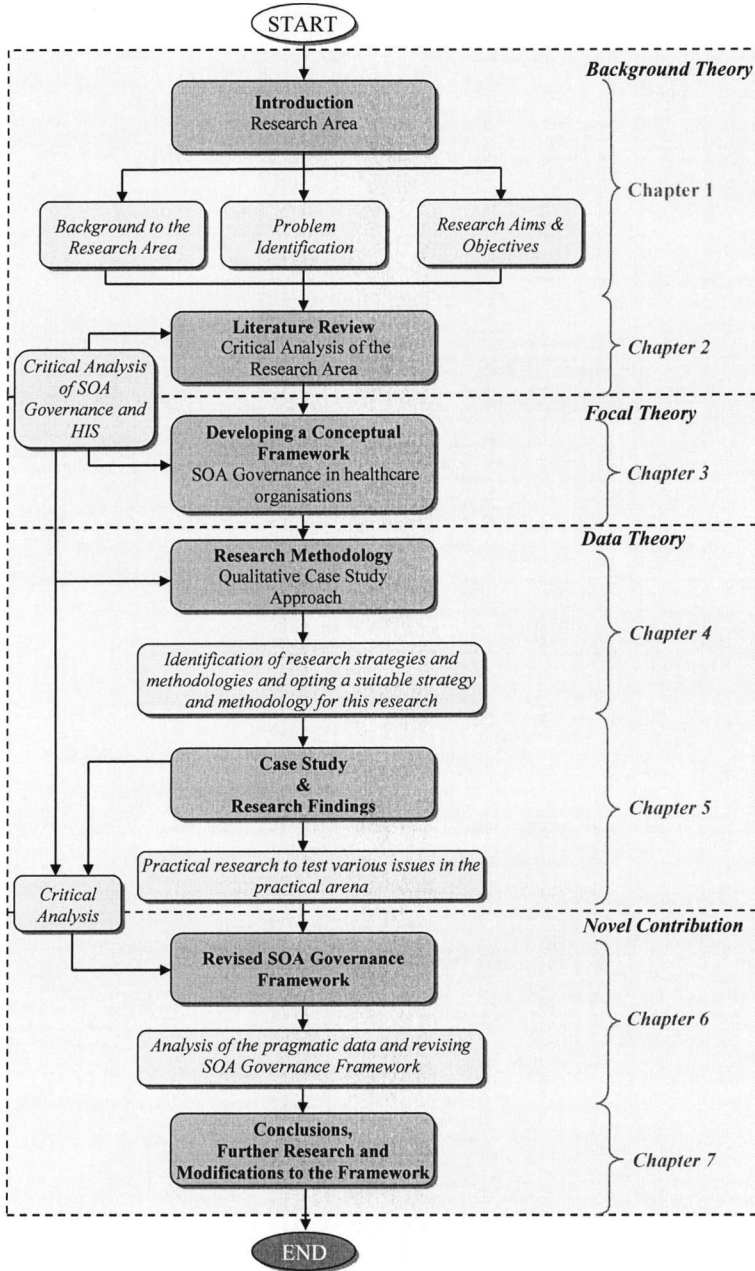


Figure 1.2: Thesis Outline

CHAPTER 2

LITERATURE REVIEW

Summary

The previous chapter introduced the research problem, the aim, the objectives and the structure of this thesis. This chapter moves a step forward and critically reviews the literature on Healthcare Information Systems (HIS) and Service Oriented Architecture (SOA). In doing so, SOA implementation benefits and Critical Success Factors (CSFs) are presented and analysed. Governance is considered as a top CSF and studied, alongside with relevant SOA Governance approaches, frameworks and models. The chapter closes by identifying research gaps and issues for further investigation, like the focal concepts required to structure a comprehensive SOA Governance framework in healthcare. These issues will be investigated in Chapter 3.

2.1 Introduction

As reported in Chapter 1, the integration of HIS is a key issue for healthcare organisations, as the non-integrated HIS are associated with medical errors that cost human lives and hold back the provision of healthcare services on a global scale.

In the past, numerous attempts have been employed to address healthcare integration issues (as seen in ANNEX I) and among others focused on the adoption of Enterprise Application Integration. The normative literature demonstrates that valuable lessons learnt from EAI application and supported organisations integrating their IT infrastructures (Khoubati *et al.*, 2007; Lam, 2005). In more detail, EAI provided valuable lessons in the development of integration mechanisms such as: (a) the separation of business processes from business applications and (b) the integration of business processes instead of business applications (Khoubati *et al.*, 2007; Marks and Bell, 2006). Despite its significant role, EAI has its own limitations too. Among others, EAI is associated with: (a) high cost, (b) resistance to change, (c) organisational issues, (d) high complexity, (e) large scale of change, (f) time consuming implementation and (g) politics. Themistocleous and Mantzana (2010) investigated these issues and reported that they relate to governance and have a negative impact on EAI adoption. Clearly, Themistocleous and Mantzana (2010) suggested that IT Governance is a significant factor that influences the adoption of an integration technology like EAI and SOA (Themistocleous and Mantzana, 2010). Consequently, better governance leads to higher adoption rates and there is therefore a need to improve governance to increase adoption rates and achieve better results.

During the last decade EAI has evolved and it is now available under the term Service Oriented Architecture. Although, SOA pays greater attention to governance than EAI, the majority of organisations do not emphasise on SOA Governance (as explained in Section 1.1.2). Instead, emphasis is placed on the technical aspects of SOA by practitioners and academics (as it is analysed in Section 2.3). While SOA's building blocks extend beyond technological elements to governance issues it is important to gain a wider understanding of the technical and non-technical aspects of SOA (Bieberstein *et al.*, 2005). In a recent research 41% of SOA users stated that SOA has delivered less benefit than expected, and another 17% states that they are struggling enough with SOA and will not expand the SOA use (Heffner, 2009). These statistics indicate that almost half the companies that utilise SOA have not figured out how to benefit from their projects. This is attributed to unclear or weak governance planning (Stephens, 2008).

This chapter critically reviews the literature and focuses on the aforementioned issues (e.g. HIS challenges, SOA and SOA Governance). In order, to aid in the discussion, a progressive in nature, literature review approach is followed for each issue. This is based on the perception that issues like HIS are adequately addressed in literature, whereas SOA Governance is a new research field that requires rigour and thorough examination. Thus, as it will be explained in the following paragraphs, each part of this chapter is written with specific intentions and thus the researcher employs different literature review methodologies accordingly. This progressive approach gradually familiarizes the reader with the topic, and increasingly builds on his/her knowledge, as it is the intention of this Thesis to correspond to a wide audience of IT/Healthcare professionals, developers and researchers. In the following paragraphs, more details of the contents of each part are given.

HIS challenges - For this part the researcher applies general literature review methods (available on-line databases/libraries, books, articles etc.) as the topics at hand require a descriptive and in some cases chronological presentation of established general information. Thus, the reader gains basic background information that is needed to set the foundation of this thesis.

SOA (benefits and Critical Success Factors) - For this part the researcher investigates various databases (Google scholar, IEEE Xplore, AISel and Science Direct) with specific search parameters (keywords, title etc.) and applies a direct content analysis to gather the appropriate material (research/white papers, reports, conference proceedings etc.) These are reviewed, analysed and presented as a detailed literature review analysis, which concludes with the importance of SOA Governance. In doing so, the reader familiarizes with the main issues addressed in this thesis and their interplay.

SOA Governance - As SOA Governance is a new research issue, a rigorous and detailed literature review is employed, following established methodology and literature research planning. Thus, the reader gets insights of the SOA Governance research field and familiarises with the research arguments.

In doing so, Section 2.2 presents the normative literature on HIS challenges, with Section 2.3 examining issues related to Service Oriented Architecture. The benefits and Critical Success Factors of SOA implementation are reviewed and analysed in Section 2.4. The chapter closes with Section 2.5 examining and analysing the research conducted in SOA Governance and Section 2.6 presents the conclusions.

2.2 Healthcare Information Systems: Challenges

Despite Healthcare Information Systems benefits (e.g. improve patient safety, work efficiency, resource allocation and quality of care (Buntin *et al.*, 2011; Ludwick and Doucette, 2009)) healthcare systems have challenges that can result in failure (Heeks, 2002). In the past, HIS failures have caused the death of patients (e.g. London Ambulance Service Computer-Aided Dispatch) (Avison and Young, 2007). Thus, as HIS are a crucial parameter for patients care and safety, it is important to investigate and identify the challenges surrounding such implementations.

The previous chapter exposed two key challenges that constitute the need for integrated HIS: (a) medical errors and (b) global provision of healthcare. This section extends the focus and summarises how HIS challenges are transformed to motivations to employ the SOA paradigm. To this end, the researcher reviews the normative literature and identifies the challenges faced by HIS. The potential and current challenges are categorised into four main categories, such as: (a) complexity, (b) globalization, (c) integration and (d) medical errors. These challenges are summarised in Table 2.1, where the challenge, its description and the way they affect HIS are presented. The rest of this section includes an analysis of the challenges.

Challenge	Description	HIS Current Challenges
Complexity	Healthcare is a complex system, with many different stakeholders, and unique parameters as each disease entity occurs in a unique individual who experiences it in his/her unique personal way in his/her unique social context (Miles, 2009).	Multiple actors – healthcare services are complex, controlled by several actors with different interests, and in many cases part of a non-integrated system, while the need is placed on augmenting the actors, connecting them and introducing new ones (e.g. patient) (Mantzana <i>et al.</i> , 2007). Complex process - healthcare tasks are distributed between several actors (physicians, nurses, residents, and other clinical support staff) and artefacts (information technology, machines, paper notes) and thus difficult to govern (Kannampallil <i>et al.</i> , 2011).
Globalization	In recent decades significant parameters encouraged the cross border movement of patients and drove healthcare services to be able to facilitate new global opportunities and applications (Lunt <i>et al.</i> , 2011).	Patient mobility - new challenges in healthcare such as patient mobility, medical tourism, cross boarder and global healthcare emerged (Connell, 2006). Interoperability – requirements of new capabilities to share and process information across systems, regardless of their implementation structure (language and platform) (Zhang <i>et al.</i> , 2007). Security – many security challenges need to be addressed like data privacy, confidentiality, access control etc. (Smith <i>et al.</i> , 2010).
Integration	Integration in healthcare is a concept bringing together inputs, delivery, management and organisation of services related to diagnosis, treatment, care, and health promotion (WHO, 2008).	Integrated care – surgery rooms, patients' wards, medical labs all use different devices for performing tests, monitoring patients and performing tasks. All these devices need specific vendor based interfaces to communicate with a HIS. These interfaces implement vendor specific protocols and much often there is a lack of integration amongst them or an increased cost to integrate them (Rhoads <i>et al.</i> , 2010). Patient centred - there is an increasing need to redesign and integrate existing HIS in such a way to focus on patients (Leventhal <i>et al.</i> , 2012). Patient empowerment - in a technological respect the empowerment happens through information-sharing, offering the patients a visual overview of their course of treatment, letting the patients take their own measurements, and letting them provide verbal and written inputs (Clemensen <i>et al.</i> , 2011). m-health – the rapid expansion of mobile devices has led the increased use of m-health applications (Chatterjee <i>et al.</i> , 2009; Kitsiou <i>et al.</i> , 2006).
Medical Errors	IS can make important fundamental contributions toward the minimisation of medical errors through improving access to information, reducing reliance on memory, increasing vigilance, and standardisation of processes (Kilbridge and Classen, 2008).	Training – is linked with the quality management passed on to hospital staff and the automation of control systems, in reducing interpretative medical errors (Ravi <i>et al.</i> , 2011). Task characteristics - complexity and time increased (Franklin <i>et al.</i> , 2007). Testing – In order to minimise security and continuity risks, the healthcare organisations installed controls to analyse the impact on the infrastructure before its implementation (Beratarbide and Kelsey, 2011). This duplication of systems (as in healthcare many systems run in parallel during testing) increases maintenance and support costs and reduces the agility to change.

Table 2.1: HIS Challenges

Complexity – Healthcare sector can be characterised as a complex multilayered one. The outer layer can be represented by healthcare organisations that constantly interact with each other, but differentiate amongst them. The differentiation can be noted in issues, such as: (a)

medical specialisations, (b) socio-technical and Information Technology capacities, (c) organisational cultures, (d) structures, (e) actors and (f) business process (Finnegan and Hamid, 2009). More precisely, healthcare tasks are distributed between several actors (physicians, nurses, residents, and other clinical support staff) and artefacts (information technology, healthcare specific machines, paper notes) (Kannampallil *et al.*, 2011). In healthcare, these tasks' distribution is addressed by the redesign automation and integration of business processes (Firat *et al.*, 2008). Therefore, sophisticated practices are required to aid in this redesign. In this respect, Business Process Management (BPM) techniques and tools in parallel with SOA are employed to aligns business processes (based on patient needs) to end-to-end integration (Koufi *et al.*, 2010; Strnadl, 2007).

Nevertheless, these healthcare processes in many cases include complex and non-integrated services that are controlled by several actors with different interests, thus with an increased level of complexity (Mantzana *et al.*, 2007). In addition, complexity is present in the inner layer of healthcare organisations, the everyday clinical functionality. This is distinctive to healthcare, as the interaction amongst healthcare professionals require a great degree of person-to-person contact for collaborative diagnosis, treatment assessment, planning, and decision making (Avison and Young, 2007). In more detail, Miles (2009) views healthcare as a complex system in which each disease entity occurs in a unique individual who experiences it in his/her unique personal way in his/her unique social context (Miles, 2009). To overcome this unique characteristic, healthcare organisations try to adapt and provide HIS centred to patient needs. In a patient-centred setting patients are encouraged to be actively involved in their care, within a physical environment that promotes patient comfort and staff who are dedicated to meet the physical, emotional, and spiritual needs of patients (Charmel and Frampton, 2008). Thus, the challenge to redesign existing HIS towards a more patient-centred way is observed (Leventhal *et al.*, 2012).

SOA can facilitate the redesign of HIS towards a patient centred design including support for the end user (e.g. patient) (Chang *et al.*, 2006; Lizcano *et al.*, 2009). However, as the number of web services grows, the SOA solution is not immune to complexity. To resolve this, literature indicates the use of an adequate SOA metrics systems that can measure design-time and run-time services and predict unwanted levels of complexity (Hirzalla *et al.*, 2009). The design, implementation, management and operation of SOA metrics, is placed on SOA Governance (Hojaji and Shirazi, 2010a). Therefore, a SOA Governance framework is required to support the SOA/HIS endeavours.

Globalisation – During the last decade, medical data and services are shared at global level (Watson, 2010). Many patients tend to travel and use healthcare services provided by organisations other than their country of residence, due to: (a) long waiting lists, (b) high cost of healthcare services, (c) specialized treatment (d) fewer barriers to travel and (e) EU regulations (Horowitz *et al.*, 2007).

Thus, new challenges in healthcare such as patient mobility, medical tourism, cross boarder and global healthcare emerged to describe this phenomenon (Connell, 2006). At international level, the facilitation of foreign patients is an industry sustained by millions of individuals (617 millions in 2006) with an annual growth of 3.9% and worth US\$513 billions (Percivil and Bridges, 2006). Furthermore, a recent report sets the amount of worldwide medical tourists up to 50 million each year (Lunt *et al.*, 2011). In order to support this growing demand, interoperability is required in-between countries, government bodies and healthcare organisations (Goene *et al.*, 2009).

Interoperability can be seen as the capability to share and process information across systems (Zhang *et al.*, 2007). At HIS, interoperability is a challenging effort, as it is linked with a variety of both technical and organisational issues, such as the diversity of applications and systems across departments and the different attitudes and perceptions between stakeholders (Daskalakis and Mantas, 2009). Also this challenge is augmented, as healthcare organisations invest in integration technologies to overcome interoperability issues, but in many cases point-to-point inter-connectivity bridges solutions, in an outdated and not managedeable way (Blanton *et al.*, 2009). Point-to-point interconnectivity has not sufficiently solved the problem but amplified the need for the adoption of more advanced integration paradigms like SOA (Themistocleous and Mantzana, 2010).

Nevertheless providing interoperability and availability of data contains threats as well. As HIS are integrated to form expanding eco-systems of interrelated HIS, the main challenge is to protect the medical data transmitted through them and to secure patient confidentiality. Despite the sophistication of HIS a large amount of data¹ transmitted without permission arise from hospitals (Smith *et al.*, 2010). This phenomenon can have consequences for healthcare providers, financial risks to healthcare organisations and medical risks to patients. These consequences could include privacy violations, medical fraud, financial identity theft, and medical identity theft (Johnson, 2009). A recent report (2010) states that compromised databases of healthcare organisations are increasing, with 119 violations compared to 39

¹ Also known as Data Leakages

suffered by the financial services industry (ITRC, 2010). This increase raises security concerns for medical data integration and sharing across HIS. Data security and patients' confidentiality from the healthcare sector are clearly a significant challenge to providers, payers, and patients (Johnson, 2009). A healthcare specific SOA Governance framework can take this issue into consideration and help practitioners and health organisations to produce guidelines and procedures that can improve their HIS security.

Integration – Healthcare organisations, surgery rooms, patients' wards, medical labs all use different devices and machines for performing tests, monitoring patients and completing tasks. All these devices need specific vendor based interfaces to communicate with computers. These interfaces are implemented based on specific protocols and much often there is a lack of integration amongst them or an increased cost to integrate them (Rhoads *et al.*, 2010). In order to contribute to this challenge independent organisations like Integrating the Healthcare Enterprise (IHE) provide standards (e.g. HL7, DICOM, etc.) to enhance the interoperability and information sharing (IHE, 2012).

An enabler of these standards is the SOA paradigm. An example of this is the recognised Healthcare Services Specification Program (HSSP) program, which is a collaborative effort between standards groups HL7 and OMG to address interoperability challenges within the healthcare sector, operating on SOA (HSSP, 2013). Additionally, HSSP's working groups emphasise on the need of an effective SOA Governance model, which they portray as a critical dimension to SOA implementations, as it becomes the guidance, the oversight, the enforcement, and ultimately the compliance mechanism needed for SOA (HL7/OMG, 2010).

Except integrating devices with HIS, HIS integration has been associated with various aspects, amongst others: strategic, social, and/or organisational (Finnegan and Hamid, 2009). In this respect, there is a common trend to address HIS integration by an overall approach, seen as integrated patient centred care (Leventhal *et al.*, 2012). Integrated patient centred care reflects on integrated HIS (with elements as e-health services) requiring coordination across professionals, facilities, support systems that is continuous over time and between patient visits (Singer *et al.*, 2011). This approach is observed on national healthcare strategies that encourage patient involvement in their healthcare treatment. Moreover, in the USA and Europe, online personal health records that allow patients to manage their health data have emerged (Pagliari, 2011). For example in Finland, this integration trend can be observed in a legislation that allows citizens to access and interact with their own Electronic Healthcare Records (EHRs), ePrescriptions and audit-logs via the Internet (Ruotsalainen *et al.*, 2008). Following similar legislative opportunities worldwide, patients increase their involvement

with HIS. This is a growing involvement, seen in parallel with the availability of mobile health applications.

Mobile technologies and especially smart phones support patients and professionals to interact with integrated EHR and other e-health applications. This is an emerging area of e-health, given the term m-health (Chatterjee *et al.*, 2009). According to Sarasohn-Kan (2010), a major mobile application vendor provides 5,805 health, medical and fitness applications with 73% of them used by patients and 27% by healthcare professionals (Sarasohn-Kahn, 2010). The aforementioned approaches empower the patients and allows them to take their own measurements, and provide verbal and written inputs (Clemensen *et al.*, 2011). Many of these applications are based on SOA as HIS can be easily delivered to both desktop and mobile computer devices using for instance Java and Visual Studio development environments. Based on the same paradigm (SOA based) HIS can be exposed and run over cloud (in the form of SaaS) (Poulymenopoulou *et al.*, 2012). Clearly except the introduction of standards (e.g. HL7) all these endeavours require adequate healthcare specific SOA Governance to be developed and run in a manageable way.

Medical errors - Healthcare requires consistent and accurate medical information exchange, a process directly linked to patients' treatment (e.g. allergies alert, patient's history, medical conditions) (Vest and Gamm, 2010). Despite the efforts made to improve the quality and exchange of medical information, it has been estimated that 5% of hospital admissions experience adverse errors with 30% of them causing consequential harm (Wachter, 2008). Medical errors, as reported in the USA's Healthcare reform plan are responsible for the death up to 98.000 people per year (US Department of Health., 2010). In addition to this, medical errors that occur through the non-integrated HIS are estimated to have resulted in the loss of more than 23.000 persons per year in the United Kingdom (Khoubati *et al.*, 2006b). Most of these errors are preventable with 44% of them classified by Kohn and Corrigan (2000) as technical errors, 17% diagnosis, 12% failure to prevent injury and 10% errors in the use of a drug. Many organisations suggested the elimination of medical errors.

In this respect, the European Consumers Organisation (2007) proposed a medical error minimisation plan, where it suggests the use of advanced integration technologies (Blumenta, 2009). IS integration can play a vital role in the enhancement of medical data quality and the reduction of medical errors (Chiasson *et al.*, 2007). Despite the advantageous effect on medical error reduction the introduction of integrated HIS can have, new reports suggest that training the employees is also a critical parameter in reducing interpretative medical errors (Ravi *et al.*, 2011). This reveals that implementing a new technology, or adopting a new

architectural paradigm as SOA is not enough to reduce medical errors. A closer fit of IT and human factors like training and education is needed (Yusof *et al.*, 2008). SOA Governance deals with these issues and implements specific processes designed to educate, communicate and enable the IS integration, with the stakeholders being part of it (Biske, 2008).

In addition, further reports argue that IS for medical error reduction increased task complexity and completion time, as the new process requires alterations to the custom process followed until then (Franklin *et al.*, 2007). In an attempt to minimise security and continuity risks, the healthcare organisations installed controls in place to analyse the impact on the infrastructure before its implemented (Beratarbide and Kelsey, 2011). This duplication of systems (as in healthcare many systems run in parallel during testing) increases maintenance and support costs and reduces the agility to change. These arguments further justify the need for governance, as only a conceptual governance model can anticipate such parameters (e.g. complexity and testing) and address them accordingly.

To sum up, SOA can facilitate the plan to redesign HIS towards patient-centred systems in parallel to end-to-end integration (Bhandari and Snowdon, 2011; Leventhal *et al.*, 2012; Papakonstantinou *et al.*, 2010). Moreover, Business Process Management (BPM) techniques and tools bridges SOA and aligns business processes (based on patient needs) to end-to-end integration (Koufi *et al.*, 2010; Strnadl, 2007). Thus, SOA can transform heterogeneous and incompatible systems in a patient-centred environment of cooperating services based on healthcare business processes and services (Bhandari and Snowdon, 2011). SOA can be directly associated with patient centred design, as sub-categories of SOA like User-Centred SOA (UCSOA) can facilitate the redesign of HIS towards a patient centred design including support for the end user (e.g. patient) (Chang *et al.*, 2006; Lizcano *et al.*, 2009). Furthermore, SOA can assist in the m-health endeavours by providing interoperable services, support diverse processing efficiently, enable cross-platform communication and adapt dynamically to meet changing needs (Firat *et al.*, 2008; Themistocleous *et al.*, 2012). In addition to this, SOA interoperability can be seen as a way to minimise medical errors, by providing data exchange accurately, effectively, securely and consistently (Mantzana *et al.*, 2011).

The value of SOA can be realised from a management point of view, when SOA incorporates a well-developed SOA Governance framework (Biske, 2008). This way SOA Governance ensures an organisation is (a) pursuing an appropriate SOA strategy aligned with business goals, and (b) is executing that strategy in accordance with guidelines and constraints defined by a body of SOA principles and policies (Marks, 2008). By focusing on SOA Governance

healthcare organisations can better address issues like complexity, security, standards, education/training and even provide the backbone for more capabilities like cloud computing.

In the following sections the researcher reviews and critically analyses the normative literature on SOA.

2.3 Service Oriented Architecture (SOA)

The evolution of integration technologies started in the 1960s with the growth of Information Technology and its correlation with the business domain (Brown, 2008). Enterprise Application Integration (EAI) as an umbrella of various technologies was not introduced until the late 1990s. EAI emerged to piece together inter- and intra-organisational systems and to combine a variety of integration technologies such as web services, message and process brokers (Juneja *et al.*, 2007). It aims at building an integration infrastructure by bridging existing heterogeneous and incompatible applications. EAI refers to the integration of existing Information Systems rather than the development of new and affects multiple IS and users in organisations (William *et al.*, 2001).

During the last decade EAI has evolved and it is now available under the term Service Oriented Architecture. This change was introduced to support reusability and simplify systems integration. Thus, emphasis was given on breaking business processes into smaller blocks of functionality (e.g. services) that could be reused. These small blocks are automated through reusable web-services and linked together to build an integrated business process. In an SOA, software resources are a collection of services. These services are well defined, self-contained modules that provide standard business functionality and are independent of the state or context of other services (Papazoglou *et al.*, 2008). According to Erl (2005) SOA is defined as:

“An open, extensible, federated, composable architecture that promotes service-orientation and is comprised of autonomous, QoS [Quality-of-Service] capable, vendor diverse, interoperable, discoverable and potentially reusable services, implemented as Web-Services”

Erl (2005, p.54)

SOA provides a framework for an infrastructure to facilitate the interactions and communications between services (Papazoglou and Van den Heuvel, 2007) and it is an architectural paradigm or a style of design (Josuttis, 2007; Marks, 2008). In other words SOA

is a way of thinking about building software. In recent years, SOA is becoming the de-facto approach to bridging the gap between business models and software infrastructure and flexibly, supporting changing business needs (Marks and Bell, 2006).

In the following paragraphs, the researcher attempts to enhance the understanding of SOA, by reviewing both the technical (ESB, Web-services), and business perspectives related to it.

The increasing adoption of SOA is supported by both the technical and the business community. From a technical perspective, SOA is an approach to develop software placing reusability as a priority, as well as clearly defined interfaces. A service infrastructure enables discovery, composition and invocation of services, thus applications are built using functionality from available services. From a business perspective, SOA is a way of providing availability of legacy functionality to remote clients, implementing new business process models by utilising existing or third-party software assets thus minimising the IT costs, implementation time and increasing innovation through IT investments (Marks, 2008).

SOA puts services into a framework that, independent of the underlying technologies, requires service providers to advertise their services with associated Service Level Agreements (SLAs) in registries that can be discovered, accessed, and used by clients. It is essentially a distributed system framework that stresses that all services have a network-addressable interface (easily locatable) and communicate via standard protocols and called messages (Hareh and Fethi, 2009). This helps resources advertise their capabilities through standard interfaces defined as part of their service definitions. There are three kinds of participants in a service-based architecture as seen in Figure 2.1, service providers, service requesters or clients, and the discovery agencies (e.g. registry) that help clients find services based on published criteria (Huhns and Singh, 2005).

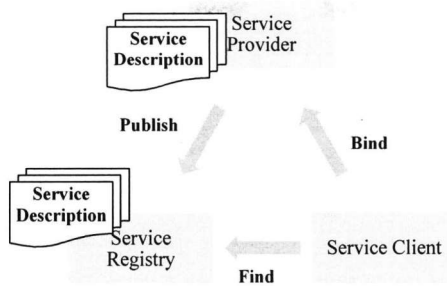


Figure 2.1: SOA Participants [Source: Papazoglou (2008)]

Service providers publish their service descriptions and register them in one or more service registries or discovery agencies well-known across the network (Papazoglou and Van den Heuvel, 2007). These registries are the equivalent of directories for business applications, allowing businesses to publish their array of services, and allowing clients to search for available services and programmatically invoke them (Papazoglou, 2008). This service description includes a listing of its attributes - its capabilities, its location, and its interface requirements among others. Service requesters query the registry using a wide variety of search criteria, including category-based searches, to find the service they need. Having identified the service, determined the interface requirements (port, protocol, and data format) and location (IP address or URL) of the service (after they discover the service they bind to the service to invoke it). This process flow of publish-discover-bind forms the basic service management capabilities of an SOA (Papazoglou *et al.*, 2007). The services in the SOA are required to be technology neutral, loosely coupled (not tightly integrated into the requester's process), and support location transparency. Thus, SOAs are essentially complex distributed computing frameworks compared to the traditional client-server approach and they require a functionality-rich supporting middleware infrastructure.

The infrastructure that supports SOA is often seen as an integration solution based on open standards that supports SOA, but it is responsible for refactoring, wrapping or replacing legacy applications with new standards-aware equivalents (Menge, 2006). This middleware infrastructure is referred to as an Enterprise Service Bus (ESB).

2.3.1 Enterprise Service Bus

The Enterprise Service Bus enables an SOA by providing the connectivity layer between services (Schmidt *et al.*, 2005). An ESB can be seen as a hub for integrating different kinds of services through messaging, event handling, and business performance management (Luo *et*

al., 2005). Thus, to reliably connect and coordinate the interaction of a significant number of diverse applications across extended enterprises with transactional integrity an ESB is required (Chapell, 2004). According to Rosen (2008) ESB is defined as:

“An ESB is an enterprise-wide extendable middleware infrastructure providing Virtualization and management of service interactions, including support for the communication, mediation, transformation, and integration technologies required by services”
Rosen *et al.*, (2008, p.345)

In more detail, the ESB virtualises the services that are made available through the bus. The service requestor, (application logic or deployment) it is not necessary to have any knowledge of the physical realisation of the service provider. Thus, the programming language, runtime environment, hardware platform or network address is not a concern to the requestor. The requestor connects to the bus, which takes responsibility for delivering its requests to a service provider, offering the required function and the quality of service. The flexibility that comes from a SOA, and the virtualisation it implies, is fully realised by the dynamic nature of the ESB (Schmidt *et al.*, 2005). All the meta-data, conditions, and constraints used to enable a connection from a requestor to a provider can be discovered, used, and modified at runtime. A service requestor might select a reduced level of assured delivery and see an improved level of performance as the ESB determines that it can use a different delivery protocol. This flexibility is available as a direct consequence of the role of the ESB registry.

Also, the ESB plays the role of a mediator, which leads to loosely coupled infrastructure, thus is able to deal with dynamic modifications (Josuttis, 2007). The ESB accepts requests as messages and meditates on them, as they flow through the bus. Mediations can be an integral part of the ESB, providing, or routing a message to an alternate provider if response times fall below an acceptable value (Schmidt *et al.*, 2005).

A basic architecture of an ESB usually contains elements, such as: (a) distributed ESB engine (run-time engine), (b) distributed ESB infrastructure services (service location/routing directory, transactional support, mediation, specialized engines, monitoring, service security support), (c) run-time configuration and (d) centralized administration and control (Rosen *et al.*, 2008). Thus, the main functionality of the ESB is to bridge Web-Services (WS).

2.3.2 Web-Services

A WS is a software function or application provided at a network address over the web or the cloud. Papazoglou (2007), describes web-services as:

“A platform-independent, loosely coupled, self-contained, programmable Web-enabled application that can be described, published, discovered, coordinated and configured using XML artefacts (open standards) for the purpose of developing distributed interoperable applications”

Papazoglou (2007, p.11)

There are two kinds of WS: (a) atomic and (b) composite (Douglas and Dick, 2013). An atomic service is a well-defined, self-contained function that does not depend on the context or state of other services. A composite service is an assembly of atomic or other composite services. A service within a composite service may depend on the context or state of another service that is also within the composite service. The aforementioned web services are designed to perform functions, ranging from simple requests to complicated business processes. In this way, services allow organisations to expose their core competencies programmatically over a network (internet or intranet) using standard (XML-based) languages and protocols, and to implement these via a self-describing interface based on open standards.

A web-service implementation depends on technologies often organised in a layered stack. The architecture of a web-services stack varies from one organisation to another, yet the researcher presents a comprehensive representation depicted in Figure 2.2. The implementation itself defines a standard protocol for each technology layer, with each layer depending on the layers appearing below it in the stack. Therefore, beginning at the bottom of the stack, the **Transport layer** defines the technology standards for communication, allowing information to move across the network. HTTP, JMS and SMTP are often used as the standard for the transport layer. Further up the **Message layer** rests on top of the Transport and defines the standards for structuring information for transport across the network. The Simple Object Access Protocol (SOAP) format is commonly used, which offers an XML structure for packaging the data.

There are many implementations in which WS are not based on SOAP but on Representational State Transfer (REST). REST is a lightweight alternative to SOAP web-services that use a set of design criteria to access an architecture. The idea is that, rather than using complex and heavy mechanisms such as SOAP to connect between machines, simple HTTP are used to make calls between machines (in many ways, the World Wide Web itself, based on HTTP, can be viewed as a REST-based architecture) (Pautasso *et al.*, 2008). In the past REST was used to build only simple, public services, but more recently is gaining equal consideration (e.g. with SOAP web-services) from enterprises, tools vendors, and the research community (Adamczyk *et al.*, 2011).

Moving on top of the Message layer, the **Description layer** is placed. The purpose of this layer is to define the public interface of a specific web service. Currently, service description is realised through the Web Service Description Language (WSDL) which is based on XML.

Further up the stack, at the **Discovery layer** the Universal Description Discovery and Integration (UDDI) offers a registry service that allows advertisement and discovery of web-services (Qi *et al.*, 2008). Except the aforementioned layers, a significant requirement for a SOA is to provide a variety of Quality of Services (QoS), such as security, transportation, coordination, reliability and context elements (Papazoglou, 2008). These form the **QoS layer**, that is subjective to each organisation specifications and requirements, thus it may differ in-between organisation. At the top most layers of the stack the orchestration and choreography are placed, forming the **Business Process layer**. Web-service choreography describes collaboration protocols of cooperating web-service participants from a global view. Symbolising a dance each participant in a service choreography executes its part of it (i.e. its *role*) according to the behavior of the other participants. A choreography's role specifies the expected messaging behavior of the participants that will play it in terms of the sequencing and timing of the messages that they can consume and produce. Whereas, WS orchestration refers to WS descriptions which take a local view. Precisely, an orchestration describes collaboration of the web-services in predefined patterns based on local decision about their interaction with one another at the message/execution level (Sun *et al.*, 2010). Orchestration symbolises a central control, aiming at aligning the business request with the applications, data and infrastructure. Additionally, their purpose is to integrate the business process using programming languages like Business Process Execution Language (BPEL).

Management/Governance	Choreography			Business Process
	Orchestration			
	Web Services Reliability	Web Services Security	Transactions	Quality of Services
			Coordination	
			Context	
	UDDI			Discovery
	WSDL			Description
	SOAP		REST	Message
	XML			
	HTTP, JMS, SMTP			Transport

Figure 2.2: Web-Services Technology Stack [Adapted from Papazoglou (2008, p.33)]

Literature indicates that all these technical aspects presented in Figure 2.2, require a good supporting plan to handle them. Papazoglou (2008) refers to that plan as WS-Management, whereas Themistocleous and Mantzana (2010) emphasise that SOA Governance is needed to manage the technical aspects of web-services. The same concerns are raised for REST web-services as the state of practice still shows gaps in understanding and applying the theory behind REST, thus indicating that the process is not complete, with issues of scalability, management and security still being a concern (Adamczyk *et al.*, 2011). These issues are the subject of SOA Governance planning.

Therefore the incorporation of standards, protocols, well-defined programming, new and old architectural styles is not enough to manage and control the SOA environment. In this respect, organisations incorporating SOA solutions are required to focus on SOA Governance to gain the full benefits of their endeavours.

2.4 Service Oriented Architecture: Benefits and Critical Success Factors

Literature flourishes with perceptions of potential generic SOA benefits but many organisations still struggle to evaluate the benefits of such SOA application (Marks, 2008; Mueller *et al.*, 2010; Yoon and Carter, 2007). According to Abelein *et al.*, (2009) and Nasr *et al.*, (2011) this deviation between the theory and practice might be attributed to issues, such as: (a) multiple perspectives required to comprehend the SOA impact, (b) difficulty to measure SOA and (c) insufficient empirical evidence to validate beneficial indications. Additionally, to the best of the researcher's knowledge there is a lack of focus on SOA benefits in healthcare. For this reason the researcher reviews the literature on SOA benefits, in order to list SOA benefits and improve the level of understanding.

2.4.1 Service Oriented Architecture: Benefits

As a starting point the researcher undertook a review of the normative literature and adopted the Shang and Seddon (2000b) categorisation to depict the SOA benefits. This categorisation was chosen as this model has been widely used to provide a distinctive view of integration technologies (Hsin, 2006; Khoubati *et al.*, 2006b; Themistocleous *et al.*, 2001). According to Shang and Seddon (2000b) the benefits can be categorised into: (a) operational, (b) managerial, (c) strategic, (d) IT infrastructure and (e) organisational. The Shang and Seddon (2000b) classification is presented in Table 2.2, where the first column reports the benefits' dimensions and the second column illustrates examples for each category.

Benefits Dimensions	Benefits Examples
Operational	<ul style="list-style-type: none"> • Cost reduction • Cycle time reduction • Productivity improvement • Quality improvement • Customer services improvement
Managerial	<ul style="list-style-type: none"> • Better resource management • Improved decision making and planning • Performance improvement
Strategic	<ul style="list-style-type: none"> • Support business growth • Support business alliance • Build business innovations • Build cost leadership • Generate product differentiation (including customisation) • Build external linkages (customers and suppliers)
IT Infrastructure	<ul style="list-style-type: none"> • Build business flexibility for current and future changes • Information Technology (IT) costs reduction • Increased IT infrastructure capability
Organisational	<ul style="list-style-type: none"> • Support organisational changes • Facilitate business learning • Empowerment • Build common visions

Table 2.2: Categorisation of Benefits [Source: Shang and Seddon (2000b)]

Furthermore, the researcher searched various databases, such as: (a) Google scholar, (b) IEEE Xplore, (c) AISEL and (d) Science Direct, using the term “SOA benefits” in options like: (a) keywords, (b) title and (c) abstract and seek representative studies. This resulted in the utilisation of nine articles from which fourteen SOA benefits were identified and listed in the next paragraphs. The researcher acknowledges that this is not an all-inclusive SOA benefits list, yet the categorisation based on a well-cited model (e.g. Shang and Seddon (2000)) and the review process followed can add value to the discussion of the beneficial perceptions surrounding SOA.

Operational

- **Reduce Costs** – The cost reduction from SOA application is mainly perceived through automation of processes and easier implementation of workflow activities (Mueller *et al.*, 2010; Yoon and Carter, 2007).
- **Quality of Services** – SOA can enhance the quality characteristics of services depending on the requirements placed for their operation (Schelp and Aier, 2009; Yoon and Carter, 2007).

Managerial

- **Enable/Improve Business Agility** – SOA implementations maximise leverage of existing resources and creates new solutions from existing and new functionality, thus enhancing the agile response of the organisation towards its business objectives (Baskerville *et al.*, 2010; Yoon and Carter, 2007).

- **Increase Scalability and Availability** - Reuse of services and the ability to withdraw or plug in new developments with considerable ease assists parallel and independent application development (Joachim *et al.*, 2011; Legner and Heutschi, 2007).
- **Integration/Reusability** - SOA provides integration and reuse of existing software resources thus providing new functionality to older applications, enhancing their applicability through established and managed channels (Lohe *et al.*, 2010; Yoon and Carter, 2007) (Lohe *et al.*, 2010).
- **Risk Reduction** - Reusability of established, evaluated services can reduce the implementation risk of an error, thus giving a safer, error free environment of cooperating services (Janssen, 2008).

Strategic

- **Higher Return on Investment** - Companies that define reusable business services maximise their IT investments (Mueller *et al.*, 2010).
- **IT Agility and Business Alignment** – Along SOA design and implementation services are created as components of business logic, thus aligning IT and Business (Yoon and Carter, 2007) (Joachim *et al.*, 2011).
- **Reduced Time to Market** – SOA connects the business logic with IT components. This software design and its implementation decompose complex problems into smaller, more manageable ones, thus reducing the time to produce a service/application and/or solution (Schelp and Aier, 2009; Yoon and Carter, 2007).

IT Infrastructure

- **Easier to Integrate Systems** –New systems are based on services which provide easier integration efforts, as services under SOA are built with autonomous logic, independent of the platform applications (Baskerville *et al.*, 2010; Joachim *et al.*, 2011; Stefanovic *et al.*, 2012; Yoon and Carter, 2007).
- **Reduce Costs** - The cost reduction from SOA application in this dimension is mainly perceived through reduction due to the lesser need of testing and debugging (Kajko-Mattsson Mira, 2007; Mueller *et al.*, 2010; Yoon and Carter, 2007).
- **Service Reusability** - Improved software reusability through enhanced reuse of existing IT resources (Lohe *et al.*, 2010; Mueller *et al.*, 2010; Yoon and Carter, 2007).
- **Interconnectivity** - SOA architecture allows interconnection between remote positioned partners and entities (Stefanovic *et al.*, 2012).

Organisational

- **Common Understanding/Design** - Provide common business understanding among: (a) platforms, (b) protocols, (c) access devices and (d) legacy systems (Janssen, 2008; Legner and Heutschi, 2007).

- ***Handle Change Management*** - Projects can be implemented in segments thus allowing time to adapt to change (Kajko-Mattsson Mira, 2007).

A summary of the benefits is presented in Table 2.3. The left column entitled “Dimensions” refers to the dimensions proposed by Shang and Seddon (2000b), the “Benefits” column presents benefits identified in the literature review and mapped with the preceding column, the “Description” column presents a more analytical explanation and the “References” column presents the reference/s.

			References									
Dimension			Yoon <i>et al.</i> (2007)	Kaiko-Mattson (2007)	Legner <i>et al.</i> , (2007)	Janssen <i>et al.</i> , (2008)	Schelp <i>et al.</i> , (2009)	Baskerville <i>et al.</i> , (2010)	Lohe <i>et al.</i> , (2010)	Mueller <i>et al.</i> , (2010)	Joachim <i>et al.</i> , (2011)	Stefanovic <i>et al.</i> , (2012)
Operational	Reduce Costs	Service reusability can provide cost reduction due to easier	✓							✓		
	Quality of Services	Quality improvements in terms of better documentation related data and	✓				✓					
Managerial	Enable/Improve Business Agility	Development of new systems using existing services can be very agile						✓				
	Increase Scalability & Availability	Decoupling application domains reduces dependencies and redundancies between applications			✓						✓	
	Integration/ Reusability	Reuse of services especially in inter organisational collaboration	✓						✓			
	Risk Reduction	Better information security and authorization				✓						
Strategic	Higher Return on Investment	Organisations have economic potential, due to: (a) product advantages, (b) operational excellence								✓		
	IT Agility & Alignments with Business	Services are created as components of business logic	✓								✓	
	Reduced Time to Market	Especially as a consequence of reduced project time	✓				✓					
IT Infrastructure	Easier to Integrate systems	Extending web services and other applications	✓					✓			✓	✓
	Reduce Costs	Lower maintenance costs	✓							✓		
	Service Reusability	Improved software reusability through enhanced reuse of existing IT	✓	✓					✓	✓		
	Interconnectivity	SOA architecture allows interconnection between remote positioned partners and entities										✓
Organisational	Common Understanding /Design	Simplified communication between IT and business areas due to common terminology and SLAs			✓	✓						
	Handle Change Management	After proof of concept the organisation spreads the use of SOA incrementally easing the adoption	✓									

Table 2.3: SOA Benefits

In an attempt to study SOA benefits in healthcare the researcher reviewed seventy cases published in normative literature and summarises the main findings in Table 2.4 (based on 28 cases). The researcher acknowledges that this is not an all-inclusive SOA benefits in healthcare list, yet the extent of coverage (2008-2013) and the literature focus (e.g. healthcare cases) can add value to the discussion of the beneficial perception surrounding SOA in healthcare.

In this Table 2.4, the left column “Dimensions” refers to benefits categories, the “Benefits” column presents benefits identified in the literature review and mapped with the preceding column, the third column describes the benefits and the “References” column presents the reference/s.

On the **Operational** dimension two extra benefits were added:

- ***Flexibility to adapt to new laws/regulations*** – Using SOA organisation incorporate a flexible environment in which adaptation to new requirements like new laws/regulations can be achieved in a flexible manner. For example, Ruth *et al.*, (2009), identifies an organisation trying to quickly respond to market needs (e.g. Private Medicare offerings) while the law (e.g. Federal government) requires for more interoperability into their business. In this case the organisation responds by using business process packaged as services that can respond effectively to the law requirements (Ruth, 2009).
- ***Reduce dependencies*** – SOA can be beneficial for healthcare organisations with complex, interweaved systems and services expanding over various medical/clinical departments, by reducing the dependencies between these systems. For example, Gilbertson (2008) addresses the issue of dependencies and emphasises the reduction of the number of interfaces between systems when implementing SOA.

On the **Managerial** dimension one extra benefit was added:

- ***Improve work efficiency*** - SOA can support Clinical Workflow as data are transmitted fast, consistent and with an informative view for the caregiver, characteristics critical for the healthcare delivery system (Leader, 2010).

On the **Strategic** dimension one extra benefit was added:

- ***Satisfy customer/partners demand*** –As identified by Miller *et al.*, (2009) one of their strategies into their SOA project (e.g. health record interoperability) was to assist their members (e.g. Veterans) by connecting EHR and health providers and thus ease patients and families from carrying the burden and play the role of information exchange (Miller *et al.*, 2009).

		References																												
Dimension	Benefits	Stephans (2008)	Lunn (2008)	Sankaran (2008)	Vengo (2008)	BCBSA (2008)	Gilbertson (2008)	Huff (2008)	Wrightson (2008)	Hensley (2008)	Giokas (2008)	Welker (2009)	Bakker <i>et al.</i> , (2009)	Blanton <i>et al.</i> , (2009)	Miller <i>et al.</i> , (2009)	Ruth (2009)	Riben (2009)	Weiler (2010)	Kadambi (2010)	Davis (2010)	Middleton (2010)	Ferguson (2010)	Campbell (2010)	Leader (2010)	Gavdos (2010)	Felton (2010)	Elamari <i>et al.</i> , (2011)	Hsieh <i>et al.</i> , (2012)	Assam <i>et al.</i> , (2013)	
Operational	Flexibility to adapt to new laws/ regulations	✓	✓									✓		✓	✓	✓		✓		✓			✓							
	Reduce operational cost	✓								✓		✓				✓						✓	✓					✓		
	Quality of services			✓	✓	✓											✓						✓				✓			
	Reduce dependencies				✓	✓	✓										✓							✓	✓					✓
Managerial	Enable improve business agility				✓								✓		✓	✓								✓						
	Improve work efficiency				✓			✓	✓	✓		✓			✓							✓	✓	✓	✓	✓	✓	✓	✓	✓
	Increase scalability and availability			✓	✓	✓											✓						✓	✓						
	Risk reduction			✓	✓	✓											✓				✓		✓							
Strategic	Satisfy customer/partner demands							✓					✓		✓	✓								✓				✓		
	Reduce time to market				✓								✓		✓	✓							✓							
	Align IT with business				✓			✓	✓	✓			✓		✓							✓	✓	✓	✓	✓				
IT Infrastructure	Integrate legacy systems	✓	✓	✓	✓			✓					✓						✓		✓				✓	✓	✓	✓	✓	✓
	Reusability of services	✓	✓	✓	✓			✓					✓	✓					✓		✓				✓	✓	✓	✓	✓	✓
	Use of new technologies	✓											✓									✓			✓					
	Improve medical data			✓	✓								✓										✓	✓						
	Supports monitoring system	✓	✓	✓	✓			✓				✓								✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Organisational	Improve accessibility/ interoperability of data	✓	✓	✓	✓			✓				✓	✓						✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Increase business efficiency			✓				✓	✓	✓			✓		✓				✓			✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 2.4: SOA Benefits in Healthcare

On the **IT infrastructure** dimension three additional benefits were added:

- **Use of new technologies** – As reported by Welker (2009), SOA is an enabler in the growing need identified in healthcare organisations, to adopt and use technological achievements (e.g. clinical, managerial etc.) (Welker, 2009).
- **Improve medical data** - Ferguson (2010) mentions that an EHR SOA integrated system improved care and its outcomes (e.g. heart attack reduction). Alongside, Leader (2010) describes a medication system based that was integrated through SOA that provides better data (more accurate, precise, correct, timely and clear data) (Leader, 2010).
- **Support monitoring system** – SOA can provide better monitoring of the HIS's functionality. This is especially important for healthcare were crucial for the well being healthcare processes and stakeholders, are involved. Weiler (2010) mentions such a SOA system, which improved ability to assess and hold suppliers accountable for interoperation of an EHR system elements, thus providing monitoring of the system functionality (Weiler, 2010).

On the **Organisational** dimension two extra benefits were added:

- **Improve interoperability** – SOA can be beneficial especially for healthcare, which is structured with fragmented legacy systems, requiring an increase in interoperability. Sankaran (2008) emphasises on the ability of SOA to provide integration of legacy systems required for the interoperable cooperation between healthcare partners (e.g. State/local government, private sector) and agencies (e.g. Healthcare organisations).
- **Increase business efficiency** – According to Campell (2010) SOA enables faster and more accurate reporting across agencies and systems, thus increases business efficiency.

Despite the benefits that SOA provides, not all SOA projects have delivered the expected outcomes, due to organisations lack of understanding especially in non-technical factors (managerial, human etc.) surrounding SOA implementations (Aier *et al.*, 2011). This is extremely important as investments of hundreds of thousands of Euros do not lead to the expected outcomes and in some cases result in failure (Erickson and Keng, 2008). A failure in a healthcare organisation's IT infrastructure is not an option as the literature is full of cases where healthcare IT failures cost patients' lives (Fitzgerald and Russo, 2005; Johnson, 2011; Kaplan and Harris-Salamone, 2009).

So far this thesis emphasised on the role of SOA Governance as critical and complementary to all SOA implementations. This is supported by Heffner's (2009) survey which reveals that SOA Governance indeed improves SOA benefit realisation in practice. Nevertheless, the researcher investigates the literature to identify and justify if SOA Governance is also considered a Critical Success Factor when the focus is placed on SOA in healthcare. In this

respect, the next section presents a literature review on SOA CSFs, to classify the aforementioned role of SOA Governance among other success factors in healthcare SOA implementations.

2.4.2 *Service Oriented Architecture: Critical Success Factors*

In reviewing the normative literature the focus is firstly placed on the factors that critically affect the success of a SOA implementation. This provides the stepping stone, upon which the focused on SOA CSF in healthcare literature research will be based. The researcher used the guide of Levy and Ellis, (2006) for the literature review process. In doing so, various databases, such as: (a) Google scholar, (b) IEEE Xplore, (c) AISel and (d) Science Direct, were investigated. The researcher run: (a) keywords, (b) title and (c) abstract, using specific keywords (e.g. “*SOA Critical Success Factors*” and “*SOA implementation*”) searches and sought representative studies. Alongside, a backward references search, with the references of the studies yielded from the keyword search, thus extending the knowledge of the theory and methodology used (Levy and Ellis, 2006). In an attempt to provide valuable insights for the IS community the review was organised in a specific structure (e.g. CSF/CSF in healthcare) (Vom Brocke *et al.*, 2009b). The literature review revealed 17 individual factors that can be considered as important for SOA implementation. It is worth noting that some factors like cost and risk are common factors that affect the success of any IT implementation and projects. The factors are explained below in alphabetical order:

- **Alignment** - In order to result in a successful SOA implementation there is a need to align the business strategy with the business processes, the SOA solution, the IT infrastructure and the actors involved. (Aier *et al.*, 2009; Antikainen and Pekkola, 2009; Chang and Lue, 2009; Haresh and Fethi, 2009; Lee *et al.*, 2010). This alignment involves common goals and requires well structured processes to reach these goals.
- **Clear goals** - Well structured goals form a significant element of a business strategy and a project. In the case of SOA implementation these should be set up in advance as upon them the service management and modification is based (e.g. mapping of measurement result). SOA goals require a good understanding of both IT and business parameters (Lee *et al.*, 2010).
- **Complexity** - Organisations’ IT infrastructures consist of hundreds of legacy, custom, packaged, e-services and other types of applications. These are based on multiple operational systems, programming languages and protocols and in their vast majority are not compatible. These systems partially integrate business processes but there is often no clear view about the processes and IS that these processes automate, due to high complexity. When the discussion comes to systems integration through SOA, the

complexity can affect the number of physical resources required to address integration and thus it may affect the whole project implementation (Lee *et al.*, 2010; Schelp and Aier, 2009).

- **Cost** - Cost is a vital factor related to any project and in any sector. Usually, organisations do not proceed to the implementation of a software solution without performing a detailed examination of all cost types and categories associated with their project. The same happens when organisations implement SOA (Aier *et al.*, 2009; Haresh and Fethi, 2009; Lee *et al.*, 2010).
- **Culture** - The lack of organisational culture that supports organisation's to integrate their IT infrastructures is considered as a major factor. It is therefore crucial to cultivate a culture that supports a SOA friendly environment as such a culture may: (a) reduce resistance to change, (b) assist individual business units to take ownership of data, processes IT systems, and (c) get commitment at the board level (Aier *et al.*, 2011; Antikainen and Pekkola, 2009; Chang *et al.*, 2006; Haresh and Fethi, 2009; Nasr *et al.*, 2011; Wong-Bushby *et al.*, 2006; Yoon and Carter, 2007).
- **Experience and training** - SOA requires the availability of experienced professionals from both IT and business orientations that can apply their skills during the SOA implementation (Aier *et al.*, 2009; Antikainen and Pekkola, 2009; Chang and Lue, 2009; Haresh and Fethi, 2009; Nasr *et al.*, 2011; Yoon and Carter, 2007).
- **Governance** - Governance refers to an overall plan that: (a) provides compliance with regulations (internal/external) and (b) checks services concerning capability, security and strategic business alignment (Aier *et al.*, 2011; Antikainen and Pekkola, 2009; Chang and Lue, 2009; Haresh and Fethi, 2009; Kajko-Mattsson *et al.*, 2007; Lee *et al.*, 2010). SOA Governance is considered as a significant factor that affects the implementation of SOA architectures as it allows the organisation to control the service lifecycle, establish decision rights (e.g. development, deployment, operations and management of new services) and monitor the progress of SOA initiatives.
- **Long-term planning** - SOA focuses on services reusability. Thus, a long-term business plan that includes reusable services to facilitate future business is required so as to achieve the potential benefits of the architectural paradigm (Antikainen and Pekkola, 2009). Long term planning is also necessary as organisations do not implement their SOA architectures in one wave but in a progressive manner.
- **Measurement** - The success of a SOA implementation is measured against specific criteria such as availability, reusability, quality of service, performance, functionality etc. For that reason it is important that organisations implementing a SOA solution should set their criteria for measurement in advance (Lee *et al.*, 2010; Schelp and Aier, 2009).

- **Maturity identification** – SOA can be applied in a progressive manner, providing better adaptability and minimise parameters that might effect its adoption (flexibility, cost etc.). This is achieved with the adoption and/or creation of a SOA maturity model (such a model is presented in ANNEX II). These models help define how the organisation would progress from the current (that might be the initial) to the higher level of SOA maturity and how it might addresses each phase of maturity (Blanton *et al.*, 2009).
- **Project identification** – SOA requires a good initial project identification, based on value adding, critical scope, time, cost, complexity and other parameters. The initial pilot projects are then followed by bigger SOA implementations buildinging on the previous success and knowledge gained (Aier *et al.*, 2011; Lee *et al.*, 2010; Nasr *et al.*, 2011; Yoon and Carter, 2007).
- **Resources** – In any software development project, the availability of resources such as: financial (budget), technical (software/hardware), staff (experts, implementation team, consultants), the correct use and management plays a critical role. The same happens for the resources that are assigned to a SOA implementation (Chang and Lue, 2009; Lee *et al.*, 2010).
- **Risk** - There are numerous risks like operational, technical, human and financial, that need to be considered during the operation of a SOA implementation (Antikainen and Pekkola, 2009; Lee *et al.*, 2010).
- **Roadmap** – Roadmap is a high level plan and a guide for building a SOA architecture. SOA roadmap's importance is seen as it includes the goals and milestones usually set in a time/activity manner in conjunction with the maturity model phases (Blanton *et al.*, 2009; Lee *et al.*, 2010). Unarguable this factor is closely related with the Long-Term Planning, yet roadmaps refer closer to expectations and guidance for the near future (and thus placed in the operational dimension) while Long-Term Planning estimates future business needs over a longer period of time (thus placed in the strategic dimension).
- **Roles** - Many individuals with different roles and level of responsibility participate, affect and or are affected by a SOA project. Placing the right role(s)-to-individual can be a crucial factor for SOA implementation as multidiscipline skills (e.g. IT and business) are required for a SOA implementation (Kajko-Mattsson *et al.*, 2007; Lee *et al.*, 2010; Nasr *et al.*, 2011).
- **Standards** - SOA is based on established global standards such as XML, UDDI, SOAP, WSDL, BPPEL and REST (Lee *et al.*, 2010). This fact supports its widespread application but at the same time implies that such standards are of critical nature for SOA.
- **Team** - In a SOA implementation there are many team members with different sets of skills and expertise that are participating. The project manager is usually responsible for the appointment of the team. Therefore, s/he has to build a balanced team that includes

members that understand the technical and business issues of the SOA implementation (Antikainen and Pekkola, 2009; Lee *et al.*, 2010; Wong-Bushby *et al.*, 2006).

- **Testing** - SOA is based on procedures, design rules and standards for ensuring that different services and components (technological and human) can successfully cooperate towards a shared business goal. Thus, tools and methods to test the integration approaches and services are required before the actual service implementation (Nasr *et al.*, 2011).

The above mentioned factors that were derived from the literature review are in the form of a laundry list. In an attempt to better present them they were classified using the Shang and Seddon (2000a) model. Despite this model was introduced to classify integration benefits it is the researcher's understanding that it can be used to categorize the factors that affect the implementation of an integration paradigm like SOA. Shang and Seddon (2000) model is suitable for this categorisation as it was originally derived from integrated IT infrastructure and widely used in the past to provide a distinctive view of integration technologies (Hsin, 2006; Khoubati *et al.*, 2006b). Also it can be argued that the model's categories can be efficiently used to present the proposed factors in a more organised and clear way. Based on Shang and Seddon (2000a) model the proposed factors were classified into: (a) Operational, (b) Managerial, (c) Strategic, (d) IT infrastructure and (e) Organisational categories. This proposed categorisation for SOA CSFs was implemented to help the researcher to focus his attention to the significant role that each identified CSF plays. In addition, the categorisation of the factors illustrates specific aspects of each factor (e.g. organisation, management, etc.).

The classification of the CSFs as depicted in Table 2.7. Where the first column from the left refers to the CSF category based on Shang and Seddon (2000a) model. The second column from the left presents the factors identified in the literature and mapped with the preceding column. The remaining columns under the heading 'References' map literature references with each factor.

			References										
Dimension	CSF	Description	Wong-Bushby <i>et al.</i> , (2006)	Yoon <i>et al.</i> , (2007)	Kajko-Mattsson <i>et al.</i> , (2007)	Blanton (2009)	Schelp <i>et al.</i> , (2009)	Chang <i>et al.</i> , (2009)	Hareesh <i>et al.</i> , (2009)	Antikainen <i>et al.</i> , (2009)	Lee <i>et al.</i> , (2010)	Alier <i>et al.</i> , (2011)	Nasr <i>et al.</i> , (2011)
Operational	Maturity Identification	Detailed description & mapping of the current state of SOA.				✓							
	Roadmap	Goal oriented map with instructions that explain the goals and the path to reach them.				✓					✓		
	Complexity	Increasingly interacting processes amplify the difficulty of operational handling of the system.					✓				✓		
Managerial	Roles	SOA calls for responsibilities-to-roles.		✓							✓	✓	
	Team	A team with understanding and experience in change management and clear vision of SOA.	✓							✓	✓		
	Governance	An overall plan to provide compliance with regulations (internal/external) and check services concerning capability, security and strategic business alignment.		✓	✓			✓	✓	✓	✓	✓	
	Cost	The use & control of resources as part of the new business plan.						✓			✓	✓	
	Measurement	Assessing performance of service processes.					✓				✓		
Strategic	Risk	Data confidentiality and security.								✓	✓		
	Long-term Planning	Long term business plan to include reusable services that fit future business.							✓				
	Clear Goals	Clear goal setting based on business value.								✓			
	Project Identification	Identify early SOA adopters, low complexity pilots based on existing needs for change.		✓							✓	✓	✓
IT Infrastructure	Resources	Prediction of exact amount and use of IT						✓			✓		
	Standards	Generating standard definitions of SOA									✓		
	Testing	Tools and methods to test new integration approaches and services.											✓
Organisational	Alignment	Top management, stakeholders, actors, strategies, processes, and technology alignment towards successful SOA implementation.						✓	✓	✓	✓	✓	
	Culture	Cultivate SOA friendly environment to: (a) reduce resistance to change, (b) assist individual business units to take ownership of data, processes IT systems and (c) get commitment at the board level.	✓	✓				✓	✓	✓		✓	✓
	Experience & Training	Availability of skills and training.		✓				✓	✓			✓	✓

Table 2.5: Classification of SOA Critical Success Factors

The aforementioned studies, presented in Table 2.5, seem to complement each other and formulate a pattern of CSF in SOA implementations that covers a wide spectrum. An interesting difference amongst them is that Antikainen *et al.*, (2009) identify that the long-term aspect given to SOA consist a valuable factor for IT development. In particular, future

long term plans incorporated into business strategy was seen as a useful input for designing reusable services and architectures that would fit potential business needs without major re-implementation efforts. In another case, Nasr *et al.*, (2011) report that testing is a factor that can affect SOA implementation, multiple testing tools and methods are required (Nasr *et al.*, 2011). Also, Blanton *et al.*, (2009) point out the value of SOA maturity identification, thus develop a detailed account of the level of SOA parameters already placed and what follows (Blanton *et al.*, 2009).

So far, the review on SOA CSFs revealed that a good knowledge foundation around CSFs of successful SOA implementations exists, with at least 18 factors (as seen in Table 2.5). These factors resemble a non-specific sector list. However, earlier reports have described healthcare as a sector holding unique factors regarding adoption and implementation of new technologies (Khoubati *et al.*, 2006a; Leonard, 2004; Mantzana *et al.*, 2008). Thus, the need to implement SOA in healthcare requires the investigation of SOA CSFs related to the healthcare. In this way, this research attempts to fill a gap in the area of SOA in healthcare.

Using direct content analysis and the CSFs identified in Table 2.5, 70 cases from the normative literature were identified and reviewed. The outcome of this critical review is a new list of SOA CSFs in healthcare, as depicted in Table 2.6 that enhances the understanding in this area. Where the first column from the left refers to the CSF category based on Shang and Seddon (2000a) model. The second column from the left presents the factors identified in the literature and mapped with the preceding column. The remaining columns under the heading 'References' map literature references with each factor. This list contains SOA CSF like: long-term planning, maturity identification, project identification, resources, roadmap and roles that its importance are equally perceived in a healthcare setting as any other sector, but also CSFs that where identified as SOA CSFs but hold additional crucial parameters when applied in healthcare. The latter are presented in the following paragraphs:

- **Alignment** – The majority of healthcare organisations, are dealing with the alignment as a multifaceted challenge and consider it an important factor regardless of their size, country, industry and business strategy. Still, when SOA is considered as a business strategy for alignment in healthcare, the alignment addresses critical dimensions like: (a) mandates to achieve regulatory compliance (e.g. Sarbanes-Oxley, data protection act.), (b) transformation of SOA projects from supporting into a strategic business enabler, (c) need to demonstrate value from SOA investments and (d) association of numerous categories of healthcare actors with different and often conflicting interests.

- **Cost** – Costs and especially aspects such as cost identification, planning and funding allocation is a critical factor related to SOA projects in any sector, that aid in the uninterrupted implementation of the paradigm. The same importance is identified in healthcare, with the particularity that costs can fluctuate and in many cases increase, due to (a) high infrastructure procurement costs (b) system duplication and extensive testing. This is observed when SOA projects target healthcare intensive environments like operational and laboratory departments that testing and duplication (e.g. old and new system running simultaneously for a period of time) are required.
- **Culture** – Healthcare units are staffed with groups of professionals with established cultural identities (e.g. doctors, nurses, technicians) that also identify themselves in sub-groups based on the healthcare structuring (e.g. departments, specialities etc.). These structures (e.g. units, departments), more than often, are given a high degree of self-determination regarding which IT application/solution best suits their particular needs. SOA implementations cause pressure to these cultural subgroup ideologies on issues, such as: (a) shift of ownership (of services, projects) from IT to business, (b) uncertainty (new way of thinking/acting), and (c) changes the way people work together (business and IT cooperation). It is therefore a crucial factor to cultivate a culture that supports a SOA friendly environment as such a culture may: (a) reduce resistance to change, (b) assist individual business units to take ownership of data, processes IT systems, and (c) get commitment at the board level.
- **Experience and training** – A SOA implementation in a healthcare setting requires an availability of skilled personnel from both IT and healthcare orientations. These individuals need to apply their skills, resolve inter-discipline problems and minimise resistance to change caused by the SOA paradigm. In healthcare, practices like secondments, cross-training, shadowing, coaching, rotation and personal development are common to enhance training and flow of knowledge, still recruiting the rightfully skilled personnel and train employees remains a critical process for achieving the beneficial aspects of SOA.
- **Governance** - SOA Governance is considered as a significant factor that affects the success of a SOA project. The successful governance of SOA is more critical in a healthcare setting, where even a small error in any one of the various pieces of information stored and used in the HIS could have consequences that directly influence the quality of human lives and even cause human lives.
- **Measurement** – Within the healthcare there are studies that indicate the majority of healthcare chief information officers struggling to demonstrate IT value and success with real-time quantifiable metrics (Krey, 2010). Thus, SOA metrics, measured against specific criteria (e.g. QoS, performance, functionality etc) can be critical not only in

inspection and adjustment of the system, but in providing indicators and triggers for further implementation of the SOA paradigm.

- **Risk** - There are numerous risks like operational, technical, human and financial, that need to be considered during the operation of a SOA implementation. In healthcare, extra caution is given to (a) minimise security and continuity risks (e.g. testing, standards, reserve systems etc.), (b) replace previous error identification mechanisms and (c) funding and sponsoring.
- **Standards** – It is worth mentioning that SOA is based on established global standards (e.g. XML, UDDI, SOAP, WSDL, BPEL and REST) from various independent stakeholders. Additionally, the health sector uses and develops standards related to information coding and sharing (e.g. SNOMED). These are usually developed from national central standardisation bodies in a lengthy process that can take up to four years from the development to a wide application. So far, SOA healthcare specific standards are developed by independent organisations like IHE (e.g. HL7, DICOM, etc.) that enhance the interoperability and improve the way HIS share information (IHE, 2012). An example of this is the recognised HSSP program, which is a collaborative effort between standards groups HL7 and OMG to address interoperability challenges within the healthcare sector, operating on SOA (HSSP, 2013). This combination between SOA and healthcare standards is an important factor for SOA implementations, regarding aspects of security, interoperability and QoS.
- **Team** – The structuring of SOA teams is a very relevant and crucial factor in healthcare. Over the years healthcare strategies tried to strategically renew healthcare through large scale restructuring (from centralised to decentralised back to centralised or semi-centralised), yet there is uncertainty about whether there is a best way, or even a particular way, to structure a healthcare organization (Duffield *et al.*, 2007). SOA teams require decision abilities (e.g. ownership placement, funding allocation, project prioritization etc.) granted to them and a mixture of IT and business members. This power shift in many cases contradicts the established structures and norms of a healthcare setting enhancing the need of a well structured SOA team that can limit unwanted friction between members and gain the support of the rest of the organisation.
- **Testing** - SOA was identified as a CSF requiring tools and methods to test the integration approaches and services before the actual service implementation. This is also a requirement for healthcare, as many healthcare organisations place tests and controls in place to analyse the impact on the infrastructure before its implemented, especially in healthcare intensive environments like operational and laboratory departments.

Additionally the direct content analysis of the literature resulted in a new CSFs, which is added to the list (e.g. Table 2.6) and explained in the following paragraph.

- **Enforce decision** - Decisions regarding the overall IT/eHealth architecture and infrastructure priorities are taken using a mixture of different structures (e.g. IT steering committees, senior management groups) members of which participate at higher decision groups like Executive Board Meeting, making the decision process time consuming and detached from the users/owners of services. In addition to this, Wendell (2009) and Mulrooney (2010), reflect on the need to establish structures, tools and methods for the detailed execution of SOA related decisions and/or the ownership of specific services. This is important for healthcare as precision and standardisation of all processes is required, in order to provide a uniform quality of care. Additionally the authors report that this enforcement can minimize the time delay experienced due to negotiations, unclear ownerships and misunderstanding and thus assist SOA implementation.

		References																							
Dimension	CSF	Huff (2008)	Gilbertson (2008)	Vengco (2008)	Mirhaji <i>et al.</i> , (2008)	Gkokas (2008)	Stephens (2008)	Wrightson (2008)	Riben (2009)	Weiker (2009)	Miller <i>et al.</i> , (2009)	Canfora <i>et al.</i> , (2009)	Wendell (2009)	Mulrooney (2009)	Gaydos (2010)	Weiler (2010)	Ferguson (2010)	Smith <i>et al.</i> , (2010)	Felton (2010)	Pandit-Pant (2010)	Do <i>et al.</i> , (2010)	Bugara (2010)	Mulrooney (2010)	Rosen (2010)	
Operational	Maturity identification	✓													✓										
	Roadmap		✓					✓	✓						✓	✓	✓								
	Complexity																✓	✓							
Managerial	Roles																	✓							
	Team					✓													✓						
	Governance	✓	✓					✓	✓						✓	✓	✓	✓	✓	✓	✓				
	Funding									✓								✓							
	Measurement																						✓		
	Risk			✓					✓		✓														
Strategic	Long-term planning				✓										✓				✓						
	Clear goals											✓		✓											
	Project identification		✓																✓	✓				✓	
IT Infrastructure	Resources	✓	✓																						
	Standards				✓	✓		✓									✓								
	Testing												✓	✓	✓								✓		
Organisational	Alignment																✓	✓						✓	
	Culture	✓	✓						✓								✓	✓							
	Experience/training																✓			✓					
	Enforce Decisions											✓											✓		

Table 2.6: Classification of SOA Critical Success Factors in Healthcare

From the aforementioned literature research it appears that the most frequently reported CSFs are: (a) governance, (b) roadmap, and (c) culture. Especially, governance was reported in 50% of the cases studied and it was reported as a critical dimension to SOA that is required from an early stage (Felton, 2010; Gaydos, 2010). The top priority given to SOA Governance is in accordance with the views of many researchers (Biske, 2008; Josuttis, 2007; Marks, 2008; Niemann *et al.*, 2008). In a nutshell they report that SOA implementations require governance mechanisms to excel, otherwise the architecture will end up complex, uncontrolled, brittle and eventually discarded (Marks, 2008). To this end, and with the aforementioned critical aspect of governance as a CSF, SOA Governance is analysed in the next section.

2.5 SOA Governance

Organisations face pressures from stakeholders (competitors, shareholders, employees and customers) to improve their IT infrastructures and adopt SOA paradigm in a quick pace. As the time frame of the SOA projects is restricted, there is no time left to introduce the changes required and adapt the organisation to the SOA paradigm. In most cases, organisations focus their attention on the technical side of SOA in an attempt to deploy and use SOA faster than their competitors. Thus, the changes caused are introduced rapidly and in many cases highlight the lack of: (a) knowledge, (b) culture (c) IT sophistication, (d) long-term planning and (e) structured processes. These parameters can be addressed by SOA Governance as it will be explained later on in this section (Baskerville *et al.*, 2005).

In addition, organisations tend to start their SOA projects from small-size pilots and extend them. In small-size projects, the scale of change and the IT solutions are small, thus governance is not perceived as an issue (Schepers *et al.*, 2008a). When the scale and frequency of SOA projects increases, complexity increases too. Large-scale SOA projects implicitly contribute towards system complexity (Niemann *et al.*, 2008). Due to the requirements, the scale of the process and project, the number of the actors involved etc. (Jeng and Lianjun, 2007). Thus, organisations usually realise the importance of governance mechanisms in a later stage when they try to overcome issues like complexity.

Therefore, either organisations are aware of SOA Governance but they do not focus on it, or they decide not to include it in their initial plans due to time constraints. Either way the result can be the creation of systems with low levels of governance, which are difficult to adopt, extend and maintain. These ungoverned systems can cause unwanted consequences. Especially HIS integration can be of critical importance as even a small error in any one of the various pieces of information stored and used in the HIS could have consequences that directly influence the quality of human lives (Aron *et al.*, 2011). In the past, failures in the adoption of IT systems in healthcare, have caused human lives (Fitzgerald and Russo, 2005; Khoumbati *et al.*, 2006a). Motivated by the need for SOA to enhance its success, researchers and practitioners have been investigating several aspects of it.

However, as the attention was driven by market demand for immediate solutions, the focus was primarily placed on IT solutions (e.g. platform, tools). Despite IT vendors produced software packages claiming successful SOA implementation and functionality not all SOA projects have delivered the expected outcome due to organisations lack of understanding especially in non-technical factors (managerial, human etc.) surrounding SOA implementations (Heffner, 2009). The focus on non-technical aspects was part of many

researchers' agenda (Biske, 2008; Josuttis, 2007; Marks, 2008; Niemann *et al.*, 2008) but none of them focused directly on healthcare, which leaves SOA in healthcare an uncharted area.

2.5.1 *SOA Governance Definition*

The meaning of the term, governance corresponds to the exercise of authority, control, government and arrangement. Also governance is used to refer to self-organising inter-organisational networks characterised by independence, resource and service exchange, and also negotiations trades and rules (Bell and Hindmoor, 2009). In more detail, governance can be seen as the act of affecting government and monitoring (through policy) the long-term strategy and direction of an organisation. Thus, governance comprises the traditions, institutions and processes that determine how power can be exercised, stakeholders are given a voice, and decisions are made on issues of concern (Romero *et al.*, 2007). In most organisations two types of governance can be found, like: (a) corporate and (b) IT governance.

Corporate Governance – is a set of relationships between a company's management, its board, its shareholders and other stakeholders that provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance are determined (OECD, 2004). Interdisciplinary interest in corporate governance has been rapidly growing, both inside and outside academia, together with recognition of its importance by researchers not only from economics and finance but also from law, management, and accounting disciplines (Bebchuk *et al.*, 2009). Yet, in healthcare the issue is not so highly documented. One reason might be that healthcare facilities are often owned by government, and boards are appointed/constrained by government. The stakeholders are wide ranging and boards are often faced with competing on unclear business objectives and funding. Literature indicated that the pressures to improve health outcomes, as well as the widely publicized failures in corporate governance over a number of years, have led administrators, policy makers and researchers to try to determine what constitutes good governance and how it can be implemented in hospitals and healthcare systems (Bennington, 2010). Yet, this is an ongoing effort.

IT Governance - is the structure of relationships, processes and mechanisms used to develop, direct and control IT strategy and resources so as to best achieve the goals and objectives of an enterprise. Moreover, it is a set of processes aimed at adding value to an organisation while balancing the risk and return aspects associated with IT investments. IT governance is mainly the responsibility of the board of directors and executive management (Campbell *et al.*, 2010). There is a significant number of frameworks for IT Governance that have been published

and/or standardised in recent years by industry consortia, standardization bodies and academia like Information Technology Infrastructure Library (ITIL), Control Objectives for Information and Related Technology (COBIT), ValIT, ISO 17799 and Capability Maturity Model (CMM). ITIL for example, is an IT Management framework that primarily defines management and support processes, ISO 17799 has a much narrower focus revolving around security management and is rather complementary than contradictory to ITIL. Yet, neither organisations themselves nor IT management systems can be certified as ITIL-compliant but organisations that base the provisioning of IT services on ITIL can seek compliance and achieve certification under the international IT Service Management standard ISO/IEC 20000, which builds upon established IT Service Management best practice contained within the ITIL framework (HM Government, 2013). Moreover, COBIT can be classified as a high level governance and control framework that is less targeted towards operational issues but is rather more tightly aligned with the business (ISACA, 2013). Additionally, ValIT, is a formal statement of principles and processes for IT portfolio management that provide a framework for the governance of IT investments. Capability Maturity Model Integration (CMMI) can be described as an approach focused on process improvement across projects, divisions, or entire organisations that helps organisations improve their performance (CMMI Institute, 2012).

In a recent research on the global status of IT governance standards and models (like COBIT, ITIL/ISO20000 etc.) the findings reveal a tendency to adopt such frameworks, but also a lack of a clear “winner” amongst them. For example, amongst 834 business executives, from 21 countries and 10 industries reveal that ISO20000 or ITIL is referred in 28% of them, while COBIT in 12% (ITGI, 2011) and ValIT in 4,9%. The percentages of IT governance in healthcare are not so clear, as out of the 839 respondents only 10% have been healthcare executives, thus probably for this report the percentages drop lower regarding their focus on IT governance in healthcare. Moreover, healthcare IT governance research is scarce, with limited published examples, like Beratarbide and Kelsey, (2011) reporting on the impact of COBIT on improving ehealth governance within the NHS in Scotland and Velez *et al.*, (2009) discussing the use of ITIL in a hospital in Portugal. While, as determine by a survey with several Swiss hospital CIOs, the majority (64%) replied, that the health care sector is a complex and heterogeneous economic sector and cannot be compared to other industry sectors, where COBIT and other IT governance framework have been successfully applied (Krey *et al.*, 2012).

Thus, far in this section the corporate and IT governance was explained and their status in healthcare discussed. As it seems IT governance can be characterised as a sub-set of corporate governance, with more specialised responsibilities. However, when the focus is placed on

SOA a different approach is required. Moreover, as the SOA matures over time and the number of services increases the organisation pays more attention on the SOA Governance. The reason behind this is that SOA Governance assists IT governance by aligning IT and business, as illustrated in Figure 2.3. In this graphical presentation, in the left hand these are the three initial governance plans, which over time as SOA matures unite to form a more integrated governance approach (Information Technology Association of America 2008).

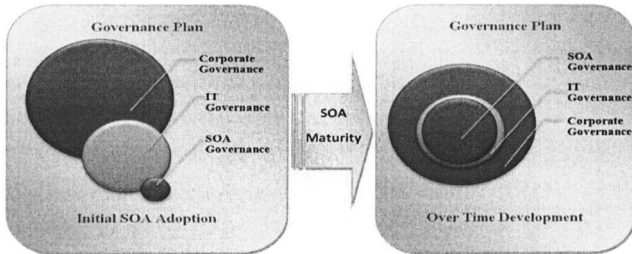


Figure 2.3: Governance Plan

Figure 2.3 depicts that, as SOA matures, the need for a more comprehensive governance plan that addresses SOA is required. SOA Governance can be characterised as a continuous control process that guarantees sufficient adaptability and integrity of an SOA system in issues like: (a) capability, (b) security and (c) strategic business alignment. Its overall goal is SOA compliance of legal, technical and intercompany regulations, respectively. In particular, it ensures the reliable long-term operation of an SOA (Niemann *et al.*, 2009b). Researchers and practitioners of the field have not yet produced a common definition of SOA Governance, this confusion might be contributed to the different perception surrounding the issue (as scope, elements, stakeholders). Nevertheless, Marks (2008), approach seems to provide a clear outlook:

“SOA Governance is the definition, implementation and ongoing execution of an SOA stakeholder decision model and accountability framework that ensures an organisation is pursuing an appropriate SOA strategy aligned with business goals, and is executing that strategy in accordance with guidelines and constraints defined by a body of SOA principles and policies.”

Marks (2008, p.7).

The aforementioned definition can be utilised to describe the focal point of this thesis, SOA Governance. Yet, considering that the focus on this area is quite new, with many different views from many different sources (academics, vendors and practitioners) a well constructed and rigorous literature research approach is required to investigate SOA Governance. To

provide a rigorous, detail account of the literature research on a new research issue, is supported highly from academia (Brereton *et al.*, 2007; Levy and Ellis, 2006; vom Brocke *et al.*, 2009a). This approach is illustrated in detail in the following section.

2.5.2 Service Oriented Architecture Governance Research

Literature indicates that literature reviews especially when addressing a new area of research (e.g. SOA Governance) is required to be rigorous and comprehensibly described (Levy and Ellis, 2006). Only then can readers assess the exhaustiveness of the review and other scholars in the field can more confidently (re)use the results in their own research (vom Brocke *et al.*, 2009a). Moreover, Webster and Watson (2002) report that a rigorous literature review creates a firm foundation for advancing knowledge, facilitates theory development, closes areas where a plethora of research exists, and uncovers areas where research is needed. In this respect, Vom Brocke *et al.*, (2009), amongst others, emphasise that the quality of a literature review is particularly determined by the literature search process. The search process is a challenging part of any literature review, as it has to include all sources that contain relative and useful research publications (Levy and Ellis, 2006). It is considered that the decisions for inclusion (or exclusion) can be more complicated in an emerging field such as IS, due to the considerable and the increasing number of articles that are published in a wide range of sources every year (vom Brocke *et al.*, 2009a).

Thus, the researcher takes into consideration the aforementioned views concurs that the process of searching the literature in SOA Governance ought to be rigorous and comprehensibly described.

2.5.3 Introduction to SOA Governance Literature Review Methodology and Plan

This SOA Governance review is based on the guidelines from the well cited approach of Cooper (1988). Cooper (1988), suggests that a literature review has six basic characteristics namely: (a) focus, (b) goals, (c) perspective, (d) coverage, (e) organisation and (f) audience, with each characteristic sub-divided into specific categories, presented in Table 2.7. In the table, the first column presents the characteristic while the second the categories into which each characteristic can be divided (Cooper, 1988).

Characteristics	Categories			
	Focus	Research outcome	Research methods	Theories	Practices or applications
Goals	Integration	Criticism	Identification of central issues	
Perspective	Neutral representation		Espousal of position	
Coverage	Exhaustive	Exhaustive with selective citation	Representative	Central or pivotal
Organisation	Historical	Conceptual	Methodological	
Audience	Specialized scholars	General scholars	Practitioners or policy makers	General public

Table 2.7: Literature Review Methodology Used for SOA Governance Literature Review [Source: Cooper (1988)]

The first characteristic entitled Focus deals with the material that is of central interest to the reviewer, like: (a) research outcome, (b) research methods, (c) theories and (d) practices and applications. The second characteristic (Goals) addresses what the author hopes the review to accomplish, like: (a) integration, (b) criticism and (c) identification of central issues. Perspective addresses the impact of the reviewers' on the discussion of the literature and can be distinguished in categories like: (a) neutral representation and (b) espousal of position. Coverage deals with how reviewers' search the literature and how they make decisions regarding the suitability and quality of the material, thus it is categorised such as: (a) exhaustive, (b) exhaustive with selective citation, (c) representative and (d) central or pivotal. The fifth characteristic (Organisation) examines how a paper is structured, with arrangements like: (a) historical, (b) conceptual and (c) methodological. The last characteristic (Audience) deals with the review's indented audience and can be categorised like: (a) specialised scholars, (b) general scholars, (c) practitioners or policy makers and (d) general public.

Apart from identifying the characteristics of a literature review methodology, as the ones adopted following the proposition by Cooper (1988), the quality of a literature review is particularly determined by the literature review process itself. In this respect, Brereton *et al.*, (2007) introduces a plan for a systematic review process with three main phases of depicted in Figure 2.4. These are:

Phase 1- Planning

- **Purpose** - Identify the purpose and intended goals of the review,
- **Research protocol** - A written, detailed document to ensure consistency in the execution of the review.

Phase 2 – Conduct Review

- **Searching the Literature** – A detailed description of the literature search,
- **Select Primary Cases** - Description of the reasoning of excluded and included studies,

- **Quality Appraisal** - Description of the criteria for judging which articles are of insufficient quality to be included in the review synthesis,
- **Data Extraction** - Systematically extract the applicable data from each study.

Phase 3 – Execution

- **Data Analysis** - Combining the facts extracted from the studies using quantitative and/or qualitative techniques,
- **Writing the review** - Reported in sufficient detail that the results of the review can be independently reproduced.

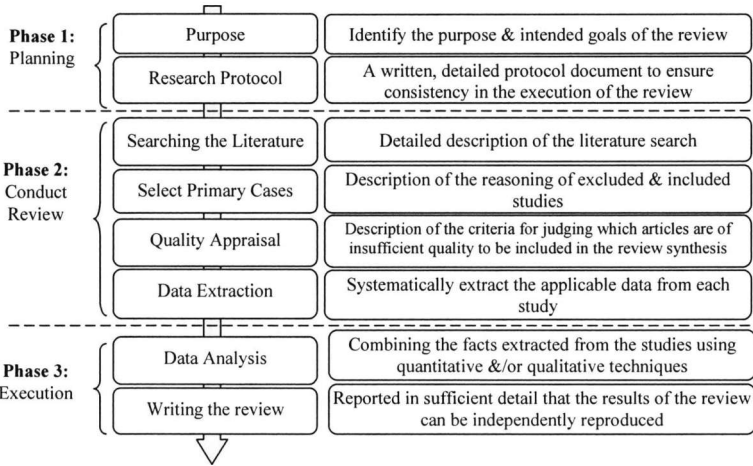


Figure 2.4: A Systematic Literature Review Plan [Adapted from Brereton et al., (2007)]

Thus, the researcher adapted the aforementioned approaches of Cooper (1988) (for the categorisation) and Brereton *et al.*, (2007) (for the planning) to construct a rigorous and comprehensive literature review. Further details on the issue is illustrated in the next section.

2.5.4 Analysis of SOA Governance Literature Review Methodology and Plan

Following Cooper’s (1988) approach, the researcher took decisions and focused on specific categories (presented in Table 2.8). In more detail, as the purpose of this research was to investigate SOA Governance, the interest was placed on discovering published research regarding SOA Governance models/frameworks and all the related knowledge supporting such research. Thus, the Focus (characteristic) of the literature review was placed on: (a) reviewing SOA Governance frameworks/models, (b) evaluating existing SOA Governance models, (c) identifying limitations – problems of these models, (d) propose a new SOA Governance framework that overcomes existing limitations and problems and (c) testing and

evaluating the proposal. The second characteristic (Goals) of the literature review was to integrate the propositions and bridge the gap between the theoretical perspectives, providing a common, well structured base of understanding (e.g. framework). Also, to criticise the findings and provide central issues that needed to be highlighted. The Perspective (third characteristic) of the review was neutral and the researcher did not reflect towards a certain position, as this provides free thinking and reflects bias. The Coverage (fourth characteristic) of the review can be characterised by two categories, exhaustive with selective citations at first and representative as the main part. In more detail, even though the literature was rigorously examined, only the representative and more mature approach was used for analysis and criticism. The methodology and details of the literature review can be seen, in detail, in the next section. The literature review was Organised (fifth characteristic) conceptually, so works relating to the same abstract ideas were grouped together. Finally, the literature review was created with emphasis on an IS literate Audience (sixth characteristic) but written in a style and detail that can be comprehended by a wider spectrum of readers.

Following Brereton *et al.*, (2007) proposition, this thesis now presents the three phases and eight stages of the literature research in the following paragraphs:

Phase 1- Planning

- **Purpose** - The purpose of this literature review is focused on discovering SOA Governance frameworks and its goal was to integrate the identified frameworks and bridge the gap between the theoretical perspectives, proposing a common framework.
- **Research protocol** - As this review is conducted only by the researcher there is no need to distribute the standards set for this review. Thus, the use of a research protocol is narrowed to a documented definition of the review process. This document is revised through the process of the research accordingly.

Phase 2 – Conduct Review

- **Searching the Literature** – The researcher studies academic and non-academic works that were disseminated in various sources, like: journals, conferences, books, workshops, vendors' websites, blogs, white papers, ongoing work, newsletters etc. Numerous literature findings is identified with the researcher paying more attention to peer-review articles published in academic journals and conferences. This is in accordance with the international research academic tradition and practice (this issue is further addressed on the next section). In more detail, the contents of eight databases were researched by the researcher using the keywords: “Service oriented architecture governance”, “SOA Governance” and “SOA Governance models/frameworks”. The research was based on a Title/Abstract/Keywords field search. The results are presented in Table 2.8. The second

column refers to the database name, the third to the coverage of the database results, the fourth to the number of results (hits) presented by the database research system, the fifth to the results (propositions) considered and the sixth to the number of the final propositions selected by the researcher for analysis (after a quality appraisal, details of which are presented in the next stage).

No	Database	Date	Results	Considered	Selected
1	IEEEExplore	2005-2011	82	9	5
2	AISeL	2008-2010	49	6	4
3	SpringerLink	2004-2010	104	1	1
4	Google Scholar	2004-2011	987	22	2
5	ACM	2006-2010	55	3	1
6	ScienceDirect	2002-2011	2	-	-
7	Wiley Online Library	2002-2010	-	-	-
8	Palgrave Macmillan	2000-2010	-	-	-

Table 2.8: Literature Review Research Findings

Furthermore, based on Levy and Ellis (2006) proposition, the researcher conducts a backward and forward reference research. The backward reference search provides researchers with the ability to learn more about the origins of the construct, theory, or model under study. While the forward reference search of any new (e.g. following in time the one identified) publication(s). Following these methods, the researcher firstly researched the databases using the author's name as keyword and the “references of references”. Additionally, a forward search was conducted. Using a forward author's search the databases were searched to retrieve what the authors published over time. In addition, the researcher through emails with some of the author’s explaining the research goals and asking them to share information about their article/research progress or newly published materials, opened a communication channel.

The result of this effort was a combination of positive replies (emails including new or even unpublished material), negative (the authors changed their research agenda and couldn't contribute with anything else), or no reply. Furthermore, in the process of searching for valuable material a wide IS specialists and researchers group's (AISnet/aisworld) communication channel was utilised. In more detail, a direct question on two occasions was placed (the question was published in a newsletter) explaining the goal, the research interest and asking the members of that group for advice and material regarding SOA Governance. The results of that approach did not produce new material (response included articles already found in databases). Also, an interest group was

created both in a wider social group (Facebook²) and in a specialised academic social group (Mendeley³), with limited results.

- **Select Primary Cases** – The screening of the literature was done following the guidelines placed as part of Phase 1 (e.g. purpose of research). In doing so, only the papers satisfying the purpose of this research were selected to be rigorously examined. In more detail, examples of non-selected papers include:
 - **Papers with limited scope** - focusing only on a specific part of SOA Governance such as: Test Governance (Bertolino and Polini, 2009), policies (Sangroya *et al.*, 2010), and service identification (Boerner and Goeken, 2009). While these papers were studied as part of this thesis, their value is to be used in support to the conceptualisation but not as a basis for the creation of the framework, as they provide a limited scope on SOA Governance.
 - **Unpublished work available from non academic sources** – examples of these are: white papers (Varadan *et al.*, 2008), vendors’ approaches (Brown *et al.*, 2006; Tilley and Smith, 2010), books (Josuttis, 2007) and technical approaches (Strnadl, 2007). While these papers were studied as part of this thesis, their value is to be used in support but not as a basis for the creation of the framework.
 - **Work published in non-English language** - papers in different languages as German (Kohnke *et al.*, 2008) were examined, but due to unavailability of accurate translation were not included as part of this review.
- **Quality Appraisal** – As reported above, peer-reviewed articles published in academic journals and conferences, were utilised. Peer-review continues to be the most appropriate way for judging academic publications and it ensures that researchers can use published work with confidence, and use the works of others as stepping stones and corner stones for advancing new concepts and insights (Davison *et al.*, 2005). The view of utilising peer reviewed articles is established by academia and considered an international academic tradition and practice and, thus, it was employed by the researcher (vom Brocke *et al.*, 2009a; Willcocks *et al.*, 2008).
- **Data Extraction** - Each of the remaining studies (after the selection and quality appraisal) that were included in the review was used to systematically extract SOA Governance related data. This, will be presented in the following Section 2.5.5.

Phase 3 – Execution

- **Data Analysis** - In this stage the facts from the studies using appropriate qualitative and quantitative techniques, were extracted. Qualitative methods were chosen to investigate

² <https://www.facebook.com/pages/SOA-Governance/120078468074879>

³ <http://www.mendeley.com/groups/2086463/soa-governance/overview/>

each aspect of SOA Governance and the theory supporting the proposition (model/framework). Quantitative methods were chosen to observe the frequency that each aspect was reported and thus elaborate on what the authors (of the selected cases) consider common issues.

- **Writing the review** – These sections (2.5.2 - 2.3.5) constitute the report of the literature review.

2.5.5 SOA Governance Literature Review Primary Cases

Based on the above methodology, fourteen primary cases were selected. These are listed in Table 2.9, where its first column refers to the author, the second to the database the article was retrieved from, the third to the name of the Journal/Conference the publication was made, the fourth to the title of the article. The next columns (fifth to seventh) represent the ranking of the primary cases in a null (-), low (○), medium (◐), high (●) scale similar to the scale used by Miles and Huberman (1994). The criteria upon which the ranking is based are: (a) the literature review, (b) the proposed model/framework and (c) the evaluation of the proposition. The three criteria were selected as they represent the basic structure elements of academic papers and thus can aid in the comparison of the selected primary cases. In more detail, the literature review is distinguished into the Methodology (M) applied to create the literature review and Analysis (A) of the review process. The model/framework is addressed by the Design (D) process applied to create the model and Analysis (A) of the model itself. The evaluation of the model/framework refers to the presence of a Methodology (M) to test the proposition and the Results (R) of such testing. For example, the methodology applied to create the literature review is characterised low if only the number of articles used to perform is presented in the article, or high if a detailed account is presented.

From this point on the researcher will use the term model to refer to the propositions (models, frameworks, propositions) as the authors did not use the same terminology. In doing so, the researcher simplifies the presentation of these models and creates a common point of reference.

Authors	Database	Journal/Conference	Titles of articles	Literature Review		Model / Framework		Evaluation	
				M	A	D	A	M	R
Beimborn <i>et al.</i> , (2009)	AISeL	Americas Conference on Information Systems	The Role of IT/Business Alignment for Achieving SOA business Value – Proposing a Research Model	-	o	o	o	-	-
Bernhardt & Seese (2009)	Springer Link	Service-Oriented Computing – ICSOC 2008	A Conceptual Framework for the Governance of Service-Oriented Architectures	-	•	•	•	-	-
Hojaji & Shirazi (2010a)	IEEE Xplore	2nd IEEE International Conference on Information Management and Engineering	Developing a more comprehensive and expressive SOA Governance framework	-	•	-	o	X	-
Hojaji & Shirazi (2010c)	IEEE Xplore	6th World Congress on Services	A Comprehensive SOA Governance Framework Based on COBIT	-	o	•	•	-	-
Hojaji & Shirazi (2010b)	IEEE Xplore	3rd IEEE International Conference on Computer Science and Information Technology (ICCSIT)	AUT SOA Governance: A new SOA Governance framework based on COBIT	-	•	•	•	-	-
Janiesch <i>et al.</i> , (2009b)	AISeL	17th European Conference on Information Systems 2009	Towards a Service Governance Framework for the Internet of Services	-	•	o	•	-	-
Janiesch <i>et al.</i> , (2009a)	Google Scholar	20th Australian Conference on IS	Conceptualisation and facilitation of SOA Governance	-	•	o	•	-	-
Janiesch & Korthaus (2010)	Google Scholar	21st Australasian Conference on Information Systems	Validation of a generic Service Governance Meta Model on the comparison of major Governance Frameworks	-	•	o	•	-	-
Niemann <i>et al.</i> , (2008)	AISeL	Fourteenth Americas Conference on Information Systems	Towards a generic Governance Model for Service-Oriented Architectures	-	•	o	•	-	-
Niemann <i>et al.</i> , (2009a)	IEEE Xplore	3rd IEEE International Conference on Digital Ecosystems and Technologies	Challenges of governance approaches for service-oriented architectures	-	•	-	o	-	-
Niemann <i>et al.</i> , (2009b)	AISeL	15th Americas Conference on Information Systems	Towards a Consistent Lifecycle Model in Service Governance	-	o	o	•	-	-
Niemann <i>et al.</i> , (2010)	Google Scholar	International Journal of IT/Business Alignment and Governance	Structuring SOA Governance	-	•	•	•	-	-
Scheepers <i>et al.</i> , (2008b)	ACM Digital Library	ACM symposium on Applied computing	A lifecycle approach to SOA Governance	-	o	-	•	-	o

Table 2.9: Literature Review Primary Cases

Apparently, the thirteen selected articles were the work of six individual authors' groups, who are individually presented in the following Sections 2.5.5.1- 2.5.5.6. These sections include a brief description of each proposition and the elements of each model. The commonalities, differences and critical analysis of the articles (Sections 2.5.5.1 - 2.5.5.6) as a whole is presented in Section 2.5.6.

2.5.5.1 *Beimborn et al., (2009) Model*

This article introduces a conceptual model that derives suggestions about the influence of SOA on flexibility and alignment (Beimborn *et al.*, 2009). While the authors do not focus directly on the development of a SOA Governance model they addresses SOA Governance and discuss such a model's elements. This suggestion is not the result of a literature review nor it is based on a literature review methodology, yet they identify three main elements within SOA Governance, namely: (a) processes, (b) structures and (c) employees, as shown in Table 2.10. The first column provides the element, the second the description given by the authors for each element, the third the sub-elements and the fourth the attributes given to each sub-element. Moreover, the authors report that SOA Governance processes: (a) deal with the management of the service life-cycle, (b) ensure that services are designed properly and (c) SOA will deliver the features required of an organisation (Beimborn *et al.*, 2009). For the second element, they point out that SOA Governance requires organisational elements such as a Centre-of-Excellence (CoE), committees, roles and policies to be governed. Moreover, it is their view that the CoE should consist of: (a) SOA experts, (b) business domain owners and (c) committees staffed with experts from both IT and business. In addition, they mention the link of employees with the notion of SOA. The authors' understanding is that employees are linked with concerns as skills and knowledge, that under SOA refer to both IT and business perspectives. Besides, they mention that this notion of employees with specific skills and IT/Business orientation can act as an organisational structuring (e.g. Service Oriented Architecture) and can serve as a link between business and IT, bridging the cultural gap between business and IT, bringing IT closer to their business "customers" (Beimborn *et al.*, 2009).

Elements	Description	Sub-elements	Attributes
Processes	Deal with the management of the service life-cycle, ensure that services are designed properly and ensure SOA will deliver the features required of an organisation	-	-
Structures	SOA Governance requires organisational elements such as a Centre-of-Excellence (CoE), committees, roles and policies to be governed	CoE	Consists of SOA experts as well as business domain owners
		Committees	Staffed with experts from both IT and business
		Councils	A cross - unit structure that gathers and analysed business requirements
		Roles	IT/Bussiness liaison
Employees	Holding IT and business knowledge can act as an organisational structuring method	Skills/Knowledge	-

Table 2.10: Elements of Beimborn et al., (2009) Model

Summarising the aforementioned model, it can be stated that the authors' SOA Governance model is clearly described alongside the three elements representing it. However, the authors do not proceed to analyse the elements in detail, neither illustrate the association(s) between them. Moreover in this article, the authors do not validate their SOA Governance proposition, thus no methodology and/or results, are presented for such process.

2.5.5.2 Bernhardt and Seese (2009) Model

This article presents a reference model for SOA Governance based on the OASIS⁴ Reference Model for SOA. The article contains a literature review analysis upon which the model's basic elements are derived. However the methodology utilised to carry out the literature review analysis is not included in this publication. Nevertheless, the authors propose a model with five elements, namely: (a) organisational structure, (b) governance process, (c) governance policy, (d) metrics and (e) SOA Governance infrastructure, as summarised in Table 2.11. The first column presents the element's name, the second the description given by the authors for each element, the third the sub-elements name and the fourth the construct given to each sub-elements. In more detail, the authors propose that the organisational structure for SOA Governance may comprise units like: (a) SOA Governance board, (b) SOA program office and (c) councils. The responsibilities of these structures, as stated by the authors, are to structure a roadmap and to govern the introduction and operation of SOA. Moreover, they discuss that taking into account best practices these organisational structures define governance policies, execute governance processes and employ metrics to measure adherence to them. Bernhardt and Seese (2009) emphasise that governance policies comprise rules that on a high level address all aspects that are important in developing, deploying and

⁴ Organization for the Advancement of Structured Information Standards(OASIS) is a not-for-profit consortium that drives the development, convergence and adoption of open standards for the global information society.

managing SOA, that is, the SOA lifecycle. According to the authors these governance policies and their enforcement are the main part of SOA Governance processes. Thus, mechanisms enabling policy enforcement have to be established, as enforcement can either be achieved manually (e.g. by a design review), or automatically (e.g. by a SOA management system). Respectively metrics can be established. Metrics can provide visibility into the processes allowing for supervision, control, and identification of areas for improvement. In addition, Bernhardt and Seese (2009) propose the utilisation of a SOA Governance infrastructure which can manage governance information, enforce governance policies, and collect corresponding metrics.

Elements	Description	Sub-elements	Attributes
Organisational structure	Have to be established to govern the introduction and operation of SOA	SOA Governance board	<ul style="list-style-type: none"> • Main governance body of the SOA initiative • Composed by specialists from business-IT • Decision making ability • Takes into account standards, best practices, laws • Defines governance policies • Defines metrics • Sets roadmap • Influence decisions on project prioritization and funding
		SOA program office	Main organisation management body, responsible to set up the councils, distributes roles but reports to the governing board.
		Councils	Empowered by the governance board to make decision regarding processes and policies
Governance process	Are the means to realise the governance policies	Policy related processes	Responsible for the definition, propagation, education and enforcement of governance policies
		Approval, review and reporting	<ul style="list-style-type: none"> • Policy enforcement • Providing feedback to the governance board
Governance policy	Comprise rules for developing, deploying and managing a SOA, (e.g. SOA lifecycle)	Enforcement	<ul style="list-style-type: none"> • Manually (e.g. by a design review), • Automatically (e.g. by a SOA management system)
Metrics	Improve transparency and provide visibility of essential states and parameters of the SOA initiative	Services	<ul style="list-style-type: none"> • How many services exist in total, • Have been proposed, are being developed, are published, and are actually consumed. • Numbers of changed, deprecated and retired services, • Information on the number of consumers per service and service version
		Service operations	<ul style="list-style-type: none"> • Number of successful vs. the number of erroneous interactions, • Performance KPI's, • Service level and security violations are also important to report
		Projects	Feedback on the number of successful and failed projects and the reasons for both failure and success
SOA Governance infrastructure	Manages governance information, automates governance processes, enforces governance policies, and collects metrics	Registry	Helps to maintain overview of existing services and to manage administrative information such as service lifecycle states
		Repository	Assists on the management of design artifacts and acts as a data type inventory
		Policy & contract management	Helps to define and document policies, attach policies to artefacts, and to propagate policies to their respective points of application
		Quality management system	Support testing complete service compositions, as well as impact analysis in case of service changes, taking into account dependencies between services
		SOA management system	Facilitate service administration (e.g. lifecycle transitions) and monitoring

Table 2.11: Elements of Bernhardt and Seese (2009) Model

In this article the design of the SOA Governance model is sufficiently presented and analysed. However, the model was not evaluated and thus both methodology and results of such process are not present in this article.

2.5.5.3 *Hojaji and Shirazi Model*

Initially these authors provide a literature review synopsis and produce a list that can be used to form a SOA Governance framework. This list/framework contains elements, such as: (a) Governance structure, (b) Service portfolio management, (c) Service lifecycle management, (d) Governance lifecycle management, (e) Monitoring and evaluation process, (f) SOA artefact management, (g) Governance performance assessment metrics, (h) SOA maturity, (i) SOA roadmap and (j) Best practice (Hojaji and Shirazi, 2010a). However, only a brief overview is presented for each element without detailed justification. For example, the authors do not provide any references of where the SOA Governance structure and best practice elements' overview was based on. Nevertheless, the elements, as they describe them are presented in Table 2.12, with the first column presenting the element's name, the second the description given by the authors for each element, the third the sub-elements name and the fourth the attributes attached to each sub-elements.

Elements	Description	Sub-elements	Attributes
Organisational structure	-	SOA Governance boards/Councils	-
		Roles/responsibilities	-
		Skills/Training	-
Service portfolio management	Enables the organization to decide which services need to be developed and how the necessary investments are prioritized for integrating of legacy systems in SOA	-	-
Service lifecycle management	Manages the lifecycle of an IT service, from planning and optimizing the IT service through the design and delivery of the IT service, to its operation and support	-	-
		-	-
		-	-
Governance lifecycle management	Policy compliance around the service lifecycle is one of the key considerations in SOA Governance. So by combining service and governance lifecycle with policies, a flexible governance system is created	-	-
		-	-
		-	-
Monitoring and evaluation processes	A governance model needs these processes to address performance management and internal control monitoring	-	-
SOA Artefacts management	SOA artefacts consist of services, policies, contracts, metadata and related SOA assets, such as XML schemas. Artefacts and policy management are governance capabilities in technical infrastructure governance	Registry	-
		Repository	-
		Policy management tools	-
Governance performance assessment metrics	Metrics must be established and regularly monitored to measure business agility, processes efficiency and performance of governance processes and activities	-	-
SOA maturity	This assessment provides a detailed analysis of SOA environment, including the relationship between business and IT infrastructure, SOA structure, processes, mechanisms and governance	SOA maturity model	Evaluates the organization and assists in the understanding of the SOA maturity level
SOA roadmap	Is a program based upon the current and target SOA and SOA Governance maturity assessments and provides an incremental SOA adoption	Transition plans	<ul style="list-style-type: none"> • Transformation initiative • Deliverables, • Resources needed • Costs • Estimated time scales • Project dependencies • Risk considerations
Best practice	Capturing and managing standard best practices of successful SOA implementations, and applying them into a comprehensive approach can be effective to provide an acceptable and affirmative framework	-	-

Table 2.12: Elements of Hojaji and Shirazi (2010a) Model

Based on the aforementioned elements, but following an unclear process (lack of analysis and justification) the authors produce a model (named AUT SOA Governance) with three domains, namely: (a) Process (including the service lifecycle management and governance lifecycle management elements, mentioned in Table 2.12) (b) Management aspects (process guidelines, policies, objectives, etc.) and (c) Maturity model, as these are presented in Table 2.13 (Hojaji and Shirazi, 2010c). The Table 2.13 starts with the first column representing the domain, the second the model's element name, the third the sub-element (if any) and the fourth the attributes, as these are described by the authors. The AUT SOA Governance, is assembled using: (a) three framework elements (service lifecycle management, governance lifecycle management elements and maturity model, as seen in Table 2.12), (b) COBIT and (c) ITIL. For the first element the authors present a brief overview of the process domain, both for the service and governance lifestyle. They also mention that the presented process domain, includes more process identified from COBIT, without reporting if these should be added or excluded. Moreover, the presentation of the process management aspect is unclear and confusing. The authors for this domain report several attributes (as seen in Table 2.13) stating that they listed these for every of the 28 process (e.g. attributes of the process domain) they identified, but do not provide any justification of their use, connections with other SOA Governance elements and details. Nevertheless, they describe the third domain, the SOA maturity model. To illustrate this description they list six dimensions (e.g. organisation, governance, etc.) against five levels (initial, managed etc.) as these are presented in Table 2.13. Yet the authors do not explain further the SOA maturity model but state that such a detailed description will follow in future publications.

Domain	Elements	Sub-elements	Attributes
Process	SOA service lifecycle	Service strategy	<ul style="list-style-type: none"> • Solution portfolio management • Service portfolio management
		Service design	<ul style="list-style-type: none"> • Service Modeling • Service Level Management • Service Capacity Management • Service Continuity Management • Security Management • Service Availability Management
		Service transitions	<ul style="list-style-type: none"> • Service Assembly • Service Testing and Validation • Service Deployment • Change Management • Configuration Management
		Service operations	<ul style="list-style-type: none"> • Event Monitoring and Management • Data Management • Infrastructure and Service Support
	Governance lifecycle	Plan	<ul style="list-style-type: none"> • Define a SOA Strategic Plan • Manage Financial and SOA Investment • Manage Communication and Direction
		Define	<ul style="list-style-type: none"> • Define Transition Plans • Define SOA Reference Architecture • Define SOA Processes • Organization and Relationships
		Implement	<ul style="list-style-type: none"> • Implement Transition Plans • Enable Operation and Use
		Measure	<ul style="list-style-type: none"> • Monitor and Evaluate Performance • Manage Policy Compliance
Management aspects	Suite of process management guidelines	28 Processes	<ul style="list-style-type: none"> • Description • Key activity goals • Activities • Inputs/outputs • Roles/responsibilities/ Responsible, Accountable, Consulted, and Informed (RACI) chart • Policies • CSFs • Control objectives
Maturity model	Dimensions	-	<ul style="list-style-type: none"> • Organization • Process • Governance • Service and Service management Architecture • Infrastructure • Business View
	Levels	-	<ul style="list-style-type: none"> • Initial • Managed • Defined • Quantitatively Managed • Optimizing

Table 2.13: AUT SOA Governance Model Hojaji and Shirazi (2010b; 2010c)

The AUT SOA Governance model was not empirically tested and thus both research methodology and results were not reported in this paper. Hojaji and Shirazi (2010b) add a comparison of their model against the qualitative criteria retrieved from the literature. The criteria, the methodology, the structure of the assessment and the findings, are unclear, detached from literature and lack sufficient explanation that could validate such comparison.

However, the authors propose future research based on case studies that could potentially verify their model.

2.5.5.4 Janiesch et al., (2010; 2009a) Model

In this article, the authors show a model that consists of three main domains, such as: (a) Processes, roles and other essential attributes, (b) Views and indicators and (c) Company-specific information, as seen in Table 2.14. The first column of the table depicts the domain name, the second element, the third a short description of the element, the next column the sub-element and the last the attributes (if any). In more detail, the authors, in (a) provide the essential constructs of any governance model like: process, roles, metrics, tools and artefacts. At (b) the authors present the non-essential attributes which add value to the model, but are not indispensable for an operationalised SOA Governance model, like: maturity model and management process. While in (c) they address company-specific information that are not part of any framework as such, but provide the necessary alignment to the overall corporate governance. For the creation of the model the authors, as stated, used empirical insights gained through the validation of an earlier version of the meta model. This process is not further documented, analysed or grounded in any research methodology. Nevertheless, the authors illustrate the connections between the elements of the model as follows: (a) the maturity level, phase, management layer, focus area, tool, skill, artefact, goal/KPI/metric and roles are all connected to process, (b) tool and person/employee are connected to the skill, (c) goal/KPI/metric and position are connected with roles and (d) roles are also connected with artefacts.

Domain	Element	Description	Sub-elements	Construct
Processes, roles and other essential attributes	Process	De-/ prescribe procedures to ensure the desired operation of an organisation	Sub-process	-
	Roles	Linked to processes a number of roles are created	<ul style="list-style-type: none"> Responsibilities RACI 	-
	Artefacts	Created by roles and restricted (read, write, delete) to specific roles	<ul style="list-style-type: none"> Documents (status updates) Roadmaps Architecture diagrams 	-
	Goal or key performance indicators	Each process has specific goals or KPIs	<ul style="list-style-type: none"> Metrics 	<ul style="list-style-type: none"> Collected through monitoring
	Tool/Method	Used to convert the input artefact to the output artefact which is handed over to the subsequent process	-	<ul style="list-style-type: none"> Pen and paper Software
	Skills	Skills are attached to roles	-	<ul style="list-style-type: none"> Process requirements Tool requirements
Views and indicators	Maturity model	Measure the maturity of a system concerning a structured set of aspects	Levels	<ul style="list-style-type: none"> Initial, Repeatable but intuitive, Defined, Managed and measurable, Optimised
	Model	The governance model as such (e.g. COBIT, ITIL) is related to its processes through phases	Phases	<ul style="list-style-type: none"> Planning Implementation Delivery Monitoring
	Management layer	Used to attribute processes to different organisational entities	-	-
	Focus area	Describe the topics that executive management needs to address within their enterprises	-	-
Company-specific information	Company	Consists of several organisational units	-	-
	Organisational unit	Offers several positions	-	-
	Position	Correspond to one or multiple roles	-	-
	Person/employee	Holds one of these positions	-	-

Table 2.14: Janiesch et al., (2010; 2009a) Model

Janiesch et al., (2010) proceed to validate their approach by mapping their model against other IT and governance frameworks (non-academic publications). For this assessment they used the parts/elements of their generic model as criteria without justifying this process and/or the value of the comparison results.

2.5.5.5 *Niemman et al., (2008; 2010) Model*

The authors, in these publications, discuss issues surrounding SOA Governance, investigate and compare different approaches, identify common concepts, and derive a generic model for SOA Governance. The model is discussed and presented in two version Niemman *et. al.*, (2008; 2010) with the one supplementing the other. The summary of parts utilised for this model (for both propositions) is presented in Table 2.15. The first column contains the domains of the model and the second to fifth column shows the elements, sub-element and attributes respectively. In these articles the literature review methodology is not present but the authors analyse the literature in order to synthesise their arguments. In this respect, they describe the main domains of the SOA Governance model, namely: (a) SOA goals, (b) control cycle and (c) SOA as enterprise architecture. The first domain includes elements such as: (a) SOA compliance (compliance to legal, technical and internal regulations), (b) Business IT-Alignment, a goal defined as the best possible integration of IT processes in the business environment and (c) Reliable long-term planning a goal that results from due diligence management of SOA.

The authors present this model in a clear, easy-to follow structure, that provides only the essential (as they describe) means. In more detail, the authors report on the SOA Governance goals as the overall goals for SOA Compliance, Business-IT Alignment and reliable long term operation. Whereas, the SOA System as enterprise architecture represents the IT system to be controlled. Then, the authors discuss that such a system consists of SOA processes (e.g. Service production, operation, maintenance, etc.), business process and the technical backbone (e.g. ESB).

Furthermore, they present the SOA Governance Control Cycle, which includes organisational entities, governance policies, a best practices catalogue, compliance observation and enforcement techniques, and a SOA maturity measurement component. For the next domain (e.g. control cycle) the authors include seven main elements with various sub-elements and attributes. They provide the phases of the cycle, such as: (a) planning (during this phase initial attributes like plans, roles, responsibilities etc. are created), (b) design (during this phase the SOA policies and metrics are defined), (c) realisation (this phase consists of the installation of the governance mechanism like metrics and policy enforcement and (d) operation (phase in which process is evaluated and policies amended accordingly) (Niemann *et al.*, 2008). The second element of this domain is the organisational entities with sub-elements, such as: (a) SOA boards (in charge of defining and abolishing policies, maintaining best practices and analysing the feedback from metrics), (b) Centre-of-Excellence (staffed with members from

both business and IT, infused with upper management support and similar to the board activities) and (c) roles and responsibilities (placed in accordance with SOA Governance). The next element is the metrics, implemented to define and assess the goals and provide feedback regarding the adherence to policies. The fourth element, is named best practices and refers to external and internal experiences and available recommendation regarding SOA Governance and policies. The sixth element, policies, is divided into two sub-elements: (a) aspects (like architecture, technology etc.) and (b) areas (like security, run and design time, etc.). Next on is the SOA maturity element which is linked to metrics and goals. The third dimension, SOA as an enterprise architecture, contains the sum of all processes and the technical backbone (like registry, repository and ESBs).

This model covers a wide extent of the challenges surrounding SOA Governance but in the process of providing a simple, generic model the authors refrained from including all the SOA issues identified as part of their research. SOA roadmap for example based on the authors literature review is identified as a common issue, but not represented in their model, nor justified why such a decision was taken. Additionally, the proposition is not empirically tested and thus nor the methodology or the results of such process are included in this article.

Domain	Elements	Sub-elements	Attributes
SOA goals	Overall Goals	SOA compliance	<ul style="list-style-type: none"> • Legal • Normative (technical) • Internal regulations
		Business-IT alignment	-
		Reliable long-term operation	-
Control cycle	Phases	Planning	<ul style="list-style-type: none"> • General SOA requirements • Decisions / specifications • Responsibilities, roles and skills • Organizational structures • Services ownership • Funding models • Initial governance framework
		Design	<ul style="list-style-type: none"> • SOA policies • Metrics
		Realization	<ul style="list-style-type: none"> • Governance mechanisms • Processes are activated
		Operation	<ul style="list-style-type: none"> • Processes are evaluated • Policies (redefined, changed, or abolished)
	Organisational entities	SOA boards	<ul style="list-style-type: none"> • Define/ abolish governance policies • Maintain best practices • Gets feedback from metrics
		Centre-of-Excellence	<ul style="list-style-type: none"> • Members from both IT and business • Upper management support • Definition, adjustment, abolishment and enforcement of governance policies • Consults the best practices • Gets feedback from SOA maturity measurement
		Roles/responsibilities	-
	Metrics	<ul style="list-style-type: none"> • Types (Business, Process, Performance, SLAs, Conformance) 	<ul style="list-style-type: none"> • Align/ assess with goals • Provide feedback of adherence to policies
	Best practices	-	<ul style="list-style-type: none"> • Collects experience • Support for the creation of new policies • Maintained by the organisational entity
	Policies	Aspects	<ul style="list-style-type: none"> • Architecture • Technology • Organization • Portfolios • Information • Project execution
		Areas	<ul style="list-style-type: none"> • Security • Cross-company cooperation • Design-time • Run-time • Finance
SOA maturity measurement	Maturity level	<ul style="list-style-type: none"> • Linked to metrics/goals • Provides feedback 	
SOA as an enterprise architecture	Processes	<ul style="list-style-type: none"> • Business • SOA 	
	Technical backbone	<ul style="list-style-type: none"> • Registry • Repository • ESBs 	

Table 2.15: Elements of Niemman et al., (2008; 2010) Model

2.5.5.6 Schepers et al., (2008b) Model

In this proposition, the authors do not reveal the process used to perform the literature review but they provide analytical justification of SOA Governance issues based on literature. In more detail, the authors propose a lifecycle approach to SOA Governance and its relative

aspects accordingly. In more detail, they propose six phases, such as: (a) create SOA strategy, (b) align the organisation, (c) manage service portfolio, (d) control service lifecycle, (e) enforce policies and (f) manage service levels. In the first phase the authors emphasise on transforming the business vision into strategic SOA goals and assigning specific roles to stakeholders (using a Responsible, Accountable, Consulted, and Informed method). In the second phase they mention the creation of SOA Governance bodies like CoE, that manage the different service domains (e.g. process, product, geographical and functional). The third phase as reported in this proposition, is the portfolio management phase in which the decisions on which services will be developed is taken (the authors propose a top-down approach that is easy to govern). The fourth phase concerns the development and delivery of services and the utilisation of SOA Governance technology (e.g. service registries and repositories). The authors in the fifth phase, place the policies and policy enforcement issues. These are business rules that pose constraints on the way that services are developed and used and can be separated in design-time (before use) and run-time (during their use). Also, the authors mention the supportive role of infrastructure tooling (e.g. ESBs) in the enforcement of policies, which then can control and monitor the services. The sixth phase is based around service level management (e.g. SLAs) and Quality of Services and the importance of clear specifications surrounding those issues. In addition to the model the authors also provide a maturity model outline. In this, the six phases of the model are mapped against business maturity levels (e.g. pioneer, department, enterprise and network). This provides a good view of the use of such models, but a practical challenge as the model can be adopted only in conjunction with the proposed phases, thus it is impractical.

As part of this proposition, a field study was carried out, but no details or methodological research was presented. The authors mention that they have collected information from projects in the government, manufacturing and banking sector, as well as from an SOA tool vendor. They briefly report that they took interviews, set up to investigate the impact of the projects and to find out to what extent the proposed phases (of their SOA Governance lifecycle model) are present in projects. As a result they conclude that although all the issues they have included in the SOA Governance lifecycle method have been recognised as being relevant, the interviews have revealed that there was no immediate necessity to apply them to the current SOA projects as the selected projects were narrow in scope and complexity.

Elements	Description	Sub-elements	Attributes
Create SOA strategy	Defines a strategic direction in order to align the SOA with business requirements	Goals	<ul style="list-style-type: none"> Strategic Long term
		Roles	<ul style="list-style-type: none"> RACI
Align the organisation	Create SOA Governance bodies	CoE	<ul style="list-style-type: none"> Defines best practices Trains people Receives feedback Requires authority
Manage service portfolio	Ensures that a sound method is used consistently to decide which services need to be developed and how the necessary investments are prioritized	Service identification	<ul style="list-style-type: none"> Top-down Bottom-up
Control service lifecycle	Concerns the development and delivery of individual services in a SOA	Registries	<ul style="list-style-type: none"> Catalogue tools Manage the publication of services Define taxonomies of the published services
		Repositories	<ul style="list-style-type: none"> Auditing function Check the changes made to a service
Enforce policies	Ensure desirable behaviour and consistency of services	Design-time	<ul style="list-style-type: none"> Security mechanisms Compliance to data standards
		Run-time	<ul style="list-style-type: none"> Performance requirements
		Manual/Automated	<ul style="list-style-type: none"> Manually Tools (e.g. ESBs)
Manage service levels	Concerns the evaluation of services and their SLA contract	Quality of Service (QoS)	<ul style="list-style-type: none"> Service Level Agreement (SLA)
Maturity model	Governance requires alignment with the maturity of a SOA, thus a maturity model is needed	Levels	<ul style="list-style-type: none"> Capability Maturity Model Integration (CMMI)

Table 2.16: Elements of Schepers et al., (2008) Model

2.5.6 A Governance Literature Review – Concept Map

The literature review in the previous sections indicates that all the authors’ intentions are focused on: (a) reporting on the importance of SOA Governance, (b) defining important SOA Governance issues, (c) analysing to the extent possible, these issues (mainly using relative literature) and (d) synthesising these issues as elements of their proposition. However, while all the authors share the same focus not all address the same issues, go about them in the same way or consider them as valuable enough to be part of their SOA Governance proposition. This limits the option to adopt a single approach to address SOA Governance, as no single approach accumulates all the issues and/or addresses them in the same way. Additionally, as depicted throughout this review process (e.g. Sections 2.5.5.1-2.5.5.6) not all the models are structured in a clear manner, with sufficient justification and detail. Thus, as a measure to understand and exploit the primary cases, the researcher attributes a concept map of the literature.

A concept map can be described as a schematic tool for representing a set of concept meanings extracted from different propositions. It can be argued that a concept map is not just

a graphical representation of the concept identified in the literature. This argument is based on the method of constructing the map, which is more than a simple placement of the concepts in a figure, but a practice in which the researcher uses three processes: subsumption, progressive differentiation and integrative reconciliation (Ausubel, 2000). Moreover, in subsumption, lower-order concepts are subsumed under higher-order concepts. In progressive differentiation, concepts are broken down into finer and finer components. In this way, progressive differentiation is similar to the process of analysis. Finally, integrative reconciliation occurs when the researcher attempts to reconcile and link concepts. This is similar to the process of synthesis. In this case, the concepts are the SOA Governance elements, the lower-order concepts are the sub-elements and the finer analysis of those end to the attributes, as these were presented in Table 2.10 - 2.16. So as to clearly separate the elements, sub-elements and attributes the map is divided into three domains, as seen in the concept map's blueprint in Figure 2.5. The first domain represents the elements, the second the sub-elements and the third the attributes.

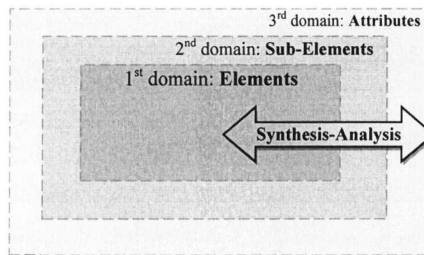


Figure 2.5: Concept Map Blueprint

All these are placed on the map, connected, analysed and synthesised, as depicted in Figure 2.6. The figure as in the blueprint is divided into three main domains, separated by dotted lines. The first (inner) domain are the main elements, namely: (a) organisational structures, (b) employees, (c) roles, (d) artefacts, (e) roadmap, (f) tool, (g) best practices, (h) policies, (i) SOA Governance processes, (j) SOA Governance infrastructure, (k) metrics, (l) goals and (m) maturity model. These main elements are connected amongst them but also extent to the second domain of sub-elements. For example the element 'organisational structure' defines, adjusts and abolishes 'policies', while 'policies' are defined with specific aspects and types and require 'enforcement'. The third (outer) domain is based on the attributes identified in literature and their association with the sub-elements. Following again the example of the 'policies' element who require 'enforcement', the 'enforcement' in the outer domain is divided into two types, namely: 'manual' and 'automated'. Finally, it is worth mentioning that each author is represented in the individual element, sub-element and/or construct by a

number, based on the following numbering order: (1) Beimborn *et al.*, (2009), (2) Bernhardt & Seese, (2009), (3) Hojaji & Shirazi, (2010), (4) Janiesch & Korthaus, (2010), (5) Niemann *et al.*, (2010) and (6) Schepers *et al.*, (2008b).

2.5.7 SOA Governance Literature Review Critical Analysis

In Section 2.5.5 an analytical view of the SOA Governance primary cases was presented. As mentioned, these cases are the result of a rigorous literature research based on academic criteria (illustrated in detail in Section 2.5.4). This process concluded with the creation of the SOA Governance literature review concepts map (seen in Section 2.5.6). The aim of this section is to critically review the body of the identified literature, with the aid of the graphical representation of the concept map (Figure 2.6), consequently review the authors' SOA Governance models.

Firstly, comparing the authors' models reveals that they hold *similarities*, these are expressed in the map, by including multiple authors in a concept. This representation aids in the understanding of the literature, as it provides a straightforward study of the various commonalities that exist. For example, almost all authors (e.g. Beimborn *et al.*, (2009), Bernhardt & Seese, (2009), etc.) identify the 'organisational structure' as a concept required to a SOA Governance approach. The same applies to concepts like 'roles', 'metrics' and 'SOA Governance processes'. This portrays that *common concepts* exist between the authors. Another similarity can be seen in the way, that some concepts are analysed throughout the phases of the map. For example, more than one author (e.g. Bernhardt & Seese, (2009), Schepers *et al.*, (2008b), etc.) analyse that 'policies' concept (first domain) requires 'enforcement' (second domain) which can be either 'manual' and/or 'automated' (third domain). This reveals that some authors follow the *same analysis* for certain concepts. Yet, to fully comprehend the similarities requires further investigation and analysis. This is a research issue that will be addressed in Chapter 3, as these common concepts will form the basis of the proposed SOA Governance framework of this thesis.

Nevertheless, examining the SOA Governance concept map also uncovers the *differences* that exist. One of the differences is that not all authors, mention all the concepts. For example the concept 'tool' was identified in only one model, presented by Janiesch & Korthaus, (2010). Another difference is the scale (the extent of space occupied and detail given) that each concept was given by the authors. For example out of the thirty five concepts of the second domain, twenty three of them are referred by no more than one author. This portrays that most of the authors did not provide analysis and/or details of their model's elements. The same applies to the concepts of the third (outer) domain in the concept map, with twenty two out of thirty nine being referred by no more than one author. This *lack of analysis* and detail is a *limitation* of many of the models. For example, it is the notion of five authors that 'roles' can play a vital part in SOA Governance, however no clear indication on which roles can be

introduced during a SOA endeavour or more precisely, are required for SOA Governance are given by any author. The same applies to other concepts as well, like the 'best practices', which is not analysed in detail as seen in Figure 2.6. Consequently, these differences, lack of analysis and limitations portrays that the existing body of concepts on SOA Governance requires further development and analysis, this will be presented in Chapter 3.

In addition, another limitation that is causing *confusion* regarding the aforementioned models is the *overlapping* of concepts. While, the map holds a degree of synthesis of all the models and the concepts identified by the literature review, the researcher refrained from incorporating similar elements, sub-elements and/or attributes as one concept. This decision was taken as to: (a) resemble the literature review findings as close to the original concept (e.g. given by the authors) as possible and (b) reveal the confusion regarding the overlapping of issues. For example, the concept 'tool' is presented as a software by Janiesch & Korthaus, (2010), but other authors like: Niemann *et al.*, (2010) and Schepers *et al.*, (2008b) identify SOA Governance infrastructure to be the application of software systems. In the same manner, 'employees' were identified by Beimborn *et al.*, (2009) and Janiesch & Korthaus, (2010), while other authors like Niemann *et al.*, (2010) and Schepers *et al.*, (2008b) incorporate the notion of the employee under the term 'organisational structure'. The same confusion is also evident for concepts of the second domain. For example, the authors indicate the need of an 'organisational structure' dedicated to SOA Governance with specific context and responsible for specific actions. However they propose two different structures, like the 'Centre-of-Excellence' (CoE) and 'Governance Board' (GB). It is not clear what is the difference between CoE and GB, as they overlap both in description and action elements. Additionally, confusion exists between the concept 'goals' as this is expressed as a first domain concept by Janiesch & Korthaus, (2010) and as a second domain concept linked to the roadmap by Niemann *et al.*, (2010). Another example of the confusion surrounding the analysis on the third domain is the concept of 'governance processes'. In this concept the authors recognise SOA Governance processes as the essence of SOA Governance, aiming at coordinating the different management processes and following a cycle in parallel with the one that services can follow but mix their analysis between the 'service' and 'governance lifecycle', as seen in Figure 2.5. The confusion surrounding the SOA Governance concepts as these are identified in the aforementioned normative literature (e.g. Figure 2.6) will be addressed in Chapter 3, as these concepts will form the basis of the proposed SOA Governance framework of this thesis and thus a clear conceptualisation is required.

Another limitation is that, the investigated propositions *lack of testing and evaluation* with empirical data. Only, Schepers *et al.*, (2008b) report undertaking a field study, but their

research lacks methodology, detailed account of research information and has resulted in limited findings, as SOA Governance was not reported as a necessity (due to the limited scope of the SOA projects investigated). The reasoning behind the absence of SOA Governance cases and empirical findings can be explained in the way that organisations perceive SOA Governance. As explained in Section 1.1.2 & 2.5.1, organisations are aware of SOA Governance, but they don't focus on it, or they decide not to include it in their initial plans (e.g. time constraints), or utilised traditional corporate/IT governance techniques that do not seem to provide the desired outcome thus the limited cases presented in literature so far (Beratarbide and Kelsey, 2011).

Another issue observed, was that all SOA Governance propositions were designed to facilitate a generic SOA endeavour, in any field of business. While the authors declared that this was a reasonable way to address SOA Governance, this thesis has emphasised that the healthcare sector is of high priority. Thus, addressing SOA Governance in healthcare and providing a successful way to implement SOA projects in healthcare requires more emphasis and research. This will be the subject of the next chapter.

2.6 Conclusions

This chapter focuses on the description of the HIS and on the need for integration utilising SOA. SOA approaches followed by healthcare organisations were described and their benefits have been identified using the literature. SOA benefits in healthcare include improvement in work efficiency, accessibility and interoperability of data, alignment of IT with business, satisfaction of customer demands and integration of legacy systems, to name a few. Additionally the researcher investigated the literature with a focus on the SOA CSFs in healthcare. This review produced a list of CSFs with the top ones to be: (a) governance, (b) SOA roadmap, (c) culture, and (d) standards.

These findings exposed that SOA Governance is of high priority regarding the successful implementation of SOA projects. Thus, the SOA Governance literature was rigorously reviewed and analysed, with relevant models presented. From this review several interesting findings were revealed.

Firstly, it was observed that the investigated models hold similarities in their conceptualisation. The researcher identified these similar concepts and expressed them as nine common elements required for SOA Governance. Namely these elements are: (a) Organisational structure, (b) Roles/Responsibilities, (c) SOA maturity models, (d) SOA roadmap, (e) SOA Governance infrastructure, (f) Policies (enforcement), (g) Metrics, (h) Best

practices, (i) Governance process. Despite the similarities no single SOA Governance model revealed to include all the common elements required to address SOA Governance. This normative literature gap exposed the need to propose a SOA Governance framework that includes all the identified elements.

Secondly, it was evident that the reviewed models lack conceptualisation and detail that causes confusion and overlapping of concepts. Thus, it can be argued that SOA Governance has not sufficiently been structured.

Additionally, the researcher reported that none of the models emphasised on healthcare organisations. The explanation for this is that SOA Governance is a new research area and still only generic propositions are created. Yet, it was emphasised in this Thesis that health care is an important sector, directly linked to the well-being of patients and requires research attention when addressing new research areas as SOA governance.

To address all the aforementioned open issues further research and development has to be conducted in this area. This research focuses on the development of a comprehensive SOA Governance framework that includes both the nine issues identified and the healthcare aspects. This approach will be presented in Chapter 3.

CHAPTER 3

CONCEPTUAL DEVELOPMENT

Summary

The previous chapter critically reviewed the normative literature on SOA Governance and highlighted open issues for further investigation. The main outcomes derived from Chapter 2 emphasise that: (a) the research in the area of Service Oriented Architecture in healthcare organisations remains limited, (b) there are various critical factors for the success of SOA projects, (c) SOA Governance is of high priority for SOA success and (d) the existing body of literature on SOA Governance in healthcare requires further development and testing. This literature void led the researcher to focus on the SOA Governance in healthcare area. Thus, in an attempt to address these issues, Chapter 3 conceptualises a SOA Governance framework. To achieve this conceptualisation the researcher uses the literature findings of the previous chapter to ground arguments and further analyse the area under study. This is done with a particular focus on the research aim of this dissertation, which is *“to study SOA Governance in healthcare organisations and develop a framework that can be used to support decision-making in SOA Governance”*, as stated in Section 1.3. The proposed framework attempts to contribute to SOA in general and to SOA Governance in healthcare in particular, as it provides an analysis of issues, such as: (a) detailed structure of the SOA Governance elements, (b) relations between the elements and healthcare, and (c) proposition of attributes and guidelines for healthcare organisations.

3.1 Introduction

In Chapter 2, a critical literature review of the Healthcare Information Systems' challenges was presented (see Section 2.2). Among others, these challenges included: (a) IT infrastructure complexity, (b) the non-integrated nature of HIS, (c) medical errors and (d) the lack of global service provision. Healthcare organisations invested in various integration approaches (e.g. EAI) to overcome these challenges. Yet, integrated technologies that have been employed by healthcare organisations have not shown great levels of adoption due to their barriers, like: (a) high costs, (b) resistance to change, (c) organisational issues, (d) high complexity, (e) large scale of change, (f) time consuming implementation and (g) politics issues. To this end, as stated in Section 2.3, the normative literature suggests that SOA can be used by healthcare organisations to overcome integration problems. SOA can be beneficial for healthcare organisation as it provides interoperability and integration of the legacy HIS (Daskalakis and Mantas, 2009). However, as explained in Section 2.4, healthcare professionals and SOA implementers ought to address SOA critical factors in operational, managerial and organisational areas, in order to gain the full spectrum of SOA benefits. In this respect, the literature highlights a significant factor that remains unexplored, the SOA Governance in general and the SOA Governance in healthcare in particular. Clearly, this is a literature void and forms an open research issue for further investigation.

SOA Governance is a research area with many issues (e.g. scope, model, attributes) uncharted. In an attempt to fill this literature void, this thesis, aims to carry out research on SOA Governance in healthcare organisations. In doing so, resulting in the development of a framework that can be used to support decision-making on SOA Governance issues.

In Chapter 2 and more precisely in Section 2.5, the researcher explained the main concepts of SOA Governance and provided a detailed description of the theoretical approaches surrounding this research area. Although SOA Governance models share common issues, no single approach seems to be used or tested adequately. The reasoning behind the absence of SOA Governance cases and empirical findings is that although organisations are aware of SOA Governance, they don't focus on it or decide not to include it in their initial plans (e.g. due to time constraints), or applied traditional IT governance techniques that do not seem to provide the desired outcome (Krey *et al.*, 2012). After a decade of SOA implementations, SOA is more matured and its applications are more complicated (scale of applications). Consequently, focus moved from the integration of HIS to SOA Governance, as there is a need to govern SOA infrastructures better and thus define and use rules and policies (Niemann *et al.*, 2009).

In this chapter, the researcher conceptualises and proposes a SOA Governance framework grounded in the findings of the literature review. Therefore, the main elements of the proposed SOA Governance framework hold the merit and quality of peer-review articles published in academic journals and conferences. Peer-review continues to be the most appropriate way for judging academic publications and it ensures that researchers can use published work with confidence, and use the works of others as stepping stones and corner stones for advancing new concepts and insights (Davison *et al.*, 2005; Vom Brocke *et al.*, 2009; Willcocks *et al.*, 2008). Despite the fact that, these articles are of great importance to build the elements of the framework, they do not cover the whole spectrum required for a rigorous study on SOA Governance. Thus, due to the limited peer-review literature in the area, the researcher extends the use of literature, in non peer-review, but academically justified published material (e.g. workshop/industry papers and books). These will not alternate the valuable findings identified in peer-review articles, as they will be included as additions and highlighted in this chapter. As well, in Section 2.5.6 the researcher focusing on the literature review findings developed a concept map that highlights the main concepts of a SOA Governance framework. The SOA Governance concept map provides not only a graphical representation of the main concepts, but aids in the discussion of the similarities (common elements), differences (scale, detail and analysis) and limitations (confusion, overlapping, lack of testing and healthcare aspects). These are all open issues for further investigation and will be addressed in this chapter. Consequently, the aim of this chapter is to: (a) use the common elements identified in the map (e.g. literature), (b) address the limitations (identified in Chapter 2) by enhancing the analysis with additions beyond the level provided by the normative literature and (c) infuse the framework with the healthcare perspective (CSFs and HIS challenges). For this reason, the researcher conceptualises a structured method to support the conceptualisation of a SOA Governance framework in healthcare. This incremental structured approach is divided in three parts, namely:

Part A - Research Issues Derived from Literature Review. In this part the researcher analyses and discusses the findings from the SOA Governance literature review. This discussion results in the common elements of SOA Governance. Additionally, the researcher addresses the common elements, reflecting on limitations as overlapping, confusion and conceptualisation and resolves these limitations by further developing the elements and/or proposing additions. The lack of analysis that some concepts hold (a limitation discussed in section 2.5.7), is not addressed as this is the subject of the second part.

Part B - Additions for SOA Governance. In this part the researcher attempts to enhance the common issues and tackle their lack of analysis by incorporating additional knowledge and

guidelines. This process includes exploitation of literature resources beyond the primary cases (an issue discussed in Section 2.5.4) and additional development of the elements. Further additions follow in the third part where the lack of healthcare specific aspects required to synthesise a SOA Governance framework in healthcare, is analysed.

Part C – Healthcare Specific Additions for SOA Governance. In this part the researcher attempts to piece together SOA Governance and healthcare and proposes a unique conceptualisation combining the identified common elements of SOA Governance (seen in Part A and B), the SOA CSFs and HIS challenges (described in Chapter 2). This way the healthcare aspects are infused in the identified normative literature to conclude in the final proposition for each element.

Following the above mentioned parts the researcher results in the construction and proposition of a SOA Governance framework in healthcare.

Therefore, the organisation of Chapter 3 is as follows. Section 3.2 presents the SOA Governance framework based on the normative literature, Section 3.3 shows the extra additions required enhancing the framework and Section 3.4 portrays the additions required for healthcare specific aspects. Thereafter, Section 3.5 presents the conclusions of the chapter.

3.2 Part A - Research Issues Derived from Literature Review

In Section 2.5.7 the body of the identified literature, aided by the graphical representation of the concept map (Figure 2.6), was reviewed. This process revealed similarities, differences and limitations surrounding the SOA Governance literature. The similarities contribute positively in the construction of the SOA Governance framework as they provide the common elements and understanding to create a proposition, the differences and limitation, however, require further analysis and research. This section (e.g. PART A) addresses all these issues and highlights the research issues derived from the literature review concluding in the proposition of the main elements of a SOA Governance framework. It is worth mentioning that the analysis is adapted in the notion that the first domain elements are the core elements upon which the sub-elements and attributes are linked. Thus, any decision (exclusion, modification etc.) taken by the researcher for this domain is reflected in the second and third domain. Therefore, the analysis starts with the first domain (e.g. elements), subsequently, presented in the next paragraphs.

The first domain, as seen in Figure 2.6, holds thirteen elements, namely: (a) organisational structures, (b) employees, (c) roles, (d) artefacts, (e) roadmap, (f) tool, (g) best practices, (h)

policies, (i) SOA Governance processes, (j) SOA Governance infrastructure, (k) metrics, (l) goals and (m) maturity model. As mentioned in Section 2.5.6 some of the elements (e.g. a,c,e,g,h,i,j,k, l and m) can be characterised as common as they are identified and clearly described, as elements of many models while others (e.g. b,d, f and l) need further investigation due to their limitations (e.g. overlapping, confusion).

Moreover the element 'employees' is addressed by two authors (as seen in Figure 2.6). Beimborn *et al.*, (2009) recognise 'employees' as an organisational structuring method, linked with service oriented knowledge (e.g. IT/Business skills). While, Janiesch *et al.*, (2010) use the term as an intermediate between organisational structures and roles, without providing any further justification of its meaning. Reflecting on the above mentioned views, the researcher believes that, this element, as portrayed by both authors is overlapping with the 'organisational structure' concept (e.g. organisational structure is identified holding members with IT/Business knowledge and skills and linked with roles). Thus, since the organisational structure is provided in a more descriptive way, identified by more authors, the element 'employees' can be disregarded. This decision is taken as to enhance the clarity of the framework with less overlapping concepts.

Also, Janiesch *et al.*, (2010) include the element 'artefacts', which refers to all sorts of documents, such as status updates, roadmaps or architecture diagrams. First, it is important to distinguish that 'roadmap' is a standalone concept addressed by many authors and thus it is separated from the aforementioned 'artefacts' proposition (as seen in Figure 2.6). Furthermore, the way that this concept is represented by Janiesch *et al.*, (2010), provides an abstract notion of any and every document/plan created during the SOA Governance processes. The researcher acknowledges that such representation may be suitable for this particular model but not for every framework, as its conceptualisation is so abstract that can cause more confusion than clarity. This might not be the case for Janiesch *et al.*, (2010) model, since they only link 'artefacts' with 'roles' and 'process' but then again they do not explain why "all sorts of documents" do not include documents about the 'maturity model', 'goals', 'tools', 'skills', etc. and if so why these are not linked with the corresponding elements of 'maturity model', 'goals', 'tools', 'skills', etc. It is the researcher's and common understanding that 'roles', 'process' (and most of the elements of an organisation) create documents, thus since this element's notion is more confusing than beneficial, the element 'artefacts' is disregarded.

Additionally, confusion and overlapping is caused also by another concept that Janiesch *et al.*, (2010) report, the concept 'tool', which is portrayed to be as simple as 'pen/paper' and/or

more often nowadays 'software'. Regarding the sub-element 'pen/paper' it is the researcher's understanding that such abstract notion is not required in a SOA Governance framework that deals with IS and digital communication. Whereas, the sub-element 'software' is overlapping with the concept 'SOA Governance infrastructure', which corresponds to the software /IS system used to facilitate SOA Governance. Thus, the concept 'tool' is disregarded so as to enhance the frameworks clarity and avoid overlapping and confusion.

Moreover, the researcher identifies confusion and overlapping to be propagated by the concept 'goals'. The term itself is very generic and it can be linked with any other element. For example, Janiech *et al.*, (2010) link the goals with the governance processes. The researcher agrees with the aforementioned authors but also believes that the same is relevant for roles, policies, and other elements. Following this notion, causes confusion and overlapping, as the goals element (generic) would require to be related with all the other elements but also the individual elements to include in their description the specific goals they address. Thus, the concept 'goals' is not described as a specific element, but integrated in each element analysis. This is decided so as to enhance the frameworks clarity and avoid overlapping and confusion.

The remaining nine elements, namely: (a) Organisational Structures (OS), (b) Roles (RL), (c) Maturity Model (MM), (d) Roadmap (RD), (e) SOA Governance Infrastructure (SGI), (f) Policies (PO), (g) Metrics (ME), (h) Best Practices (BP), and (i) Governance Processes (GP), do not overlap each other and can form stand-alone concepts. Thus, they form the nine common elements identified in the normative literature that the SOA Governance framework builds upon. Yet, further analysis and research is required as to clarify issues (e.g. limitations etc.) that each element holds in the second and third domain. These will be addressed in detail, in individual basis for each element, in the following section.

3.2.1 SOA Governance Organisational Structure (OS) Element

Providing a closer look at the literature review of Chapter 2 and more precisely of the primary cases as presented in Section 2.5.5 and SOA Governance concept map as illustrated in Section 2.5.6, reveals that the creation of a SOA Governance organisational structure is a basic consideration. This is evident as the majority of authors (five out of six) include the SOA Governance models as a basic element of their model and link it in great extent with other elements, thus adding to its value in a SOA Governance model. For this reason the researcher proposes that a SOA Governance organisational structure needs to be included as an element of the proposed framework of this thesis. Yet, as discussed in Section 2.5.7 not all the identified models portray this element in the same way and/or propose the same sub-elements

and attributes. Thus, in order to clarify the issue, in the following paragraph a detailed summary of the SOA Governance organisational structure as presented by each model (based on authors) is presented.

The primary cases address the SOA Governance structure by providing widely used examples to structure an organisation, like: committees, councils and offices (Beimborn *et al.*, 2009; Bernhardt and Seese, 2009; Hojaji and Shirazi, 2010). These are referred as supporting structures in many cases and identified to play specific roles. For example, Bernhardt and Seese (2009) include the creation of a SOA program office, which reports to the board and is responsible for issues, such as: (a) delegating councils, (b) project prioritisation, selection and funding, (c) assignment of people to roles and (d) responsible to set up the roadmap. The authors seem to place this structure a bit higher in the hierarchy than councils/committees but still identify it to hold a supporting role, since the authors refer to it as a limited decision structure that reports to a higher organisational structure (Bernhardt and Seese, 2009). At the top of the hierarchy the authors put two distinctive structures, such as: (a) the Governance Board (GB) (Bernhardt and Seese, 2009; Hojaji and Shirazi, 2010) and (b) the Centre-of-Excellence (CoE) (Beimborn *et al.*, 2009; Niemann *et al.*, 2010; Schepers *et al.*, 2008). Based on the authors' perception these structures overlap both in description and attributes, as these are presented in Table 3.1. The first column of the table holds the name of the structure, the second column includes the description and the third the attributes that each structure is described with. The only additional attribute provided for GB, i.e. influencing project identification and prioritisation, is due to the extensive analytical review given by Bernhardt and Seese (2009) on the subject and can equally apply to CoE.

Element	Description	Attributes
Centre-of-Excellence (CoE)	<ul style="list-style-type: none"> Main governance body of the SOA initiative (Beimborn <i>et al.</i>, 2009; Niemann <i>et al.</i>, 2010; Schepers <i>et al.</i>, 2008) Specialists from both IT and business (Niemann <i>et al.</i>, 2010) (Beimborn <i>et al.</i>, 2009) Decision making authority (Niemann <i>et al.</i>, 2010; Schepers <i>et al.</i>, 2008) Structured in a centralized or decentralized manner (Niemann <i>et al.</i>, 2010) (Schepers <i>et al.</i>, 2008) (Beimborn <i>et al.</i>, 2009) Holds roles and responsibilities (Beimborn <i>et al.</i>, 2009; Niemann <i>et al.</i>, 2010) 	<ul style="list-style-type: none"> Define and abolish governance policies (Niemann <i>et al.</i>, 2010) Maintain best practices (Niemann <i>et al.</i>, 2010; Schepers <i>et al.</i>, 2008) Obtain feedback from metrics (e.g. about maturity and compliance policies) (Niemann <i>et al.</i>, 2010) Train employees (Schepers <i>et al.</i>, 2008) Communicates SOA purpose (Schepers <i>et al.</i>, 2008)
SOA Governance Board (GB)	<ul style="list-style-type: none"> Main governance body of the SOA initiative (Bernhardt and Seese, 2009; Hojaji and Shirazi, 2010) Specialists from both IT and business (Bernhardt and Seese, 2009) Decision making authority (Bernhardt and Seese, 2009) Can be centralized or distributed (e.g. decision rights)(Bernhardt and Seese, 2009) Holds roles and responsibilities (Hojaji and Shirazi, 2010) 	<ul style="list-style-type: none"> Define governance policies (Bernhardt and Seese, 2009) Obtains business objectives, standards, best practices (Bernhardt and Seese, 2009) Defines metrics (Bernhardt and Seese, 2009) Corroborates a number of councils (Bernhardt and Seese, 2009) Sets roadmap (Bernhardt and Seese, 2009) Influence decisions on project prioritization (Bernhardt and Seese, 2009) Influence decisions on funding (Bernhardt and Seese, 2009)

Table 3.1: Summary of SOA Governance OS Element Derived From Normative Literature

Since the literature does not highlight one over the other, the researcher includes all the aforementioned approaches (e.g CoE, GB etc.) as sub-elements of SOA Governance structure (main element) and their description as guidelines to form such element, as depicted in Table 3.2. The first column of the table portrays the attributes, the second includes the sub-elements, the third presents the guidelines and the fourth the association between ‘organisational structure’ and other elements. The latter is presented based on the connections observed in the SOA Governance concept map (Figure 2.6). This way the body of the normative literature is expressed in full in a clear and understandable manner.

Organisational Structure (OS) Element			
Attributes (AT)	Sub-elements (SE)	Guidelines (GU)	Relations (RE)
<ol style="list-style-type: none"> Corroborates a number of councils Define and abolish governance policies Obtain and maintain business objectives, standards, best practices Define and obtain feedback from metrics Train employees Communicates SOA purpose Sets roadmap Influence decisions on project prioritisation Influence decisions on funding 	<ol style="list-style-type: none"> Centre-of-Excellence Governance Board Program office Councils/Committees 	<ol style="list-style-type: none"> Main governance body Members from both IT and business Structured in a centralized or decentralized manner 	<ol style="list-style-type: none"> Roles Roadmap Best practices Policies Governance processes Governance Infrastructure Metrics Maturity model

Table 3.2: Organisational Structure (OS) as Identified in Normative Literature

The researcher acknowledges that the organisational structure element as identified in the normative literature, is required as an element of the SOA Governance framework and as summarised in Table 3.2 can provide guidance in the design and creation of such structure. However, other researchers beyond the ones included in the primary cases, as Biske (2008) report that additional issues need to be explored regarding the organisational structure element, such as the engagement approach of such element with the organisation. Why Biske's addition is considered by the researcher will be addressed in more detail in Section 3.3. Additionally, the organisational structure as represented in Table 3.2 lacks healthcare specific aspects. These will also be addressed but in Section 3.4.

3.2.2 Roles (RL) Element

The concept map as seen in Section 2.5.6, demonstrates the roles element to be referred in five models (out of six). This high inclusion rate of the roles reflects on the importance of the element in a SOA Governance framework. Thus, it is also the researcher understanding that in normative literature this is an accepted element, required to better describe SOA Governance. Following this notion, the researcher includes roles as an element of the proposed SOA Governance framework of this thesis. Thus, in order to explain the element, in the following paragraph a synopsis of the roles element as presented in the primary cases is described.

More precisely, the authors report on the need to introduce new or adapt existing roles related to SOA and SOA Governance (Beimborn *et al.*, 2009; Hojaji and Shirazi, 2010; Janiesch *et al.*, 2009; Niemann *et al.*, 2010; Schepers *et al.*, 2008). However, none of the aforementioned authors provide a description or a list of such roles. Yet, some authors like Janiesch *et al.*, (2010; 2009) report the need of these roles to be clearly defined, and others like Beimborn *et al.*, (2009) emphasise the IT/business liaison of these roles. Additionally, on the subject Schepers *et al.*, (2008) propose that a balanced number of roles given to different stakeholders from the beginning (e.g. of SOA endeavour) can gain the support of all the relevant stakeholders, decrease their resistance to change and reduce the risk of program failure in a later stage. Additionally, Hojaji & Shirazi (2010a) and Niemann *et al.*, (2010) point-out that roles are implemented or realised by organisational structures.

Thus far, considering the aforementioned views it is evident that 'roles' is required as an element of the SOA Governance and directly links it to the 'organisational structure' element, which is responsible to place these roles to SOA stakeholders. However, none of the aforementioned authors provide a description or a list of such roles. Thus, in an attempt to enhance the understanding of SOA Governance roles and provide further guidance, the researcher provides and explains such a list in Section 3.3.

Nevertheless, the aforementioned authors emphasise on the need to link roles with responsibilities, so as to better apply SOA Governance. In more detail, Hojaji & Shirazi (2010a), Janiesch *et al.*, (2010; 2009), Niemann *et al.*, (2010) and Schepers *et al.*, (2008) highlight the need to link ‘roles’ with ‘responsibilities’ in a Responsible, Accountable, Consulted and Informed (RACI) chart (Hojaji and Shirazi, 2010). Applying a RACI method has the potential to help clarify individual expectations, reduce redundancy in tasks, improve communication, reduce levels of approval in processes, eliminate consolidators and coordinators and define interfaces between individuals (Janiesch *et al.*, 2009). Yet, from these authors only Janiesch *et al.*, (2010; 2009) elaborate further on the RACI approach. According to them, the RACI approach is a key best practice that organisations ought to adopt it in order to maximise the effectiveness of their SOA Governance efforts. Moreover, the authors report that the RACI charts correlates activities of the SOA lifecycle to roles of stakeholders in a SOA initiative and propose their responsibilities by specifying which roles are (r)esponsible (i.e., perform the actual activity), (a)ccountable (i.e., ensure that the activity happens), (c)onsulted (i.e., should be consulted prior to decision or action) or (i)nformed (i.e., need to be informed of the decision or action after it is made) regarding specific activities (Janiesch *et al.*, 2009). This way, roles are represented as columns and SOA lifecycle activities as rows.

Thus far, regarding the responsibilities that are given to specific roles, it is reported that a RACI chart can be a useful tool, but not identified as a prerequisite of such processes, rather as a good practice. At this point it has to be mentioned that authors like Janiesch *et al.*, (2010; 2009) also raise concerns about RACI charts. Moreover, they report that the creation of a RACI chart is typically a political process that surfaces many organisational issues because it confronts role conceptions, role expectations and role behaviours (Janiesch *et al.*, 2009). Thus, the researcher acknowledges the usefulness of such tool but has reservations if such an elaborate, methodological approach that raises concerns can be proposed as part of SOA Governance and more concerning introduced in a healthcare organisation. Even more since this method was not tested (e.g. by the authors of the primary cases) emphasis ought to be given in its applicability in a healthcare environment before its inclusion in the SOA Governance conceptualisation.

Nevertheless, the ‘roles’ as an element of the SOA Governance framework as identified in normative literature is summarised in Table 3.3, with the first column of the table portraying the attributes, the second column presenting the sub-element, the third column including the guidelines and the fourth highlighting the relations (relations derived from Figure 2.6).

Roles (RL) Element			
Attributes (AT)	Sub-elements (SE)	Guidelines (GU)	Relations (RE)
1. Hold SOA responsibilities 2. Responsible for governance processes 3. Gain the support of all the relevant stakeholders 4. Decrease resistance to change 5. Reduce the risk of program failure in a later stage	1. Responsibilities	1. Members from both IT and business 2. Require specific skills/training 3. RACI	1. Organisational structure

Table 3.3: Roles (RL) as Identified in Normative Literature

It is the researcher understanding that for this element to aid the guidance of an organisation towards SOA Governance further guidelines need to be included. These, may include a list of roles with their responsibilities. This list can act as a supportive guideline when an organisation addresses this element. Further analysis of the issue will be presented in Section 3.3.

3.2.3 SOA Maturity Model (MM) Element

The SOA Governance concept map as shown in Section 2.5.6 includes the maturity model as an element. Observing closely the map reveals that this element was part of four authors' models. The conceptualisation of such element that measures the current maturity level of an organisation and describes the ones that follow, is understandably important. The importance originates from the need of organisations to adopt tools and methods that can evaluate their capabilities in regards to a certain discipline. Organisations, after a decade of SOA implementations, most of them not reaching their full potential, are more concerned in revealing their current SOA capabilities (as-is level) and in parallel identify the shortcomings that they need to understand and address, as to better apply the SOA paradigm. Therefore, the researcher concurs with the normative literature and adds the 'maturity model' as an element of the proposed SOA Governance framework of this thesis. Yet, maturity models are complex, with many parameters that need to be addressed. Thus as a starting point, in the following paragraph a summary of the way that the maturity model was identified in the primary cases is presented.

Moreover, Janiesch *et al.*, (2010) report that: (a) each governance process is associated with (e.g. holds) one maturity level and (b) indications of how to proceed to the next level need to be planned. The authors do not propose a distinctive model, but mention the levels: initial, repeatable but intuitive, defined, managed/measurable and optimised. These levels are based on the well known IT governance approach CMMI (explained in Section 2.5.1). Additionally, Niemann *et al.*, (2010) report that a SOA maturity model is a structured collection of components that describe certain aspects of maturity in an IT environment (technology, processes, and organization) where a SOA is implemented or is considered to be

implemented. Furthermore, they state that a maturity model can be used as a benchmark for comparison and as an aid in steering and planning capabilities needed for running a SOA (Niemann *et al.*, 2010). While the authors do not emphasise on a particular model they discuss the SOA maturity measurement as a core element that provides feedback and directly link it with metrics (Niemann *et al.*, 2010). Furthermore, Hojaji & Shirazi (2010) report that a maturity model can act as an assessment mechanism and provide a detailed analysis of the SOA environment, thus the organisation can better evaluate the SOA implementation and understand the SOA maturity level. Additionally the authors propose the use of a maturity model based on COBIT, with six dimensions (e.g. organisation, process, governance, service management, infrastructure and business) against five maturity levels (e.g. initial, managed, defined, qualitatively managed and optimised), however, the authors do not provide any further specifications of the model structure and contents (Hojaji and Shirazi, 2010). In another proposition, Schepers *et al.*, (2008), design and propose a maturity model (relating to CMMI) tailored to express the phases in the SOA Governance lifecycle (e.g. the authors proposed model) against specific maturity levels. It is the researcher's belief that this dedicated design requires the complete adoption of the authors' model to be functional, thus it can be characterised as limited in scope and applicability for this thesis.

Gathering the aforementioned views the researcher summarises them and presents them in Table 3.4, with the first column of the table representing the attributes, the second including sub-elements, the third highlighting the guidelines and the fourth presenting the relations.

Maturity Model (MM) Element			
Attributes (AT)	Sub-elements (SE)	Guidelines (GU)	Relations (RE)
1. Assessment mechanism 2. Provides comparison between current and future states of SOA 3. Assist in steering and planning needed for running a SOA	1. Levels 2. Application Areas	1. Detailed analysis 2. Levels such as: initial, managed, defined, qualitatively managed and optimised 3. Application areas such as: organization, process, governance, service/ service management architecture, infrastructure and business view 4. Examples such as CMMI, COBIT	1. Organisational structure 2. Metrics

Table 3.4: SOA Maturity Model (MM) as Identified in Normative Literature

Reflecting on the above mentioned view, the SOA maturity model as identified in normative literature is presented as a basic element for a SOA Governance framework. Yet, while the authors agree on the levels of the model, proposing the utilisation of CMMI (analysed in Section 2.5.1) or similar, the same consensus is not identified in the application areas of the model. The latter includes areas as: technology, organisation and other. Yet, if all of the areas, or specific ones are required is not clear. Additionally, it can be argued that a SOA MM as the one mentioned by the researcher in Section 2.4.2 and analysed in Annex II can be utilised as a

tool to identify the SOA maturity status of an organisation. Nevertheless, this requires further testing and analysis based on empirical data to satisfy such claim.

3.2.4 Roadmap (RD) Element

The implementation of SOA requires a significant change of both the IT landscape and the mindset of business and IT people within an organisation. Guidance on where to start and which subsequent steps to follow at the beginning and over time of the SOA implementation, is therefore, essential and should be provided by creating a suitable SOA roadmap (Ott *et al.*, 2011). This need for guidance planning was also identified in the SOA Governance literature review (Section 2.5.6), where the SOA roadmap was considered as an important element of three different SOA Governance models and also observed in the concept map (Section 2.5.6). The researcher coincides with the normative literature and considers the ‘roadmap’ as an element of the proposed SOA Governance framework of this thesis. To better analyse the element a summary of the normative literature is presented in the next paragraph.

Moreover, Bernhardt and Seese (2009) and Janiesch and Korthaus (2010), mention the existence of a roadmap and place the SOA organisational structure responsible to set it up, but the authors do not provide any further analysis for the element. Additionally, Hojaji and Shirazi (2010), report that the SOA roadmap provides a high-level incremental transition planning for SOA adoption and can be based upon: (a) the current SOA (at the time), (b) the target SOA and (c) SOA maturity assessments (e.g. maturity model). The authors also, report that roadmaps may include planning for: transformation initiative, deliverables, resources needed, costs, estimated time scales, project dependencies, and risk considerations.

Thus far, taking into account the above views discussed, it can be argued that the roadmap is: (a) an essential part of the SOA Governance framework as a high-level transition plan, (b) set up by the organisational structure and (c) linked with the SOA maturity model. The researcher summarises these views and depicts them in Table 3.5, with the first column of the table representing the attributes, the second includes the sub-elements, the third showing the guidelines and the fourth incorporating the associations (the latter are derived from the Figure 2.6).

Roadmap (RD) Element			
Attributes (AT)	Sub-elements (SE)	Guidelines (GU)	Relations (RE)
1. Provides an incremental SOA adoption 2. Detailed planning process	1. Transition plans	1. Based on: current and target SOA and SOA Governance maturity assessments 2. Designed for each organisation's particularities 3. Planning for: (transformation initiative, deliverables, resources needed, costs, estimated time scales, project dependencies, and risk considerations)	1. Organisational structure 2. Maturity model

Table 3.5: Roadmap (RD) as Identified in Normative Literature

From the above mentioned summary it is evident that while the authors include the roadmap as an element they do not provide a detailed analysis of its conceptualisation. While it is not clear why the authors do not analyse the element, other views (from the primary cases) like Niemann *et al.*, (2010) point towards the dependencies of the roadmap's design with the individual systems' (and or organisations) particularities. The researcher acknowledges the particularities that the design of a roadmap is based upon, and that this might be the cause of the limited analysis, but in an attempt to further address the issue, incorporates supplementary literature resources (beyond the primary cases) and incorporated additions which are presented in Section 3.3.

3.2.5 SOA Governance Infrastructure (SGI) Element

The SOA Governance Infrastructure (SGI) is the SOA concept that gets the biggest attention from SOA vendors and IT suppliers, consisting a small but rapidly growing IT market, as many organisations require deployment of a variety of products (registries, repositories, ESBs, management systems, etc.) to support their governance systems. Collectively, these products provide a SGI. As the SOA Governance market evolved towards more sophisticated solutions so did the notion of what SGI includes. Molinverno and Plummer (2011) report on this market evolution, placing the early (2009-2010) customers' need to be focused on acquiring a partial solution covering one stage of the service life cycle (e.g. dichotomy between design/implementation and operations). While later on, the need transferred into acquiring SOA Governance solutions that may serve their purpose throughout the whole SOA activities from planning and design all the way to implementation, operation and retirement (Malinverno and Plummer, 2011). Additionally, other reports identify the SGI as a saturated, complex and overloaded notion with many vendors offering multiple products addressing different and frequently overlapping aspects of the service life cycle (Manes, 2011). The researcher acknowledges the aforementioned reports and also highlights that many organisations deployed their first services without specific SGI, but also reflects that since then the requirements have changed. One aspect of this change is seen in the need for

augmenting security, monitoring and control of the SOA. Thus, deploying services may require more sophisticated tools to assist SOA Governance framework. Therefore, the researcher includes the SGI element as part of the SOA Governance framework for this thesis and presents a summary of the normative literature in the next paragraph.

Respectively, Bernhardt and Seese (2009) identify that ‘SOA Governance infrastructure’ is required to manage governance information, automate governance processes, enforce governance policies, and collect metrics. Moreover the authors propose as part of a ‘SOA Governance infrastructure’ the following sub-elements: (a) service registry, (b) a repository, (c) policy and contract management systems, (d) quality management system and (e) SOA management system. The authors provide a description of these sub-elements as they are presented in Table 3.4. In the same lines, but without emphasising on the issue Niemann *et al.*, (2010) and Hojaji and Shirazi (2010) briefly mention the existence of a registry, repository and Enterprise Service Bus (ESB) as the technical SOA backbone of the organisation (e.g. infrastructure). Whereas, Niemann *et al.*, (2010) also report that an ESB can play a supportive role in the enforcement of policies. Alongside, Schepers *et al.*, (2008) state the need of an infrastructure in the form of registries and repositories, providing a brief account for the two. A detailed view of all the aforementioned authors’ propositions can be seen in Figure 3.6.

Element	Description	Sub-elements	Description	Authors
SOA Governance Infrastructure (SGI)	Manages governance information, automates governance processes, enforce governance policies, and collects metrics	Registry	<ul style="list-style-type: none"> Helps to maintain an overview of existing services Manages administrative information such as service lifecycle states Manages the publication of services Defines taxonomies of the published services Catalogue tool 	Bernhardt and Seese (2009), Niemann <i>et al.</i> , (2010) Schepers <i>et al.</i> , (2008), Hojaji and Shirazi (2010)
		Repository	<ul style="list-style-type: none"> Assists in the management of design artefacts Acts as a data type inventory Auditing function Checks the changes made to a service 	Bernhardt and Seese (2009), Niemann <i>et al.</i> , (2010), Schepers <i>et al.</i> , (2008), Hojaji and Shirazi (2010)
		Enterprise Service Bus	Technical backbone of SOA	Niemann <i>et al.</i> , (2010), Hojaji and Shirazi (2010)
		Policy & Contract Management	<ul style="list-style-type: none"> Define and document policies Attach policies to artefacts, Propagate policies to their respective points of application 	Bernhardt and Seese (2009)
		Quality Management System	<ul style="list-style-type: none"> Support services’ testing Impact analysis (service alteration, dependencies) 	Bernhardt and Seese (2009)
		SOA Management System	<ul style="list-style-type: none"> Facilitate service administration (e.g. lifecycle transitions) Monitoring 	Bernhardt and Seese (2009)

Table 3.6: Proposed Technology Solutions for the SOA Governance Infrastructure (SGI)

It is evident that the aforementioned table covers a wide spectrum of ‘SOA Governance Infrastructure’ sub-elements, like a service registry used for service administration management (proposed by four authors) to more sophisticated ones like the quality management system for testing services (proposed by one author). Yet, the aforementioned four authors do not highlight the importance of a specific sub-element over the others but generalise on the need of infrastructure to support SOA Governance. In the same lines, the researcher refrains from providing a specific classification of the sub-elements and considers them as parts of the SOA Governance infrastructure.

As a result, it can be argued that the SOA Governance infrastructure can be integrated as an element of the proposed SOA Governance framework. This element may include technological solutions and systems that can assist with issues, like: (a) enforcement of policies, (b) collection of data (e.g. from metrics) and (c) automation of the governance process. Thus, the SOA Governance infrastructure as an element of the SOA Governance framework as identified in the literature, is depicted in Figure 3.7.

SOA Governance infrastructure (SGI)			
Attributes (AT)	Sub-elements (SE)	Guidelines (GU)	Relations (RE)
1. Manages governance information, 2. Automates governance processes, 3. Enforce governance policies, 4. Collects metrics	1. Registry 2. Repository 3. ESB 4. Policy & contract management 5. Quality management system 6. SOA management system	1. The sub-elements are determined by the specific governance requirements	1. Organisational structure 2. Metrics 3. SOA Governance processes 4. Policies

Table 3.7: SOA Governance Infrastructure (SGI) as Identified in Normative Literature

The researcher acknowledges that the SGI element as identified in the normative literature may support the SOA Governance implementation and as summarised in Table 3.7 may provide control in an organisation’s SOA endeavours. Yet, as this element was not evaluated (from the authors of the primary cases) as part of a SOA Governance framework, it requires testing and evaluation with empirical data to verify its use.

3.2.6 Policies (PO) Element

Policies are the means by which governance is operationalised in order to make it more tangible, enforceable and meaningful for the SOA stakeholders (e.g. IT developers, SOA teams) (Marks, 2008). Moreover, policies translate business objectives from SOA strategy into actionable guidance, principles, and rules. In this respect, policy makers (e.g. members of the organisational structure) are striving to define, configure and assign policies that allow the SOA stakeholders to easily adhere to a wide list of policies (e.g. enterprise, technical, business etc.). This need to include policies in SOA Governance was observed in the SOA

Governance concept map (Section 2.5.5), where policies were identified as a SOA Governance element in three models. Therefore, the researcher concurs with the normative literature and adds the ‘policies’ as an element of the proposed SOA Governance framework of this thesis. Yet, a closer look on the way that this element is addressed in the literature is required, thus a synopsis of the SOA normative literature on the concept follows in the next paragraph.

Bernhardt and Seese (2009), mention that policies include rules for developing, deploying and managing a SOA and emphasise on the policy enforcement, that can be either achieved manually (e.g. by a design review), or automatically (e.g. by a SOA management system) (Bernhardt and Seese, 2009). Additionally, Niemann *et al.*, (2010) provide a clear account of the ‘policies’ element. The authors divide ‘policies’ into aspects (like architecture, technology etc.) and areas (like security, run and design time, etc.). Thus, for example security policies (e.g. area) may be required both for architecture and technology (e.g. aspects). Additionally, the authors further divide these policies into ‘company-internal aspects’ which comprise all the general policies concerning an organisation’s SOA system and ‘standards compliance’ which covers all aspects of adherence to accepted standards. Thus, for example a security policy may be placed for architecture and also hold two parts, one generated by the organisation (e.g. ‘company-internal aspects’) and one by requirements on standards (e.g. ‘standards compliance’). Moreover, Schepers *et al.*, (2008), distinguish between enforcement in design-time and run-time policies. According to the authors, design-time policies are directed to the developer (e.g. security mechanisms or compliance to data standards), while run-time policies involve the operational environment and often concern requirements (e.g. performance requirements, Service Level Agreements (SLAs)). Also, the authors point-out that infrastructure tooling (as ESBs) monitors the service usage and exceptions and pass on this information to other management tools which can then generate reports to assist policy owners in improving them.

In view of the aforementioned approaches the policies can be integrated as an element of the proposed SOA Governance framework. This element includes specific aspects and areas and requires enforcement. Thus, the policies as an element of the SOA Governance framework as identified in the literature, can be seen in Figure 3.8.

Policies (PO) Element			
Attributes (AT)	Sub-elements (SE)	Guidelines (GU)	Relations (RE)
1. Comprise rules for developing, deploying and managing a SOA	1. Enforcement 2. Aspects 3. Areas	1. Aspects may include: Architecture, Technology, Organization, Portfolios, Information and Project execution 2. Areas may include: Security, Cross-company cooperation, Design-time, Run-time and Finance 3. Enforcement either manually, or automatically	1. Organisational structure 2. SOA Governance processes

Table 3.8: Policies (PO) as Identified in Normative Literature

The researcher acknowledges that the policy element as described in the normative literature can support the SOA Governance implementation and as summarised in Table 3.8 can offer direction in an organisation realising SOA. Still, as this is a synthesis of different authors' views, with limited evaluation provided, the researcher proposes further testing with empirical data.

3.2.7 Metrics (ME) Element

In order, to evaluate if SOA adheres to strategic parameters set by the organisation (e.g. goals, compliance, return-on-investment etc.), constant measurement and monitoring is required. For this purpose, appropriate metrics are defined. Metrics are indicators of system, user, and group performance that can be observed, singly or collectively, while executing scenarios (Russell *et al.*, 2006). Without metrics, there can be confusion about whether predefined goals are being met. The researcher acknowledges the need to incorporate the metrics element as part of the SOA Governance framework and summarises the concept as it was identified in the normative literature (Section 2.5.5) in the next paragraph.

Moreover, Bernhardt and Seese (2009) in an analytical approach, propose that metrics can be partitioned into metrics related to (a) services, (b) service operations and (c) projects. Regarding services the authors report that is useful to know the number of existing, proposed, developed, published and consumed services. Regarding service operations related metrics include the number of successful vs. the number of invalid interactions, including information indicating the reasons for the errors (e.g. SOAP faults, invalid input data, size of input data etc.), performance KPI's and service level and security violations. Additionally, regarding projects they propose the inclusion of feedback on the number of successful and/or failed projects and the reasons for both failure and/or success (Bernhardt and Seese, 2009). Furthermore, Hojaji and Shirazi (2010) mention that the organisation should define and periodically review metrics and upon them make the needed changes (to issues like governance policies, standards, and processes). Also, Janiech *et al.*, (2010) briefly mention the use of 'metrics' in order to derive KPIs and or goals linked to specific processes.

Nevertheless, the authors do not elaborate further to the issue. Niemann *et al.*, (2010), report that the design of a metrics system is a central issue and mention various types of metrics like business process, performance, SLAs and conformance. Also, the authors propose the alignment of metrics with specific goals in order to assess the achievement of these goals, (e.g. the fulfilment of a policy) (Niemann *et al.*, 2010). In this way, the measured result provides feedback regarding the degree of adherence to a given policy. Additionally, Schepers *et al.*, (2008), connect metrics with the infrastructure tooling (like ESBs) that monitors the services' usage and exceptions, in regard to compliance to standards, legislation and/or business rules.

Thus far, based on the normative literature it can be argued that metrics is an essential element for a SOA Governance framework. Moreover, metrics can be defined, periodically reviewed by the organisation and used to measure categories such as: services, service operations, projects and governance processes. Corresponding metrics can be designed to match these categories. Thus, guidelines that support this design are required to accompany this element. So, the proposed by literature metrics element can be seen in Figure 3.9.

Metrics (ME) Element			
Attributes	Sub-elements	Guidelines	Relations
1.Improve transparency 2.Provide visibility of essential states and parameters of the SOA initiative	1.Metric's categories	1.Design Metrics for Services, Service operation, Projects, Governance processes	1.Organisational structure 2.SOA Governance processes 3.Maturity model 4.Goals

Table 3.9: Metrics (ME) as Identified in Normative Literature

It is the researcher understanding that while the normative literature describes metric divisions for services, service operation, projects and governance processes more divisions may exist requiring different questions to be attached to them. Following this requirement the researcher emphasises on the need to include as a guideline an accepted method to form metrics, thus explores and further develops the element in Section 3.3

3.2.8 Best Practices (BB) Element

O'Dell and Grayson (1998) identify best practice as any practice, knowledge, know-how, or experience that has proven to be valuable or effective within one organisation that may have applicability to other organisations. This conceptual notion is applicable for many areas from management to IT and of course SOA. For example, best practices for SOA policies can be valuable for creating SOA policies, SGI best practices can assist an organisation in accumulating SGI related knowledge (and probably applying it in a later stage). The same

applies for all the elements. Similarly, the need for SOA best practices is shared by the authors examined as part of the SOA Governance normative literature (Section 2.5.5). Consequently, the researcher coincides with the normative literature and includes the ‘best practices’ as an element of the proposed SOA Governance framework of this thesis. Still, in order to highlight and discuss the issue, a synopsis of the normative literature is shown in the following paragraph.

Hojaji and Shirazi (2010) and Niemann *et al.*, (2010) include the best practices, as an element of their proposition. Respectively, Hojaji and Shirazi (2010) report that SOA best practices are necessary for IT organizations to (a) maintain the high standards in SOA consistency, (b) cost-effective SOA operations and (c) aid in structuring a better SOA. Whereas, Niemann *et al.*, (2010) emphasise on the commonality of best practices as a SOA Governance element (e.g. in other frameworks and propositions) and endorse its use as part of their model. Additionally, the authors place best practices closely with policies and describe them as an up-datable catalogue that collects experience and provides support for the creation of new policies, with the responsibility to update and maintain the best practices given to the organisational structure (Hojaji and Shirazi, 2010; Niemann *et al.*, 2010) .

As a result of the aforementioned views, the researcher summarises the best practice element as it is identified by the normative literature and presents it in Table 3.10.

Best practice (BB) Element			
Attributes (AT)	Sub-elements (SE)	Guidelines (GU)	Relations (RE)
<ol style="list-style-type: none"> 1. Collects experience 2. Support the creation of new policies, 3. Cost-effective operation 	<ol style="list-style-type: none"> 1. Best practice's categories 	<ol style="list-style-type: none"> 1. Maintained by the organisational entity 	<ol style="list-style-type: none"> 1. Organisational structure

Table 3.10: Best practices (BB) as Identified in Normative Literature

Apparently, while both authors emphasise on the need to use best practices as part of the SOA framework and mention its benefits like: maintaining consistency, supporting policy creation and cost-effective operation, the aforementioned authors do not provide any further analysis for this element. The researcher agrees with the authors that best practices can aid SOA Governance as they provide guidance towards effective and accepted ways that SOA needs to function. Still, in an attempt to enhance the limited analysis of the element (as it was identified in the normative literature so far), the researcher develops the issue and illustrates the process in Section 3.3.

3.2.9 Governance Processes (GP) Element

'Governance processes' is considered as a main element in many SOA Governance models. This is understandable not only by the self-explanatory term closely related to governance (e.g. governance processes consist of all the processes required for governance), but also from the observation that all the authors in the SOA Governance concept map include it as an element. This is so, as this element refers to the core of SOA Governance, the processes required to make the plans into action. For this reason the researcher proposes that SOA Governance processes element needs to be included as an element, of the proposed framework of this thesis. Yet, as discussed in Section 2.5.7 not all the identified models portray this element in the same way and/or propose the same sub-elements and attributes. Thus, in order to clarify the issue, in the following paragraph the researcher presents a synopsis of the normative literature.

All the authors included as part of the SOA Governance literature review of Section 2.5.7 agree that the governance processes revolve around the service lifecycle, still they do not conceptualise the element the same way. For example, Beimborn *et al.*, (2009) reports that SOA Governance processes are responsible for the management of the service lifecycle, and alongside Janiesch *et al.*, (2010) emphasise that no matter which service design methodology is used (e.g. to construct the service lifecycle) governance processes will always aim at the same result, to ensure that SOA will deliver the features required for an organisation. Following the same logic, but in a more elaborate approach, Hojaji and Shirazi (2010) and Niemann *et al.*, (2010) propose a governance lifecycle that may include phases as plan, define, implement and measure. This is a very useful description as it provides clear distinction into phases and attributes for each phase. Hojaji and Shirazi (2010) and Niemann *et al.*, (2010) provide such attributes (seen in detail in Table 2.13 and 2.15 respectively), which the researcher considers and utilises to further develop the element (as seen in Section 3.3). Additionally, Bernhardt and Seese (2009) focus more in the policies aspect and portray SOA Governance processes to be responsible for issues like: (a) the definition, propagation, education and enforcement of governance policies and (b) approval, review, reporting and provide the feedback to the organisational structures (Bernhardt and Seese, 2009). These authors' views seem to revolve around the same issue, that of service lifecycle, without expressing it in the same way, as the previous phased approach. Furthermore, Schepers *et al.*, (2008) proposition which is entirely dedicated to address the SOA Governance lifecycle propose phases, such as: (a) create SOA strategy, (b) align the organisation, (c) manage service portfolio, (d) control service lifecycle, (e) enforce policies and (f) manage service

levels (seen in detail in Section 2.5.6). Schepers *et al.*, (2008) proposition is considered as valuable and will be incorporated in the development of the element (seen in Section 3.3.6)

In an attempt to illustrate the aforementioned views the researcher provides a synopsis of the normative literature, as seen in Table 3.11. The first from the left column of the table presents the attributes, the second includes the sub-elements, the third describes the guidelines and the fourth depicts the relations.

Governance Processes (GP) Element			
Attributes (AT)	Sub-elements (SE)	Guidelines (GU)	Relations (RE)
1. Deal with the management of the service life-cycle 2. Manage service portfolio 3. Ensure that services are designed properly 4. Ensure SOA will deliver the features required by an organization 5. Create and enforce policies	1. Governance lifecycle	1. Governance lifecycle may include phases such as: plan, define, implement and measure	1. Organisational structure 2. Policies 3. Governance Infrastructure

Table 3.11: SOA Governance Processes (GP) as Identified in Normative Literature

In an attempt to integrate the aforementioned views and add enhancements (based on literature beyond the primary cases) the researcher develops the issue further in Section 3.3.

3.3 Part B - Additions for SOA Governance Elements

Thus far, in the previous sections a detailed view of the SOA Governance framework elements, such as: governance structure (Section 3.2.1), roles (Section 3.2.2), maturity model (Section 3.2.3), roadmap (Section 3.2.4), SOA Governance infrastructure (Section 3.2.5), policies (Section 3.2.6), metrics (Section 3.2.7), best practices (Section 3.2.8), and SOA Governance processes (Section 3.2.9) were presented as identified in normative literature. In this part the researcher attempts to enhance the common issues and tackle their lack of analysis by incorporating additional knowledge and guidelines. This process includes exploitation of literature resources beyond the primary cases (an issue discussed in Section 2.5.4).

3.3.1 Additional Guidelines for Organisational Structure (OS) Element

The researcher acknowledges that the SOA organisational structure element as identified in the normative literature supports the SOA Governance implementation and as summarised in Table 3.2 can provide guidance in an organisation's move towards SOA. Still, it has been reported that the way an organisation forms and engages new appointed structures against already established organisational structures can affect the performance of the whole

organisation if not coordinated appropriately (Burns and Hewitt-Dundas, 2010). This is the case for SOA Governance as coordinating technology, processes, strategies and structural issues all at once, augments the percentage of a near miss and can leave an organisation worse off than before the organisational restructuring (Marks, 2008). Especially in healthcare organisational readiness for change (e.g. organisational restructuring) is considered a critical precursor to the successful implementation of complex changes in healthcare settings (the healthcare perspective will be further explored in section 3.4.) (Weiner, 2009).

In this section the researcher reflects on the aforementioned concerns about readiness to change and proposes a set of additional guidelines to accompany the SOA Governance element, such as:

- A better understanding about how the organisation is currently structured, is required before the creation of the SOA Governance structure. This is supported by Marks (2008) who emphasises that SOA Governance structure needs to be designed and implemented in light of and in many ways to compensate for weaknesses of the current organisational and IT structure.
- A better understanding about how the SOA organisational structure will engage with the organisation is required. This is supported by Biske (2008) proposition, in which he identifies three different approaches, with their positive and negative characteristics, namely: (a) communication/education centre, (b) staffing centre and (c) outsourcing centre, as seen in Table 3.12. Moreover, the table presents the engagement approach in which a governance structure can function, alongside its description, positive and negative characteristics.

Engagement Proposition	Description	Positive Characteristics	Negative Characteristics
Communication /education centre	Communicate the SOA message & educate the rest of the organisation with a minimum function as a reviewer of SOA projects	<ul style="list-style-type: none"> • Simple form of structure 	<ul style="list-style-type: none"> • Disconnection from projects
Staffing centre	Train other staff by working alongside them	<ul style="list-style-type: none"> • Works well for technical aspects of SOA • Ensures compliance • Feedback from trainees and the field experience 	<ul style="list-style-type: none"> • Not practical for the business and managerial aspects
Outsourcing centre	The development is separated from projects and allocated in the centre	<ul style="list-style-type: none"> • Developing is aiming a wide audience 	<ul style="list-style-type: none"> • Requirements on functional knowledge • Scale limitation

Table 3.12: Proposed Engagement of SOA Governance Organisational Structure

- A good balance on the number of boards is required. This is supported by Marks (2008) who emphasises that: (a) fewer high-impact governance councils (or boards) are more effective than diluted governance spread across many councils and (b) that the

organisation ought to continually assess whether it has too many, too few, or just enough and amend accordingly.

Therefore, the researcher proposes three additional guidelines to be included in the SOA Governance structure element as to enhance its conceptualization, namely: (a) designed to compensate for the weaknesses of the current organisational and IT structure, (b) engagement approach and (c) balanced number of structures.

3.3.2 Additional Guidelines for Roles (RL) Element

As expressed in Section 3.2.2 the roles element as identified in the normative literature may support the SOA Governance. Yet, it is the researcher understanding that for this element to aid the guidance of an organisation towards SOA Governance further guidelines need to be included. These, may include a list of roles with their responsibilities. This list can act as a supportive guideline when an organisation addresses this element. In more detail, following the well-cited Kajko-Mattsson *et al.*, (2007), proposition the roles can be divided into four categories, like: (a) SOA support (sub-categories: front-end, back-end), (b) SOA strategy and governance, (c) SOA design and quality and (d) SOA development and evolution. Additionally, the researcher incorporates Strandl (2007) and Biske (2008) proposition on roles and responsibilities, so as to enhance the aforementioned list conceptualisation. The proposed list is presented in Table 3.13. The first two columns of the table are the categories and sub-categories proposed by Kajko-Mattsson *et al.*, (2007) and the next two columns indicate the roles and responsibilities based on views by Strandl (2007), Biske (2008) and Kajko-Mattsson *et al.*, (2007). A description of the proposed roles is presented in the following paragraphs.

SOA Front-End Support: This group is responsible for supporting the SOA-based applications that are in direct contact with customers.

- *Operator:* Is responsible for the day-to-day operation of applications like starting and stopping applications and handling exceptional circumstances. Also, accepts reports on problems or changes in business processes, and escalates and monitors problems/changes reports to the *SOA Support Engineer*, if necessary (Kajko-Mattsson *et al.*, 2007; Strnadl, 2007).
- *Support Personnel:* Confirms reported problems, identifies solutions (if any), and escalates and monitors problems/change/requests to the *Back-End Support* role group after having confirmed the problem (Kajko-Mattsson *et al.*, 2007).

SOA Back-End Support: This group is responsible for creating, evolving, maintaining and reusing services and business processes. Individuals in this role have profound knowledge of business processes and supporting services.

- *Business Process Analyst:* Analyses problem reports and change requests (coming from the SOA Front-End Support group) to business processes/services, validates required changes with the SOA Design role groups and assigns development, maintenance and evolution tasks. The analyst ensures business requirements are met and may have key relationships within the organisation outside of IT (Biske, 2008; Kajko-Mattsson *et al.*, 2007; Strnadl, 2007).
- *Service Developer:* Performs service development, evolution and maintenance tasks as assigned by the Business Process Analyst. This may include reuse of services and error-localisation (Kajko-Mattsson *et al.*, 2007; Strnadl, 2007).
- *Application Developer:* Is responsible for implementing applications from specifications by business analysts and service designers. This includes deployment packages for the applications (Strnadl, 2007).

SOA Strategy and Governance Roles: This role group is responsible for the management and governance of SOA-based systems, based on an overall SOA strategy. This group ensures that business needs are met on a strategic, tactical and operational level.

- *SOA Strategy Manager:* Creates and evolves the organisation's SOA strategy to support business needs (Kajko-Mattsson *et al.*, 2007).
- *SOA Governance Manager:* Creates and evolves policies and procedures for SOA Governance. Defines the overall development, evolution and maintenance of process measurement (e.g. process model), monitors and controls the measurement process, and provides feedback to the rest of the organisation (Kajko-Mattsson *et al.*, 2007).
- *SOA Process Manager:* Creates and evolves the organisation's development, evolution and maintenance processes (Kajko-Mattsson *et al.*, 2007).
- *SOA Security Manager:* Ensures appropriate measures are taken considering protection of sensitive information. Thus, creates, monitors and controls security policies and strategic plans for all SOA-based systems. Special attention is given to the identification of service interaction as the degree of interactions increases and more automation is required (Biske, 2008; Kajko-Mattsson *et al.*, 2007).
- *SOA Technology Scout:* Provides technical direction for SOA implementation (conceptualises on effective adoption of products, standards, and processes) and assesses

technology trends to determine appropriateness for use within the organisation (Kajko-Mattsson *et al.*, 2007).

SOA Design and Quality management: This role group is responsible for modelling of business processes, integration of business processes along with assurance of their interoperability and quality, service repository management, and administration of SOA-based systems releases.

SOA Design: This group is responsible for the modelling and architecture of business processes and their mapping to new or existing services. Specific roles include:

- *SOA architect:* is responsible for the technical leadership and decisions on a project. Works with developers and analysts to coordinate and ensure the compliance of the solution's architecture and design (Kajko-Mattsson *et al.*, 2007). It can be a local/departmental role or a wider spectrum/global role, either way special attention is given to incorporate the functional knowledge required to hold this role (Biske, 2008; Kajko-Mattsson *et al.*, 2007).
- *Infrastructure Architect:* Is responsible for planning and organizing the infrastructure strategy. From server, communications to ESBs and other technologies the architect ensures that they are used properly and provides clarity on their use (to the application developer) (Biske, 2008; Strnadl, 2007). Also, may be responsible for the consistency of representation of the transmitted information (Biske, 2008).
- *SOA Service Designer:* Is the person in charge to create technical service designs from business requirements for the application developer to implement. This role is closely related with the business analyst and SOA architect.

SOA Quality Assurance: This group is responsible for integrating the business processes and assuring their interoperability and quality. Specific roles include:

- *Business Process Integrator:* Integrates business process components and assures their interoperability (Kajko-Mattsson *et al.*, 2007).
- *Tester:* Is the person that tests the application provided by the application developer, possibly with assistance from the administrator (Error Search, Test coverage, search, documentation). (Kajko-Mattsson *et al.*, 2007; Strnadl, 2007).

SOA Administration: This group is responsible for administrating the SOA-based systems and their releases. Specific roles include:

- *Administrator*: Is responsible for the runtime environment and installs and uninstalls applications and infrastructure components. Responsible for the service repository, ensures that correct data are published and maintained about all services, and manages the repository of all services so they can be discovered and accessed (Strnadl, 2007). Maintains control over releases and documentation for the SOA infrastructure and the services that are available (Kajko-Mattsson *et al.*, 2007).
- *SOA Librarian*: Is responsible for the consistency of the service registry, repository and establishes rules and guidelines for services, approves additions and changes to service registry content. Also, maintains control over releases and documentation for the SOA infrastructure and the services that are available (Kajko-Mattsson *et al.*, 2007; Strnadl, 2007).

SOA development and evolution: As with traditional development and evolution, minor development and changes to business processes and their components are conducted in teams. Major development and changes, however, are conducted in projects. For this reason, there is the need for the following roles:

- *SOA Project Manager*: Responsible for managing projects, defining project plans, implementing the plans, and monitoring the project (Kajko-Mattsson *et al.*, 2007).
- *SOA Project Member*: This role may be composed of a group of different roles coming from various *Business Process Teams*, *SOA Designers*, *SOA Quality Assurance* and other role groups (Kajko-Mattsson *et al.*, 2007).

In a healthcare organisation these roles may or may not already exist before the SOA application. The *SOA development and evolution* (project manager and member), for example can be given to a doctor-manager and/or nurse-manager that had experience with previous projects, while other more technical roles might require more IT sophisticated personnel and/or training. Either way, the introduction of the proposed roles list is optional but supportive as they give a clear task structure. However, their applicability to healthcare requires investigation.

Category	Sub-category	Role	Responsibilities
SOA support	Front-end	Operator	<ul style="list-style-type: none"> Day-to-day operation Starts and stops applications
		Support Personnel	<ul style="list-style-type: none"> Identifies/confirms problems Identifies/confirms solutions Reports accordingly
	Back-end	Business Process Analyst	<ul style="list-style-type: none"> Validates business requirements Assigns tasks Reports accordingly
		Service Developer	<ul style="list-style-type: none"> Performs (development, evolution & maintenance) tasks Reuse & error localisation
		Application Developer	<ul style="list-style-type: none"> Application implementation Application deployment
SOA strategy & governance	-	Strategy manager	<ul style="list-style-type: none"> Strategic blueprints Business plans
		Process manager	<ul style="list-style-type: none"> Development process Evolution process Maintenance process
		Security manager	<ul style="list-style-type: none"> Protection Identity of service interactions Documentation
		Governance manager	<ul style="list-style-type: none"> Controls policies Manages measurement
		Technology scout	<ul style="list-style-type: none"> Technical directions Assesses technology solutions
SOA design & quality management	Design	SOA architect	<ul style="list-style-type: none"> Logical architecture Physical architecture Coordination
		Infrastructure architect	<ul style="list-style-type: none"> Technology planning, organizing Data consistency
		SOA designer	<ul style="list-style-type: none"> Design Consolidate Documentation
	Quality assurance	Business integrator	<ul style="list-style-type: none"> Integrates business processes
		Tester	<ul style="list-style-type: none"> Error Search Test coverage search Documentation
	Administration	Administrator	<ul style="list-style-type: none"> Runtime management Installs applications Uninstalls applications
		Service librarian	<ul style="list-style-type: none"> Service registry Rules and guidelines Registry consistency
SOA development & evolution	-	Project manager	<ul style="list-style-type: none"> Management, definition and monitoring of project plans
	-	Project member	<ul style="list-style-type: none"> Participation to the project team

Table 3.13: Proposed SOA Roles [Adapted from:Strandl (2007), Biske (2008) and Kajko-Mattsson et al., (2007)]

Therefore, the researcher proposes this list of roles as an explanatory guideline to accompany the roles element.

3.3.3 *Additional Guidelines for Roadmap (RD) Element*

Section 3.2.4 reflects the normative literature and concludes that the SOA roadmap needs to be an element in the SOA Governance arsenal. Yet, it is the researcher's understanding that for this element to aid the guidance of an organisation towards SOA Governance further development is required. This will be described in the following paragraph.

Taking as a starting point, Hojaji and Shirazi (2010) proposition that the SOA roadmap is based on the SOA maturity model and thus to its maturity levels (e.g. Initial, Managed, Defined, Quantitatively Managed and Optimised) the researcher sets to further develop the element. Aid in this development, is Rosen *et al.*, (2008) description that when a minimum SOA architecture is required, (e.g. initial maturity level) the roadmap address at least two areas: (a) a rough priority order of service implementation and (b) a high-level plan for building the architecture (Rosen *et al.*, 2008). Thereafter, in a progressive sequence, as SOA matures the roadmap can be updated to include (a) the existing services created, and (b) new business models (Rosen *et al.*, 2008). It is the researcher's understanding that the new business models are variables, dependable on each organisation's particularities and needs at the time. Thus, in order for the organisation to progresses from one level of maturity to the next, a new planning sequence is generated, and new goals are set. These new goals include the new business models. However, before embarking on designing the roadmap, the organisation ought to understand the maturity held at the time (e.g. initial maturity level assessment) (Hojaji and Shirazi, 2010). This process is performed with a SOA maturity model (as the element proposed in Section 3.2.3) as it can provide detailed categorisation of application areas (e.g. technology, process, organisation etc.) and thus infuse more detail in the construction of the SOA roadmap. This way the goals can be set for each of the application areas.

This method of addressing the roadmap based on the maturity levels, that can produce clear goals, may be a good management exercise for healthcare organisations. As it was revealed in Section 2.4.2, setting goals was identified as a SOA CSF in healthcare. Thus, such a proposition may assist healthcare professionals to better address this critical factor. This issue will be explained in Section 3.4

Therefore, combining the SOA maturity model levels proposed in the previous section (e.g. Initial, Managed, Defined, Quantitatively Managed and Optimised), with Rosen *et al.*, (2008) proposition the researcher, proposes the SOA roadmap based on SOA maturity levels, as seen in Figure 3.5. In this figure the left side presents the maturity levels, each one corresponding to a roadmap, which is presented on the right side.

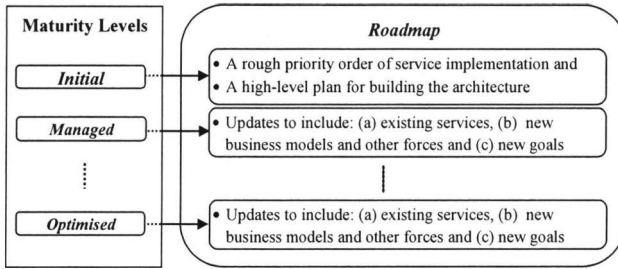


Figure 3.1: Proposed SOA Roadmap's Based on SOA Maturity Levels

Therefore, the researcher proposes this additional illustration of designing a roadmap to be added as a guideline in the corresponding roadmap element.

3.3.4 Additional Guidelines for Metrics (ME) Element

Section 3.2.7 reflects the normative literature and concludes that metrics needs to be an element, part of the SOA Governance framework. However in the same section it was described that while the normative literature illustrates metric divisions for services, service operation, projects and governance processes more divisions may exist that require different questions to be raised for them. Following this requirement the researcher analyses Zmuda *et al.*, (2010) proposition for metrics. According to Zmuda *et al.*, (2010) the metric definition refers to the metric name and indicates which metric attributes have to be provided and when the metric is instantiated. The actual values of metric attributes represent the metric configuration, which, for example, can specify how the metric monitoring data should be aggregated (Zmuda *et al.*, 2010). To aggregate the data and provide guidance, a good practice is to apply the Goal/Question/ Metric (GQM) method (Basili *et al.*, 2010). This method has been applied to SOA aspects by Aier *et al.*, (2009) and follows a top-down approach by first defining goals, then deriving questions and finally deriving metrics.

For example, as seen in Table 3.14, the first column represents the aforementioned metrics categories, such as: services (s), service operations (so), and projects (p). The second column represents the goals each metric category corresponds to, set numerically (e.g. for services: Gs1, Gs2... for service operations: Gso1, Gso2... etc.). The third column the question(s) that each goal corresponds to (e.g. Gs1 corresponds to Qs1 and Qs2 etc.), and in the fourth column, each question maps to one or more metrics (e.g. Qs1 corresponds to Ms1). For example, if the set goal for a service requires a specific time frame of execution, the question

can be set to ask the time it took for the service to be executed and the metrics can be the actual measurement or observation of the time that it takes.

By utilising the Goal/Question/ Metric (GQM) method, the data gathered from the metrics can be linked back to the goals and, thus, compared with the initial goal requirements. Then these goals can be set as milestones in the SOA roadmap.

Categories	Goals	Questions	Metrics
Services	Gs1	Qs1	Ms1
	Gs2	Qs2	Ms2

	Gsn	Qsn	Msn
Service operations	Gso1	Qso1	Mso1
	Gso2	Qso2	Mso2

	Gson	Qson	Mson
Projects	Gp1	Qp1	Mp1
	Gp2	Qp2	Mp2

	Gpn	Qpn	Mpn

Table 3.14: Example of Metrics Framework

Consequently, the researcher proposes the G/Q/M method as an additional guideline to metrics element as to enhance its conceptualisation.

3.3.5 Additional Guidelines for Best Practices (BB) Element

As expressed in Section 3.2.8 the best practices element can aid SOA Governance as it provide guidance towards effective and accepted ways that SOA needs to function, but, in an attempt to enhance the limited analysis of the element (as it was identified in the normative literature so far), the researcher provides and explains the issue in the next paragraphs.

A well cited view about best practices is given by O'Dell and Grayson (1998) who propose that best practices can be categorised into four levels, namely: (a) good idea, (b) good practice, (c) local best practice and (d) industry best practice, as seen in Table 3.15. The

researcher believes that this is a good guideline for SOA. For example a “good idea” can be a SOA practice used internally in an organisation (e.g. a policy), respected by a part of it but not established as an “industry best practice” (e.g. a standard policy). In this example, a part of the organisational structure defined and disseminated the “good idea” (the employees that use it), while others account for it and even expand it to build a “good practice” that then can become a “local good practice”. The same can apply for many issues such as technological solutions, security mechanisms etc.

Best Practices	
Categories	Definition
Good idea	Unproven practice, making a lot of sense intuitively and thus a potential candidate.
Good practice	A candidate practice which has been tested in one or more projects. Further substantiation is needed. There is little or no comparative data from other organisations.
Local best practice	A good practice that has been determined to be the best approach for all or part of an organisation. This is based on an analysis of performance data, including some review of similar practices outside the organisation where the best practice originated.
Industry best practice	A practice that has been determined to be the best approach for all or most of the organisations in an industry. This is based on benchmarking inside and outside the original organisation (including organisations outside its industry), and includes analysis of performance data.

Table 3.15: Best Practices Categories [O’Dell & Grayson (1998)]

Moreover, in O’Dell and Grayson (1998) proposition, the first three categories of best practices can be originated internally in any organisation, while the last category, the industry best practices can be seen as the influences of the industry (in this case IT/SOA and healthcare) to the healthcare organisation. Consequently, the researcher proposes this explanatory categorization to be included in the best practices element as to enhance its conceptualisation.

3.3.6 Additional Guidelines for Governance Processes (GP) Element

To better illustrate the governance processes element, the researcher follows a similar approach as the ones suggested by Hojaji and Shirazi (2010) and Niemann *et al.*, (2010). That is to separate the SOA Governance processes in four phases, like: plan, define, implement and measure. It can be argued that this approach provides a clear and concise view of the governance process. Still, to fully support the identified literature the researcher integrates respectively in these phases all the issues specified by the authors of the primary cases. For example, Schepers *et al.*, (2008) proposes a starting phase “create SOA strategy” that can clearly be integrated in the plan phase. The same is done for the rest of the phases. Thus, the SOA Governance processes element as identified in literature, can be separated in four phases, with each one holding specific attributes. Additionally, to enhance the knowledge surrounding this element, the researcher includes Biske (2008) views about SOA Governance processes. The researcher believes that while the normative literature depicted this issue,

additional attributes for each phase are needed. These are provided by Biske (2008) who agrees on the separation of the element in four phases in an analogy to Hojaji and Shirazi (2010) and Niemann *et al.*, (2010) way (e.g. create, educate, enforce and measure) but also provides a better analysis that each phase needs to include. For example, the author identifies the need to educate the organisation by formal education and communications plans targeting a wide and/or specialised audience accordingly, so as to raise awareness of the SOA Governance effort (Biske, 2008). The researcher agrees with Biske (2008) proposition and integrates it as part of the plan phase. The same logic is followed for the rest of the phases. Therefore the resulting element, divided in four phases, with the identified normative literature and Biske's (2008) proposition can be seen in Figure 3.2.

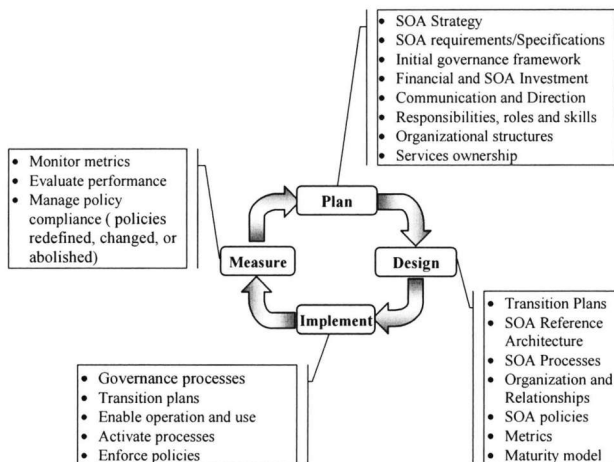


Figure 3.2: Proposed SOA Governance Process (GP) Element

Thus, the researcher includes governance process as an element of the proposed SOA Governance framework and Figure 3.2 with all the phases and their attributes to represent the processes conceptualisation.

Thus far, in this part the researcher proceeded to several additions on the SOA Governance elements, like: (a) SOA Governance structure guidelines, (b) example list of SOA roles and responsibilities, (c) SOA roadmap design guidelines, (d) method to construct metrics, (e) best practices categorisation guidelines, and (f) SOA Governance phases and attributes (examples of the latter). In the next part, the researcher highlights the SOA Governance aspects needed for governance in a healthcare setting.

3.4 Part C – Healthcare Specific Attributes

In this part, the researcher attempts to enhance the common issues and tackle their lack of healthcare specific conceptualisation. Moreover, In Section 2.4.2 a list of SOA CSFs as identified in healthcare was presented and analysed. The researcher argues, that the SOA Governance elements need to address these factors and where applicable include augmentation that can also resolve HIS challenges like: complexity, security, medical errors/testing (these challenges can be seen in Section 2.2). This process is presented in the following paragraphs, based on the SOA CSFs.

- **Alignment** – Beimborn *et al.*, (2009) suggest that well established SOA Governance structures positively influence the structural dimension of IT/business alignment. The researcher agrees with the aforementioned authors and believes that organisational structures can address this CSF with attributes as dedicated committees and/or individuals who hold alignment related *roles* and responsibilities (e.g. strategy manager). These individuals can then set specific goals like SOA compliance (e.g. alignment with legal, internal regulations) and business/IT alignment (these goals are also supported by Niemman *et al.*, (2008; 2010)), implement *SOA Governance processes*, design *policies* that influence the alignment and using appropriate *metrics* measure and control these policies and the level of complexity.
- **Clear goals** – This is a broadly defined CSF that can be implied for all the elements of the proposed SOA Governance framework. For example, *SOA Governance processes* and *metrics* have specific goals that are set by *organisational structures* and individuals holding *roles* in these structures. It is the researcher understanding that the clear definition of these goals is placed on the clarity of the concept they address and the skills of the individuals defining them. Thus, the researcher proposes to include in the organisational structure element the guidelines: (a) responsible to set clear goals for SOA Governance issues and (b) involve individuals with skills that can set clear goals so as to address this CSF.
- **Complexity** – The researcher argues that identifying sources that increase the overall complexity in a system can be placed as a responsibility in individual *roles*. For example, the SOA architect (a role proposed in Section 3.3.2) holds the responsibility for designing and implementing the logical/physical architecture and thus can foresee and manage in some extent the complexity introduced by the implementation. Additionally, individuals with these kind of responsibilities (e.g. complexity related) can collectively under an *organisational structure* (e.g. committee, interest groups) or more informally (e.g. intranets, wikis) address potential complexity issues. Yet, as complexity was also

identified as a HIS challenge (shown in Section 2.2) the researcher emphasises the need for this CSF to be adequately addressed. Literature suggestions recommend the utilisation of SOA metric systems that can measure design-time and run-time services and predict unwanted levels of complexity (Hirzalla *et al.*, 2009). The researcher agrees with this suggestion and proposes that the *metrics* element (metrics that measure system complexity) need to be utilised so as to provide better governance of the complexity factor.

- **Cost** – Cost and more precisely funding was included in the *organisational structures* element that can control in certain extent the funding of SOA projects. However, it is the researchers belief that for this CSF to be better dealt, the creation of committees in charge of cost planning and control that can also identify service/project sponsors within or outside the organisation is required. Additionally, funding can be added as an area in the *SOA maturity model*, so as the healthcare organisation can compare the progress of business processes, technology and other areas with financial data and better govern this factor.
- **Culture** – The researcher argues that the *organisational structure* can cultivate a SOA friendly culture and gain the trust and cooperation with the rest of the healthcare organisation. This may involve specific *governance processes* that promote SOA and its beneficial parameters (e.g. educational and communication planning). Thus, the researcher proposes the aforementioned additions in the corresponding elements.
- **Experience and training** – This CSF including the requirements of experienced personnel and additional training is in great extent covered by the *SOA organisational structures'* and *SOA Governance processes'* attributes, as portrayed in Section 3.2.1 and 3.2.9 respectively.
- **Governance** – It is the researchers understanding that the proposed SOA Governance elements (Part A and B) and healthcare aspect added in this section (Part C) can address all the requirements for governance (as an CSF) in a healthcare organisation.
- **Long-term planning** – The researcher argues that the CSF identified as long-term planning can be represented by the *SOA maturity model* as a more elaborate approach. For example, one of the application areas that a SOA maturity model examines is the services, these are described starting from an initial and reaching to a final maturity level, expressed in a similar progressive way as in a long-term plan. Thus, the researcher identifies this approach to be a useful tool for SOA Governance and proposes its utilisation to address this CSF.
- **Measurement** – It can be stated that this CSF can be addressed by the *metrics* element, as they hold similar conceptualisation, with emphasis on the role of the *SOA Governance infrastructure* in the collection of metrics and diffusion of feedback about them.

- **Maturity identification** – The researcher accepts that this CSF can be represented by the SOA *maturity model* element, as this is described in Section 3.2.3.
- **Project identification** – It can be argued that this factor is addressed as part of the SOA *organisational structure*'s attributes presented in Section 3.2.1 and also it is the researcher's belief that specific *roles*, like strategy manager, SOA architect and SOA designer (as proposed in Table 3.13), are responsible for the project identification.
- **Resources** – This CSF is described as a multifaceted one with parameters as financial (budget), technical (software/hardware), and staff (experts, implementation team, consultants) aspects. The financial parameter can be addressed similarly the cost CSF (e.g. from *organisational structures* and SOA *maturity model* elements). As far as the technical aspect the researcher believes that is covered by the SOA *Governance infrastructure* element conceptualisation, since both refer to adequate resources as software and hardware systems. Additionally, the introduction of the *roles* element can resemble the staffing aspect of this CSF.
- **Risk** – It can be stated that this CSF is addressed by the proposed *roles* of security manager and tester regarding the security and error risk, and from the *organisational structure* element regarding the funding and sponsoring risk (in the form of dedicated committees or groups). Yet, it is the researcher understanding that data security and patients' confidentiality are clearly a significant challenge to healthcare (highlighted in Section 2.2) and beyond the organisational structures and roles, specific testing, standards, *policies* and *best practices* are needed. These will be discussed in the following paragraphs.
- **Roadmap** – It can be stated that this CSF can be addressed by the *roadmap* element, as it was presented in Section 3.2 and 3.3.
- **Roles** – The researcher argues that this CSF can be addressed by the *roles* element as this was identified in Sections 3.2 and enhanced by a list of roles in Section 3.3.
- **Standards** – SOA is based on established global standards (e.g. XML, UDDI, SOAP, WSDL, BPEL and REST). In healthcare the standards related to information coding and sharing (e.g. SNOMED, HL7) or protocols (e.g. DICOM) that enhance the interoperability and improve the way HIS share information are usually developed from national central standardisation bodies or independent organisations like IHE (IHE, 2012). An example of this is the recognised HSSP program, which is a collaborative effort between standards groups HL7 and OMG to address interoperability challenges within the healthcare sector, operating on SOA (HSSP, 2013). This combination between SOA and healthcare standards is an important factor for SOA implementations, regarding aspects of security, interoperability and QoS. Thus, it is the researcher's belief that such standards need to be incorporated as *best practices* and utilised accordingly. In charge of

such best practices can be *organisational structures* (e.g. committees, interest groups) that can identify the standards, evaluate them and recommend them as best practices and thus minimise the risk in issues like: security, access control and medical errors. Additionally, this activity can be included as a SOA Governance process (e.g. standardisation process).

- **Team** – The researcher argues that this CSF can be addressed by the *SOA Governance organisational structures* element as this was illustrated in Sections 3.2 and 3.3.
- **Testing** - This CSF was identified requiring tools and methods to test the integration approaches and services before the actual service implementation. The researcher extents this CSF’s importance to testing in both design- and run-time SOA and believes that specific *roles* like tester, infrastructure and SOA architect, service developer, process and security manager with the aid of *SOA Governance infrastructure* can control the criticality of this factor. These roles, as proposed in Table 3.13, include a wide spectrum of responsibilities related to testing like error localization for service developer, and/or maintenance for process manager and of course testing for the tester role. Yet, it is the researcher understanding that since testing was identified as a HIS challenge (explained in Section 2.2), additional emphasis is required to address this factor. Thus, proposes governance processes that address this factor to be included in the *SOA Governance processes* element, which with the aid of *SOA Governance infrastructure* can provide testing capabilities. Furthermore, these processes can be placed in *best practices* element and form guidelines that minimize errors.

To better illustrate, which of the SOA Governance elements (as identified in PART A and B) address the CSF and which require additions, the researcher presents them in Table 3.16. In this table the first column presents the CSF and HIS challenges, the second to tenth the SOA Governance elements and the last column describes the additions required as these were proposed by the researcher. The symbols underneath the SOA Governance elements symbolise (✓): addressed by corresponding element, (+): addition proposed for the element and (-): not directly addresses the CSF/challenge.

		SOA Governance elements									
		Organisational structure	Roles	Maturity model	Roadmap	SOA Governance infrastructure	Policies	Metrics	Best practices	SOA Governance processes	
CSF/Challenge											Additions to address healthcare aspects (CSFs & HIS challenges)
Alignment	+	✓	-	-	-	+	+	-	+		<ul style="list-style-type: none"> Dedicated alignment structures (e.g. committees, councils) Business/IT alignment goals Alignment governance process Alignment policies Metrics to measure alignment level
Clear goals	+	-	-	-	-	-	-	-	-		<ul style="list-style-type: none"> Set clear goals for all elements Involve individuals with skills that can set clear goals
Complexity	+	✓	-	-	-	-	+	-	-		<ul style="list-style-type: none"> Dedicated formal (committees, interest groups) or informal (intranets, wikis) to control complexity Metrics measuring complexity
Cost	+	-	+	-	-	-	-	-	-		<ul style="list-style-type: none"> Committees dedicated to cost control, sponsor identification and funding. Funding added as a 'application area' in the maturity model
Culture	+	-	-	-	-	-	-	-	+		<ul style="list-style-type: none"> Cultivate SOA friendly culture Promotional processes that endorse SOA and its beneficial parameters (e.g. educational and communication planning).
Experience and training	✓	-	-	-	-	-	-	-	✓		Covered by existing elements conceptualisation
Governance	✓	✓	✓	✓	✓	✓	✓	✓	✓		Covered by existing elements conceptualisation
Long-term planning	-	-	✓	-	-	-	-	-	-		Covered by existing elements conceptualisation
Measurement	-	-	-	-	✓	-	✓	-	-		Covered by existing elements conceptualisation
Maturity identification	-	-	✓	-	-	-	-	-	-		Covered by existing elements conceptualisation
Project	✓	✓	-	-	-	-	-	-	-		Covered by existing elements conceptualisation
Resources	✓	✓	✓	-	✓	-	-	-	-		Covered by existing elements conceptualisation
Risk	+	✓	-	-	-	+	-	+	-		<ul style="list-style-type: none"> Dedicated structures (e.g. committees and interest groups) to minimize risk Policies based on risk minimization Highlight practices of error minimisation
Roadmap	-	-	-	✓	-	-	-	-	-		Covered by existing elements conceptualisation
Roles	-	✓	-	-	-	-	-	-	-		Covered by existing elements conceptualisation
Standards	+	-	-	-	-	-	-	+	+		<ul style="list-style-type: none"> Dedicated structures (e.g. committees and interest groups) to identify and propose standards Best practices based on standards Standardisation process
Team	✓	-	-	-	-	-	-	-	-		Covered by existing elements conceptualisation
Testing	-	✓	-	-	✓	-	-	+	+		<ul style="list-style-type: none"> Testing processes Practices focusing on testing and error minimisation

Table 3.16: Healthcare Additions to SOA Governance Elements

An important observation that can be deduced from the above table is that all SOA Governance elements are needed to implement SOA Governance in healthcare. Yet some elements require additions, while others can already deal with specific factors. This is understandable as the CSFs list includes both basic factors but also healthcare specific ones (an issue highlighted in Section 2.4.2).

To this end, the researcher following the literature review findings of the previous chapter, clarified and proposed (in Part A) the main nine elements that a SOA Governance framework may consist of, namely: (a) organisational structures, (b) roles, (c) roadmap, (d) best practices, (e) policies, (f) SOA Governance processes, (g) SOA Governance infrastructure, (h) metrics, and (i) maturity model. To these elements, specific additions were introduced (in Part B) as guidelines to enhance them, like: (a) SOA Governance structure guidelines, (b) example list of SOA roles and responsibilities, (c) SOA roadmap design guidelines, (d) method to construct metrics, (e) best practices categorisation guidelines, and (f) SOA Governance phases and their attributes (examples of the latter). In this section, (Part C) the researcher proposed specific additions (based on SOA CSFs in healthcare and HIS challenges) to the nine elements so as to tackle their lack of healthcare specific conceptualisation. The aforementioned synthesis can be graphically observed in Figure 3.3.

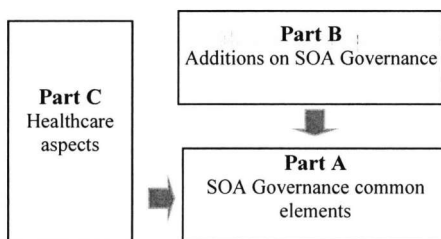


Figure 3.3: SOA Governance Framework Synthesis

Following the synthesis of the SOA Governance elements, the SOA Governance framework is presented in the next section alongside the research issues that require empirical investigation.

3.5 SOA Governance Framework and Research Issues

Up till now, most of the SOA Governance elements were introduced in parts, as common elements in Part A, additions to these elements in Part B and healthcare aspects of the

elements in Part C. In this section, the researcher gives an inclusive aspect of the elements and proposes a SOA Governance framework that can be applied in a healthcare setting.

Thus, starting with the nine common elements the researcher unifies all the concepts (Part A, B, C) under each element and presents them in Table 3.17.

SOA Governance Elements						
Organisational Structure (OS)	Roles (RL)	Maturity Model (MM)	Roadmap (RD)	SOA Governance Infrastructure (SGI)	Policies (PO)	Metrics (ME)
<ol style="list-style-type: none"> 1. Corroborates a number of councils 2. Define and abolish governance policies 3. Obtain and maintain business objectives, standards, best practices 4. Define and obtain feedback from metrics 5. Train employees 6. Communicates SOA purpose 7. Sets roadmap 8. Influence decisions on project prioritisation 9. Influence decisions on funding 	<ol style="list-style-type: none"> 1. Hold SOA responsibilities 2. Responsibility for governance processes 3. Gain the support of all the relevant stakeholders 4. Decrease resistance to change 5. Reduce the risk of program failure in a later stage 	<ol style="list-style-type: none"> 1. Assessment mechanism 2. Provides comparison between current and future states of SOA 3. Assist in steering and planning needed for running a SOA 	<ol style="list-style-type: none"> 1. Provides an incremental SOA adoption 2. Detailed planning process 	<ol style="list-style-type: none"> 1. Manages governance information, automates governance processes, 2. Enforce governance policies, 3. Collects metrics 	<ol style="list-style-type: none"> 1. Comprise rules for developing, deploying and managing a SOA 	<ol style="list-style-type: none"> 1. Improve transparency 2. Provide visibility of essential states and parameters of the SOA initiative
Attributes (AT)						
Sub-elements (SE)	<ol style="list-style-type: none"> 1. Centre-of-Excellence 2. Governance Board 3. Program office 4. Councils/Committees 	<ol style="list-style-type: none"> 1. Responsibilites 	<ol style="list-style-type: none"> 1. Transition plans 	<ol style="list-style-type: none"> 1. Registry 2. Repository 3. ESB 4. Policy & contract management 5. Quality management system 6. SOA management system 	<ol style="list-style-type: none"> 1. Enforcement 2. Aspects 3. Areas 	<ol style="list-style-type: none"> 1. Metrics categories (Such as: Services, Service operation, Projects and Governance processes)
						<ol style="list-style-type: none"> 1. Governance lifecycle
						<ol style="list-style-type: none"> 1. Best practices' categories
						<ol style="list-style-type: none"> 1. Deal with the management of the service life-cycle 2. Manage service portfolio 3. Ensure that services are designed properly 4. Ensure SOA will deliver the features required by an organization 5. Create and enforce policies

Table 3.17a: Proposed SOA Governance Elements

SOA Governance Elements								
Organisational Structure (OS)	Roles (RL)	Maturity Model (MM)	Roadmap (RD)	SOA Governance Infrastructure (SGI)	Policies (PO)	Metrics (ME)	Best Practices (BP)	Governance Processes (GP)
<ol style="list-style-type: none"> 1. Main governance body 2. Members from both IT and business 3. Structured in a centralized or decentralized manner 	<ol style="list-style-type: none"> 1. Members from both IT and business 2. Require specific skills/training 3. RACI 	<ol style="list-style-type: none"> 1. Detailed analysis 2. Levels such as initial, managed, defined, qualitatively managed and optimised 3. Application areas: organization, process, governance, service/ service management architecture, infrastructure and business view 4. Examples such as CMMI, COBIT 	<ol style="list-style-type: none"> 1. Based on: current and target SOA and SOA Governance maturity assessments 2. Designed for each organisation's particularities 3. Planning for: transformation initiative, deliverables, resources, costs, time scales, project dependencies, and risk 	<ol style="list-style-type: none"> 1. The sub-elements are determined by the specific governance requirements 	<ol style="list-style-type: none"> 1. Aspects may include: Architecture, Technology, Organization, Portfolios, Information and Project execution 2. Areas may include: Security, Cross-company cooperation, Design-time, Run-time and Finance 3. Enforcement either manually, or automatically 	<ol style="list-style-type: none"> 1. Design metrics for categories such as: Services, Service operation, Projects, Governance processes 	<ol style="list-style-type: none"> 1. Maintained by the organisational entity 	<ol style="list-style-type: none"> 1. Governance lifecycle may include phases such as: plan, design, implement and measure
Additional Guidelines (A-GU)	<ol style="list-style-type: none"> 1. List of roles and responsibilities 		<ol style="list-style-type: none"> 1. Design guidelines 			<ol style="list-style-type: none"> 1. G/Q/M method 	<ol style="list-style-type: none"> 1. Best practices categorisation 	<ol style="list-style-type: none"> 1. SOA Governance phases and their attributes (examples of the latter)

Guidelines (GU)

Table 3.17b: Proposed SOA Governance Elements

SOA Governance Elements								
Organisational Structure (OS)	Roles (RL)	Maturity Model (MM)	Roadmap (RD)	SOA Governance Infrastructure (SGI)	Policies (PO)	Metrics (ME)	Best Practices (BP)	Governance Processes (GP)
<ol style="list-style-type: none"> 1. Dedicated alignment structures (e.g. committees, councils) 2. Business/IT alignment goals 3. Responsible to set clear goals for SOA Governance issues 4. Involve individuals with skills that can set clear goals 5. Dedicated formal (committees, interest groups) or informal (intranets, wikis) to control complexity 6. Committees dedicated to cost control, sponsor identification and funding 7. Dedicated structures (e.g. committees and interest groups) to minimize risk 8. Dedicated structures (e.g. committees and interest groups) to identify and propose standards 9. Cultivate SOA friendly culture 	<ol style="list-style-type: none"> 1. Organisational structure 	<ol style="list-style-type: none"> 1. Funding added as a application area in the maturity model 			<ol style="list-style-type: none"> 2. Alignment policies 3. Policies based on risk minimization 	<ol style="list-style-type: none"> 1. Metrics to measure alignment level 2. Metrics measuring complexity 	<ol style="list-style-type: none"> 1. Best practices based on standards 2. Practices focusing on testing and error minimisation 	<ol style="list-style-type: none"> 1. Alignment governance process 2. Promotional processes that endorse SOA and its beneficial parameters (e.g. educational and communication planning) 3. Standardisation process 4. Testing processes
<ol style="list-style-type: none"> 1. Roles 2. Roadmap 3. Best practices 4. Policies 5. Governance processes 6. Governance Infrastructure 7. Metrics 8. Maturity model 	<ol style="list-style-type: none"> 1. Organisational structure 	<ol style="list-style-type: none"> 1. Organisational structure 2. Metrics 	<ol style="list-style-type: none"> 1. Organisational structure 2. Maturity model 	<ol style="list-style-type: none"> 1. Organisational structure 2. Metrics 3. SOA Governance processes 4. Policies 	<ol style="list-style-type: none"> 1. Organisational structure 2. SOA Governance processes 3. SOA Governance Infrastructure 	<ol style="list-style-type: none"> 1. Organisational structure 2. SOA Governance process 3. Maturity model 	<ol style="list-style-type: none"> 1. Organisational structure 	<ol style="list-style-type: none"> 1. Organisational structure 2. Policies 3. Governance Infrastructure
Healthcare Aspects (HA)								
Relations (RE)								

Table 3.17c: Proposed SOA Governance Elements

The researcher recognises that the elements presented in Table 3.17 contain views according to SOA Governance normative literature and the researcher's propositions and are proposed as to aid healthcare stakeholders to better govern a SOA project and take decisions towards a successful SOA implementation. Yet, one of the limitations of the normative literature, as identified in Section 2.5.7 involves the lack of testing with empirical data and more especially in a healthcare setting. The absence of valuable empirical data creates the need for every proposed SOA Governance elements to be evaluated, regarding its attributes, sub-elements, guidelines and relations. Thus, the following issue entitled the '*SOA Governance elements*' is proposed for further examination:

SOA Governance elements: 'The proposed SOA Governance elements can contribute in the SOA Governance in a healthcare organisation'.

In order to provide a cohesive conceptualisation of the SOA Governance, the researcher includes all the nine elements in a reference blueprint depicting only the elements, sub-elements and relations in-between them, as seen in Figure 3.4. This approach provides an easy to follow reference blueprint, which can diagrammatically express the elements without cluttering the demonstration with further details (e.g attributes, guidelines, relations). Nevertheless, the framework requires to be accompanied with the theoretical analysis of each element (as presented in Table 3.17) to be fully represented and comprehend.

The researcher recognises that the proposed SOA Governance framework highlighted in Figure 3.4, contains the conceptualisation of each element as identified in the normative literature and proposed by the researcher, but yet as a unit requires testing and evaluation with empirical data. Thus, the following issue entitled the '*SOA Governance framework*' is proposed for further examination:

SOA Governance framework: 'The proposed SOA Governance framework can be applied as a decision-making tool for SOA Governance by healthcare organisations'.

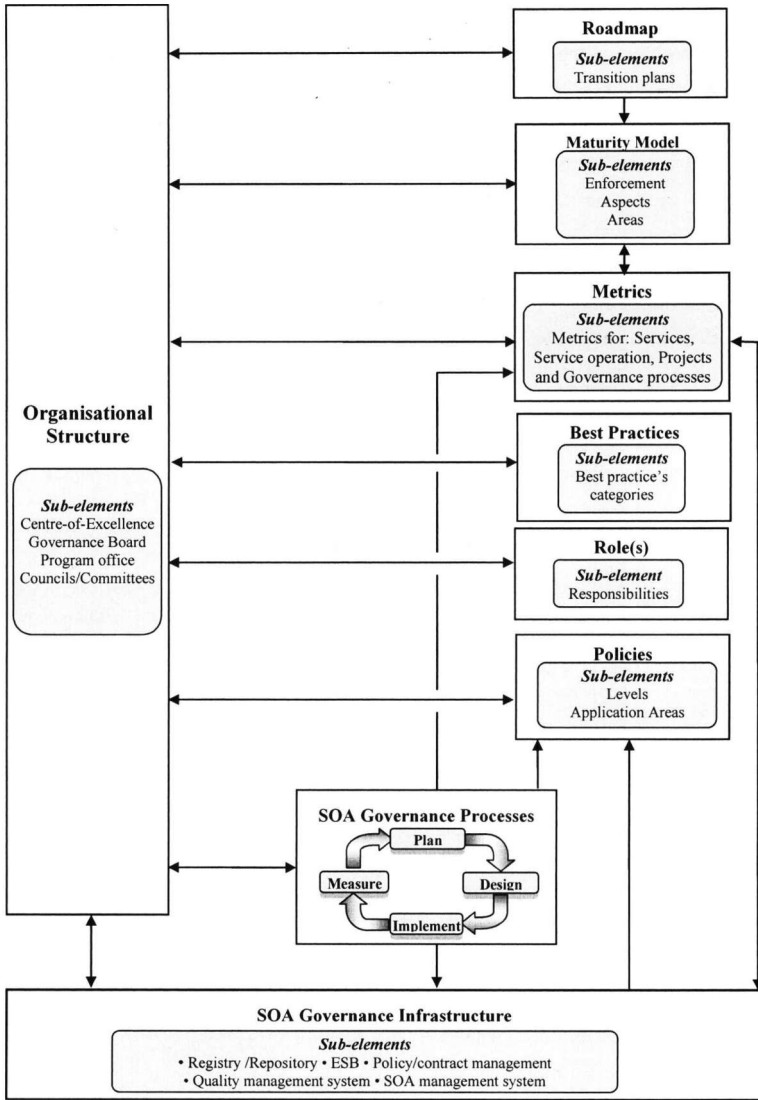


Figure 3.4: Proposed SOA Governance Framework

The proposed framework in Figure 3.4 makes a novel contribution at two levels. Firstly, at a conceptual level, it identifies and proposes nine elements that should be considered during the SOA Governance process. The identification of the nine elements is based on the theoretical works conducted by others in this area. As a result, the conceptualisation of the elements is grounded in the normative literature. In addition to this, the framework incorporates additions that are gathered from additional literature resources beyond the ones that composed the elements. This comes as a method to overcome the limitations identified in normative literature and enhance the elements' conceptualisation. Moreover, the researcher proposes a unique formulation combining the identified common elements of SOA Governance (seen in Part A and B), the SOA CSFs and HIS challenges. This proposal aims to pinpoint attributes and guidelines for each element, required to successfully govern a SOA and tackle longstanding HIS challenges. Secondly, at a practical level, the proposed framework contributes towards a better understanding of the research area (SOA Governance in healthcare).

This dissertation makes a step forward and contributes to the body of knowledge as it: (a) highlights the elements required in SOA Governance, (b) introduces specific additions and guidelines beyond the normative literature, (c) identifies healthcare specific aspects required in a the SOA Governance and interprets them as part of the identified elements and (d) combines the elements and proposes a SOA Governance framework. The researcher believes that such an approach is significant and novel as it: (a) facilitates the various SOA concepts in clearly illustrated elements, (b) enhances existing SOA Governance models by incorporating several additions and (c) facilitates healthcare organisations in making robust decisions for SOA Governance.

3.6 Conclusions

To overcome the limitations of previous approaches on SOA Governance, the researcher reviewed the normative literature and proposed a SOA Governance framework integrated with nine elements. The detailed approach and theoretical analysis provided for each element, its corresponding attributes, guidelines and relations, examples and relevance to healthcare seek to limit the void in the relative literature and provide new insights into a critical issue. Failure to successfully realise SOA in healthcare can have consequences that influence the quality of care and even cost human lives. Thus, it is essential to test this proposition in the practical arena. In testing this framework in the healthcare field, the researcher proposes two main research issues, firstly the SOA Governance framework's elements, namely: (a) 34 Attributes, (b) 20 Sub- Elements, (c) 20 Guidelines, (d) 8 Additional Guidelines and (e) 20

Healthcare Aspects as seen in Table 3.17. Secondly, the researcher proposes to investigate the SOA Governance framework use as a decision making tool and the relation of its elements, as it was presented in Figure 3.4.

Proposed Issues for Further Investigation									
	OS	RL	MM	RD	SGI	PO	ME	BP	GP
Attributes	AT1	AT1	AT1	AT1	AT1	AT1	AT1	AT1	AT1
	AT2	AT2	AT2	AT2	AT2		AT2	AT2	AT2
	AT3	AT3	AT3		AT3			AT3	AT3
	AT4	AT4			AT4				AT4
	AT5	AT5							AT5
	AT6								
	AT7								
	AT8								
	AT9								
Sub-elements	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1
	SE2		SE2		SE2	SE2			
	SE3				SE3	SE3			
	SE4				SE4				
					SE5				
					SE6				
Guidelines	GU1	GU1	GU1	GU1	GU1	GU1	GU1	GU1	GU1
	GU2	GU2	GU2	GU2		GU2			
	GU3	GU3	GU3	GU3		GU3			
			GU4						
Additional Guidelines	AGU1	AGU1		AGU1			AGU1	AGU1	AGU1
	AGU2								
	AGU3								
Healthcare Aspects	HA1		HA1			HA1	HA1	HA1	HA1
	HA2					HA2	HA2	HA2	HA2
	HA3								HA3
	HA4								HA4
	HA5								
	HA6								
	HA7								
	HA8								
	HA9								

Table 3.18: Proposed Issues for Further Investigation

In Chapter 4, the researcher presents the research methodology used to test the aforementioned SOA Governance framework and the identified issues (as seen in Table 3.18).

CHAPTER 4

RESEARCH METHODOLOGY

Summary

In Chapter 3, the conceptual framework related to SOA Governance in healthcare organisations was proposed and presented. In this chapter, the researcher based on the aim of this research, develops an argument for the selection of a suitable research methodology. Based on the notion that researchers in the Information Systems (IS) field have to choose among multiple methods, approaches and techniques, the normative literature needs to be reviewed. As a result, the review, presented in this chapter, leads to the justification for the selection of the qualitative interpretive epistemological research stance for the purpose of theory testing.

In this chapter, the researcher reviews both positivism and interpretivism epistemological stances. This review results in the justification of interpretivism as the research approach that is adopted by this dissertation. Subsequently, the researcher explains why qualitative research is used in this research and justifies the adoption of a multiple case study research strategy. Then, the researcher presents an empirical research methodology, which acts as a framework for conducting the empirical inquiry, which consists of three interrelated parts, namely: (a) research design, (b) data collection and (c) data analysis. Finally, the research protocol with emphasis on triangulation that was employed to carry out this research is presented and analysed and conclusions are provided.

4.1 Introduction

The purpose of this chapter is to elaborate on the research methodology followed in this thesis. This description is within the context of research methods used in the area of information systems. This section presents the introduction to the chapter. Thereafter, in Section 4.2, the researcher explains why qualitative research is used in this research and illustrates the benefits and limitations of qualitative research. Furthermore, Section 4.3, follows with reviews on different epistemological stances. The results of this review provide the justification of interpretivism as the research approach that is adopted by this thesis. In Section 4.4, the researcher selects and explains an appropriate research strategy i.e. justifies the adoption of a case study research strategy. Then in Section 4.5, the researcher presents an empirical research methodology, which acts as a framework for conducting the empirical enquiry. The unwanted bias and other concerns are addressed and considered and propositions to overcome them are presented (e.g. as data triangulation). Finally, in Section 4.6, this methodology is transformed into a protocol, which acts as a data collection tool where data are deduced from the case studies, such that the proposed research issues can be verified and where needed tested and validated. Consequently summarising the conclusions in Section 4.7.

4.2 Research Approach

According to Land (1992), Information Systems are basically social systems of which technology is but one aspect. Furthermore, Land (1992) portrays IS as a multi-disciplinary endeavour, which requires a wide array of sciences to be studied, such as: (a) natural sciences, (b) mathematics – engineering and (c) behavioural sciences-linguistics. For this reason, the author reports that there is no single framework which encompasses all the domains of knowledge needed for the study of IS (Galliers, 1992). In the same respect, well cited scholars as Galliers (1991) and Walsham (1995), emphasise, that it is unlikely that there is a universal IS research approach. Thus, the selection of an appropriate research approach that can support the study of IS is one of the most difficult and critical decisions for a researcher.

In the following section, the research methods and paradigms that have been selected during the development of the research framework of this thesis are presented, as well as the justification for the selection of the specific research approaches.

4.2.1 *Qualitative and Quantitative Research Approaches*

Qualitative research is a broad umbrella term for research methodologies that describe and explain persons' experiences, behaviours, interactions and social contexts without the use of statistical procedures or quantification (Fossey *et al.*, 2002). Qualitative (e.g. quality) refers to the *what, how, when, and where* of a thing, therefore its essence and ambience. Qualitative research thus refers to the meanings, concepts, definitions, characteristics, metaphors, symbols, and descriptions of things. In this respect, Van Maanen (1983) defines qualitative research as:

“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 Maanen (1983, p. 9).

Furthermore, Benbasat *et al.*, (1987a) support 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.

Alternatively, **quantitative research** is directed towards the development of testable hypotheses and theory that can be generalised across settings (Polit and Beck, 2010). 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.

Quantitative research methods differ from qualitative in issues, such as: (a) their analytical objectives, (b) the types of questions they pose, (c) the types of data collection instruments they use, (d) the forms of data they produce, (e) the degree of flexibility built into study design (Mack *et al.*, 2005). A more analytical view of the differences between the two approaches can be seen in Table 4.1. The first left column are the characteristics of research (as theory, framework etc.) and the second and third the characteristics based on the research.

	Qualitative	Quantitative
Social theory	<ul style="list-style-type: none"> Action 	<ul style="list-style-type: none"> Structure
General Framework	<ul style="list-style-type: none"> Observation Seek to explore phenomena Instruments use more flexible, iterative style of eliciting and categorizing responses to questions Use semi-structured methods such as in-depth interviews, focus groups, and participant observation 	<ul style="list-style-type: none"> Experiment Seek to confirm hypotheses about phenomena Instruments use more rigid style of eliciting and categorizing responses to questions Use highly structured methods such as questionnaires, surveys, and structured observation
Analytical Objectives	<ul style="list-style-type: none"> To describe variation To describe and explain relationships To describe individual experiences To describe group norms 	<ul style="list-style-type: none"> To quantify variation To predict causal relationships To describe characteristics of a population
Question Format	<ul style="list-style-type: none"> Open ended 	<ul style="list-style-type: none"> Closed ended
Data Format	<ul style="list-style-type: none"> Textual (obtained from audiotapes, videotapes, digital recording and field notes) 	<ul style="list-style-type: none"> Numerical (obtained by assigning numerical values to responses)

Table 4.1: Qualitative vs. Quantitative Research Method [Source: Pope & Mayes (1995) and Mack et al., (2005)]

Observing Table 4.1, several differences can be distinguished between the two methods, with flexibility being one of them. Qualitative research is more flexible than quantitative, which can be fairly inflexible (Mack *et al.*, 2005). This is the case as quantitative methods employ surveys and questionnaires. For example, researchers ask all participants identical “closed-ended” or fixed questions in the same order from which participants may choose. The advantage of this inflexibility is that it allows for meaningful comparison of responses across participants and study sites. However, it requires a thorough understanding of the important questions to ask, the best way to ask them, and the range of possible responses. Respectively, qualitative methods are typically more flexible, with the researcher holding a substantial level of naturalness and adaptation on the interaction between him/her and the study participant. This is more evident, in the “open-ended” questions asked, that in many cases differ and/or depending on each participant. In addition, with qualitative methods, the relationship between the researcher and the participant is often less formal than in quantitative research. Participants have the opportunity to respond more elaborately and in greater detail than is typically the case with quantitative methods. In turn, researchers have the opportunity to respond immediately to what participants say by tailoring subsequent questions to information the participant has provided (Mack *et al.*, 2005).

4.2.2 Justifying the Selection of a Qualitative Research Approach

The aim of this research is to study SOA Governance in healthcare organisations and develop a SOA Governance framework that can be used to support decision-making on SOA Governance issues. To achieve this, the researcher is required to achieve a number of

objective ranging from carrying out a literature review and structuring a framework, to testing the proposed framework and interpreting the empirical findings (the full list of objectives is depicted in Section 1.2.2.). Both the aim and the objectives of this research focus on two issues: (a) the utilisation of SOA as a paradigm to integrate HIS and (b) the nature of healthcare itself. Thus, SOA and healthcare, are the two substantial issues that drove this research and thus upon them the research method were based. Therefore, the researcher investigated the literature and identified the qualitative research, as a valid approach to study SOA Governance in healthcare (Fossey *et al.*, 2002; Khoubati *et al.*, 2006; Mantzana *et al.*, 2008). The justification of this decision is analysed in the following paragraphs.

Moreover, healthcare can be characterised by unique issues, such as: (a) the interactive nature of practitioner/patient relationships, (b) patients' subjective experiences of illness, (c) their own personal understanding of human suffering and (d) stakeholders behaviour and interpersonal interactions (Miles, 2009). The aforementioned characteristics of healthcare drive effective clinical process to rely not to a single but rather several different kinds of knowledge (e.g. medical, anthropological and instrumental). Thus, giving the required depth of understanding that can be applied to a given problem situation. Literature, proposes that the same principle, as in clinical practice, is useful to be applied to the research methodology so as to research a healthcare setting (Fossey *et al.*, 2002). Therefore, as to understand the interplay between stakeholders (clinical and non-clinical) and IS, emphasis is required on the meanings, concepts, definitions, characteristics, descriptions and associations rather than numbers and statistics. Thus, comparing the characteristics (as analysed in Section 4.2.1) as a more suitable candidate the qualitative research approach is followed in this research, as it can relate closely to the healthcare aspect of the research.

Additionally, qualitative research methods are being used increasingly in evaluations of computer systems and information technology both within and outside healthcare (Kaplan and Maxwell, 2005). The main assumption of this approach is that qualitative researchers study things in their natural settings, attempting to understand phenomena in terms of the meanings that people bring to them (Denzin and Lincoln, 1994). This comes as a tight fit with the requirements to investigate little-known and complex combinations, such as SOA Governance and healthcare organisations. Qualitative methods are excellent for studying these kind of issues, in which an understanding of the meaning and context of the issue under study, and the particular events and processes that make up these issues over time, in real-life, natural settings, is needed (Kaplan and Maxwell, 2005). Thus, in order to investigate SOA Governance the qualitative research approach is considered as appropriate and it is adopted.

Having justified the utilisation of qualitative research based on its merits the researcher also considers the issue of the philosophical perspective of the research. More details for this choice are depicted in the next section.

4.3 Philosophical Stance

The selection of an appropriate epistemological stance is an important and complicated task during the research process (Walsham, 2006). The reason is that there is a methodological pluralism, as many methodologies to choose from exist. For example, Orlikowski and Baroudi, (1991) Goles and Hirschheim (2000) and Goldkuhl (2012) identified four categories of epistemological stances, namely: (a) positivist, (b) interpretive, (c) critical and (d) pragmatism. Taking under account the aforementioned views the researcher in the following paragraphs describes and discusses the philosophical stances and then the justification for the utilisation of interpretive perspective is presented.

4.3.1 Types of Philosophical Stances

Positivist stance test theory, in an attempt to increase the predictive rather than developing a descriptive understanding, of the phenomenon under research (Walsham, 1995). Thus, positivists act usually as observers. They establish quantifiable measures of variables, hypothesis testing, and make statistical generalizations (Orlikowski and Baroudi, 1991). According to, Galliers (1992) positivism assumes that observations of phenomena under investigation can be made objectively and rigorously (by measurement). Nonetheless, the positivist approach has arisen from scientific tradition and thus, is characterised by repeatability, reductionism and refutability.

Interpretive stance primarily focus on understanding and accounting for the meaning of human experiences and actions, that is, the truth that can be fully identified and understood, through subjective interpretations (Davison, 1998). The core idea of interpretivism is to work with subjective meanings that exist already in the social world. The researcher's role is to acknowledge their existence, to reconstruct them, to understand them, to avoid distorting them, to use them as building-blocks in theorizing (Goldkuhl, 2012).

Critical stance emphasize the social and historical origins and contexts of meaning, regardless of the individual or collective forms of embodiment and expression they might take (Fossey *et al.*, 2002). Thus, knowledge is not seen as discovered by objective inquiry but as acquired through critical discourse and debate. It focuses on the critique and transformation of current structures, relationships, and conditions that shape and constrain the development of

social practices in organisations and communities, through examining them within their historical, social, cultural and political contexts (Miles and Huberman, 1994).

Pragmatism stance insist upon consequent phenomena and the possibilities of action (Cherryholmes, 1992). Pragmatism is focused on action and change and the interplay between knowledge and action. Thus, this method is appropriate as a basis for research approaches intervening into the world and not merely observing the world (Goldkuhl, 2012). In more detail, this viewpoint, is based on the proposition that researchers should use whatever philosophical and/or methodological approach (that) works best for the particular research program under study' thus conducting a mix-approach (Goles and Hirschheim, 2000).

All of the aforementioned stances can aid in the research of IS, a diverse field in issues, such as: (a) problems addressed, (b) theoretical foundations and referent disciplines, and (c) research methodologies (Benbasat and Weber, 1996). Yet, the researcher chooses to apply an interpretive stance for this research. This choice aligns with the opinions of the researchers who champion the view that a reliance on a solitary research paradigm inhibits a full understanding of and appreciation for, the multifaceted reality of IS. A justification of this approach is presented in the following section.

4.3.2 Justifying the Selection of the Interpretive Stance

The diversity of research paradigms posed complex challenges for the selection of the appropriate approach for this research. These approaches rely on different assumptions about the nature of knowledge, and demand different approaches to research. Yet, Myers (1997) reports that while these research epistemologies are philosophically distinct, in the practice of social research, these distinctions are not always so clear-cut. Nor is the decision of which approach better fit the qualitative research approach adopted as part of this thesis. The researcher acknowledges that the qualitative research agenda is favourably linked the interpretive approach (Goldkuhl, 2012). This was an observation when important contributions of interpretivism to IS were made (e.g. Orlikowski & Baroudi (1991), Walsham (1995; 2006), and Klein & Myers (1999)) and can ground the argument to use the interpretive approach for this thesis, as well. However, some reservations exist against such views, like Myers and Avison (2002) reporting that 'qualitative' is not synonym for 'interpretive' and that qualitative research may or may not be interpretive, depending on the underlying philosophical assumptions of the researcher. Additionally, there is a substantial debate as to whether these underlying epistemologies are necessarily opposed, and there is further debate about whether they can be accommodated within one study (Myers, 1997). Thus, in an effort

to clarify the issue, the research presents positivism, criticism, pragmatism and interpretivism approaches in the following paragraphs.

Evidences from literature report that among all, positivism has been the dominant stance in IS research (Miles and Huberman, 1994; Walsham, 1995a; Yin, 1994). Orlikowski and Baroudi (1991) suggest that IS can be classified as positivist if there is evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and drawing of inferences about a phenomenon from a perspective sample to a stated population. Galliers (1992) also reports that positivism assumes that observations of phenomena under investigation can be made objectively and rigorously (by measurement). Nonetheless, positivism approach has arisen from scientific tradition and thus, is characterised by repeatability, reductionism and refutability.

Moreover, when conducting a positivist study, the researcher(s) act as observers and establish mainly quantifiable measures of variability and drawing of inferences about a phenomenon from a perspective sample to a stated population. Positivist studies assume that observations of the phenomena under investigation can be made objectively and rigorously (Galliers, 1994). Yet the research presented herein is not based on quantifiable measures of variables, so the positivism approach cannot support it.

The **critical** is another stance used for IS research, in which the focus is on the critique through examination of structures within their historical, social, cultural and political contexts (Miles and Huberman, 1994). Moreover, critical researchers recognise that people's ability act to change their social and economic circumstance is constrained by various forms of social, cultural and political domination (Myers and Newman, 2007). The implication for this way to study IS is that critical stance aims to foster self-reflection, mutual learning, participation and empowerment, rather than the acceptance of discoveries (*Fossey et al.*, 2002). Thus, this implication constitutes the critical stance not to be applied in this research, in which emphasis is given in human experience and action, regardless of their individual or collective origin.

In another debate, Goles and Hirscheim (2000) argue in favour of **pragmatism**. Goldkuhl (2012) reports that pragmatist thinking has influenced IS research to a great extent, although the paradigmatic foundations have not been fully acknowledged. Pragmatism is concerned with action and change and the interplay between knowledge and action. This makes it appropriate as a basis for research approaches intervening into the world and not merely observing the world. Thus, pragmatism is not a suitable candidate stance as in this thesis the researcher acts as an observer reflecting on the meaning of human experiences and actions, which can be fully identified and understood, through subjective interpretations.

To this end, having justified the utilisation of interpretive stance based on its merits and its fit with the aim of this research to investigate SOA Governance in healthcare organisations, an analytical view of interpretivism is given, as seen in Table 4.2. Whereas, based on the analysis by Fossey *et al.*, (2002), in the left column of the table the characteristics of the stance are presented (e.g. in the form of questions or aspects) and in the right column the relevant approach followed is depicted.

Characteristics	Interpretive
Philosophical/ theoretical origins	Hermeneutics, phenomenology, symbolic interactionism
Why conduct research?	To understand social life and describe how people construct social meaning
What is the nature of social reality?	Fluid definitions of situations created by people through their social interactions with others
What is the nature of human beings?	Social beings who create meaning and constantly engage in making sense of their worlds
Role of common sense	Powerful everyday theories that guide daily life; necessary to understand people; and no less valid than science
What constitutes an explanation/theory of social reality?	A description of how a group's meaning system is generated and sustained; contains detailed contextual information and limited abstraction
An explanation that is true	Resonates with or feels right to those who participated in the study
Whose voices are privileged?	Participant(s)
What does good evidence look like?	Embedded in the context of fluid social interactions, in which meanings are assigned
Where do social/ political values enter into science?	Values are an integral part of social life; no group's values are presumed superior to others
What is the place of ethics in research?	Intrinsic; participant values and personal nature of the researcher–researched interactions are integral to the research process

Table 4.2: Interpretive Stance [Source: Fossey *et al.*, (2002)]

In the next section, another important aspect of the research methodology i.e. the research strategy is presented and the decisions taken by the researcher discussed.

4.4 Research Strategy

Having justified the use of interpretivism as an epistemological stance, and of the qualitative research approach and its process, this section focuses on selecting an appropriate research strategy. Galliers (1992) reports that research strategy is the means of going about one's research, taking on a particular style, and utilising different research methods to collect data. Therefore, to decide on a strategy that would dictate the way in which data are collected and analysed, different research strategies must be reviewed. Their characteristics should be identified, and a research strategy should be justified in light of these study characteristics.

Having justified the use of (a) qualitative research approach and (b) interpretivism as an epistemological stance, this section focuses on selecting an appropriate research strategy. Galleries (1992) reports that research strategy is the means of going about one's research, taking on a particular style, and utilising different research methods to collect data. Therefore, to decide on a strategy that would dictate the way in which data are collected and analysed,

different research strategies must be reviewed. Their characteristics should be identified, and a research strategy should be justified in light of these study characteristics. Based on this review, a multiple case study strategy was employed, the analysis and justification of which is presented in the next section.

4.4.1 Selecting and Justifying the Use of Case Study Strategy

For the purpose of this thesis, 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. SOA Governance in healthcare), (b) complex processes (e.g. SOA Governance healthcare process) in their natural setting and (c) answer how, what and why questions (e.g. SOA Governance implementation). In more detail, a case study examines a phenomenon in its natural settings, employing multiple methods of data collection to gather information from one or few entities (people, groups or organisations) (Benbasat *et al.*, 1987a). Typically case study research uses a variety of evidence from different sources, such as documents, artefacts, interviews and observation, and this goes beyond the range of sources of evidence that might be available other types of research (e.g. historical study) (Rowley, 2002).

Yin, (1994) suggests 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). The main characteristics of case studies, as summarised by Benbasat *et al.* (1987a) are:

- Phenomenon is examined in a natural setting,
- Data are collected by multiple means,
- One or few entities are examined,
- The complexity of the unit is studied intensively,
- Case studies are more suitable for the exploration, classification and hypothesis development stages of the knowledge building process; the investigator should have a receptive attitude towards exploration,
- No experimental controls or manipulation are involved,
- The investigator may not specify the set of independent and dependent variables in advance,
- The results derived depend heavily on the integrative powers of the investigator,

- Changes in site selection and data collection methods could take place as the investigator develops new hypotheses,
- Case research is useful in the study of ‘why’ and ‘how’ questions, because these deal with operational links to be traced over time rather than with frequency or incidence,
- The focus is on contemporary events.

Additionally, Yin (1994) distinguishes three types of case studies, namely: (a) exploratory, (b) descriptive and (c) explanatory.

According to Streb (2010), the **exploratory case study** investigates distinct phenomena characterized by a lack of detailed preliminary research, especially formulated hypotheses that can be tested, and/or by a specific research environment that limits the choice of methodology. 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). Since exploratory case studies are by definition often applied in a research context that is not clearly specified and still requires data for the formulation of valid hypotheses, their broad concept provides the researcher with a high degree of flexibility and independence with regard to the research design as well as the data collection (Mills *et al.*, 2010).

Tobin (2010) reports that the **descriptive case study** is a focused and detailed study, in which propositions and questions about a phenomenon are carefully examined and articulated at the beginning. This articulation of what is already known about the phenomenon is called a descriptive theory. The researcher aims to answer *how* the phenomenon was realised by assessing a sample of data in detail and in depth, based on an articulation of a descriptive theory. This theory must respect the depth and scope of the case under study, which is conveyed through robust propositions and questions (Mills *et al.*, 2010). Therefore, the power and promise of a descriptive case study lie in its potential for mining for abstract interpretations of data and theory development.

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. On the basis of the data retrieved, the researcher may then form a theory and set to test this theory. Harder (2010) reports that explanatory case studies may consist of an accurate description of the facts of a case, considerations of alternative explanations, and a conclusion based on credible explanations that are congruent with the facts.

Based on this terminology, the case study followed in this thesis can be classified as exploratory since the research focuses more on questions of the *what* type (e.g. what are the SOA Governance Organisational Structures that the organisation formed in this case?).

Exploratory case studies like the one presented in this thesis are useful for theory building, as they are valuable in developing and refining concepts for further study. Roethlisbeger (1977) suggests that case study research is particularly appropriate for certain types of problems, such as those in which research and theory are at their early formative stages. As stated in Chapters 2 and 3, there is limited literature regarding SOA Governance in healthcare organisations. Based on the above discussion, the use of a qualitative case study strategy is considered appropriate for studying SOA Governance in healthcare organisations.

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 investigate SOA Governance, as multiple organisation in different level of SOA maturity are required to describe the phenomenon. 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 (Benbasat *et al.*, 1987a). Moreover, the theory tested can be extended and more general research results can be obtained. For this reason, the researcher proposes that an exploratory multiple case study strategy should be employed to study SOA Governance in the critical healthcare setting.

4.4.2 Justifying the Cases Selection

In the context of the research presented in this dissertation, two case-organisations were selected, a **Publicinsurance Healthcare Organisation (PubHealthOrg)** and a **Private Healthcare Organisation (hospital) in Greece (PriHealthOrg)**¹. The researcher therefore employed multiple cases studies as suggested by Bassey (1981). The reasons for selecting these cases are explained in the following paragraphs.

¹ Due to confidentiality restrictions the name and country of origins of the organisation is not revealed.

Literature indicates that when the researcher employs a multiple case study strategy, the justification of the cases selection is an important issue that should be carefully thought out (Benbasat *et al.*, 1987b; Rowley, 2002). Moreover, Rowley (2002) emphasises that cases selection should be determined by the research purpose, questions, propositions, theoretical context but also constraints. Constraints may include accessibility (access to the data), resources (availability of resources for data collection) and time availability (time constraints for case synthesis) (Rowley, 2002). The researcher acknowledges the aforementioned views, yet adds to the discussion a set of criteria proposed by Miles and Huberman (1994) in their well known manual on qualitative data analysis. Miles and Huberman (1994) suggest that case selection strategies (e.g. choosing the sample) can be evaluated in terms of six different criteria, as presented in the left column of Table 4.3 and discussed in the following paragraphs. The discussion includes justification for both cases (PubHealthOrg and PriHealthOrg).

• **The case strategy should be relevant to the conceptual framework and the research questions addressed by the research (Miles and Huberman, 1994).** At this point it must be mentioned that the researcher was part of an educational program providing seminars in IS and managements related issues. These seminars were offered to healthcare professionals (e.g. nurses, doctors, IT and management staff) in the public healthcare sector. The researcher gave many educational seminars and travelled in six different regions in Greece, for about a year. At that time he had the opportunity to gain a close look of the local organisations (mainly public hospitals and some insurance bodies) and discussed the relevance of this research with the participants of the seminars and employees of the organisations. While this interaction provided useful insights of the local healthcare organisations, it also revealed the lack of efficiently implemented integration approaches, integrated HIS and SOA projects. This observation comes in accordance with literature that exposes the limited and/or incomplete integration approaches in the Greek healthcare sector (Economou, 2010; Tsavalias *et al.*, 2012). Consequently, the researcher extended the investigation for case organisations and examined the entire Greek healthcare sector (e.g., public and private, hospitals, clinics, healthcare insurance bodies etc.) based on reports, relevant media announcements and had several discussions with experts (academics and practitioners) both in the field of SOA and healthcare. Based on the aforementioned thorough examination two cases that satisfied Miles and Huberman (1994) criterion were located, PubHealthOrg and PriHealthOrg. PubHealthOrg at that time had just completed a SOA integration project that was considered as a pioneer for the Greek healthcare sector and PriHealthOrg had completed a Business Process restructuring endeavour based on the guidelines of an international accreditation program for hospitals. More details, both for the

Greek healthcare sector and the individual cases relevance to this research, are given in Chapter 5.

- **The researcher needs to comprehend if the phenomena of interest in the research are likely to appear, or they can appear (Miles and Huberman, 1994).** Regarding the PubHealthOrg case the researcher explored preliminary sources of data (e.g. newsletters, web-site announcements etc.) that included details of the involvement of the organisation in a SOA project. These preliminary indicators alongside the size, functionality and value of the organisation's functionality in the Greek healthcare sector, increased the possibility for the PubHealthOrg case to produce a rich set of data. Equivalent preliminary indicators (e.g. web-site announcements, discussions with experts on academic seminars, views on scientific blogs etc.) were identified for the PriHealthOrg case. These indicators advertised the involvement of the hospital on a Business Process restructuring, quality improvements certification and its SOA integration activities. Consequently, the researcher considering the size, position as a leading private hospital and reputation of the organisation recognized the potential of the PriHealthOrg case as a valid candidate and included it as a case.
- **The plan should enhance the generalizability of the findings, either through conceptual power or representativeness (Miles and Huberman, 1994).** As reported in Section 4.4.1 the researcher applied a qualitative approach, taking an interpretivism stance based on a multiple exploratory case study strategy. The researcher does not claim generalability of the findings but rather draws attentions to the specifics of the cases. Thus, allowing others to relate their experiences to the reported analysis.
- **The sample should produce believable descriptions/explanations (in the sense of being true to real life) (Miles and Huberman, 1994).** The researcher accounted for this criterion and considered the validity of the cases and whether they can provide a really convincing account and explanation of what is researched. Thus, several measures were designed to adhere to these considerations (seen in Section 4.5.4). Additionally, relating to the cases' reliability the researcher considered the professionalism of the candidate informants and credibility of records/archives. For both organisations, the professionalism and credibility were evaluated as: (a) appropriate and (b) safe to illustrate descriptions/explanations. This evaluation was based on the researchers' knowledge of several key informants background (academic reputation) in PubHealthOrg and the national and international awards and standards certifications awarded to the PriHealthOrg (like: International, Best workplace in Greece award, Joint Commission International certificate etc).

- **The case plan needs to be feasible in terms of the resource costs of money and time, the practical issues of accessibility and whether the sampling strategy is compatible with the researcher's work style (Miles and Huberman, 1994).** This criterion played a major part in the selection of cases as it limited the research area to the Greek healthcare sector. This decision was taken as the time and resources required to investigate the SOA Governance framework (34 Attributes, 20 Sub-Elements, 20 Guidelines, 8 Additional Guidelines and 20 Healthcare Aspects), could adhere in a feasible (based on time and availability of resources) plan. Therefore, since (a) the Greek sector was adequately represented by the two cases, (b) no further cases were available in the Greek healthcare sector (discussed as part of the first criterion) and (c) unavailability of resources (based on time and cost) to extent the research in other countries, the researcher utilised the PubHealthOrg and PriHealthOrg cases for this research. For these cases the researcher investigated various aspects before their selection such as: (a) Access to organisation, (b) Availability of data, (c) Availability of informants, and (d) Availability of resources and time to complete the research. These aspects were addressed and therefore the PubHealthOrg and PriHealthOrg were identified as feasible cases to investigate the proposed SOA Governance framework.

- **The researcher may consider whether the method of selection permits informed consent and whether there are benefits or risks associated with selection for and participation in the study, and the ethical nature of the relationship between researcher and informants (Miles and Huberman, 1994).** The researcher included several ethical considerations (informants consent, confidentiality restrictions, etc.) conducting this research and addressed them based on academic standards (e.g. professionalism, research protocol etc.).

Therefore, using the six guidelines proposed by Miles and Huberman (1994) the researcher employed them as a checklist for case selection. The reasons for selecting the Public insurance Healthcare Organisation (PubHealthOrg) and the Hospital in Greece (PriHealthOrg) as cases, based on the aforementioned checklist are presented in Table 4.3.

Criteria	Case 1: PubHealthOrg	Case 2: PriHealthOrg
Miles and Huberman (1994)		
Relevance to conceptual SOA Governance framework	Yes: based on preliminary information of an on-going SOA project	Yes: based on preliminary information of an on-going Business Process restructuring
The phenomena of interest in the research are likely to appear, or they can appear	Yes: based on preliminary data the SOA implementation can produce rich data sets appropriate to study SOA Governance	Yes: based on preliminary data the on-going Business Process restructuring can produce rich data sets appropriate for this research
Generalizability of the findings, either through conceptual power or representativeness	The researcher refrains for generalisation but describes case study perspectives that allows others to relate their experiences to those reported	The researcher refrains for generalisation but describes case study perspectives that allows others to relate their experiences to those reported
Potential to produce believable descriptions/explanations	Yes: The professionalism of the candidate informants, credibility of records and archives, were considered	Yes: The professionalism of the candidate informants, credibility of records and archives, were considered
Feasibility as accessibility (access to the data), resources (availability of resources for data collection) and time availability	Yes: Access to organisation, data, informants is gained, resources and time is considered as sufficient	Yes: Access to organisation, data, informants is gained, resources and time is considered as sufficient
Ethics	This consideration was addressed in all accounts (informants consent, confidentiality restrictions, etc.)	This consideration was addressed in all accounts (informants consent, confidentiality restrictions, etc.)

Table 4.3: Relevance of the Criteria Proposed by Miles and Huberman (1994) to Select Case Studies

Moreover, the data collection process was carried out until enough data were collected to test the issues under investigation, and stopped only when additional data collection provided ‘non-value’. In Figure 4.1, the researcher presents the timeline of the research conducted in the two organisations selected.

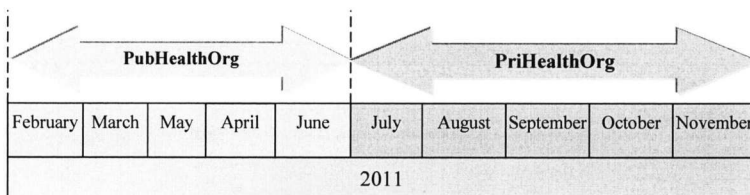


Figure 4.1: Research Timeline

4.5 Empirical Research Methodology

In an elaborate metaphor Oldfather & West (1994) portray qualitative research as jazz . As jazz is guided by a deep structure of chord progressions and themes, qualitative inquiry is guided by epistemological principles, socially constructed values, inquiry focuses, and findings emerging through analytic methodologies (Oldfather and West, 1994). Similarly, but

in a more structured approach, Jankowicz (2000) and Themistocleous (2002), amongst others, propose that a qualitative research methodology may follow three stages: (a) research design, (b) case study data collection and (c) case study data analysis. Consequently, for this research the researcher has developed the research methodology based on these three stages. These stages are illustrated in Figure 4.2 and are analysed in following sub-sections.

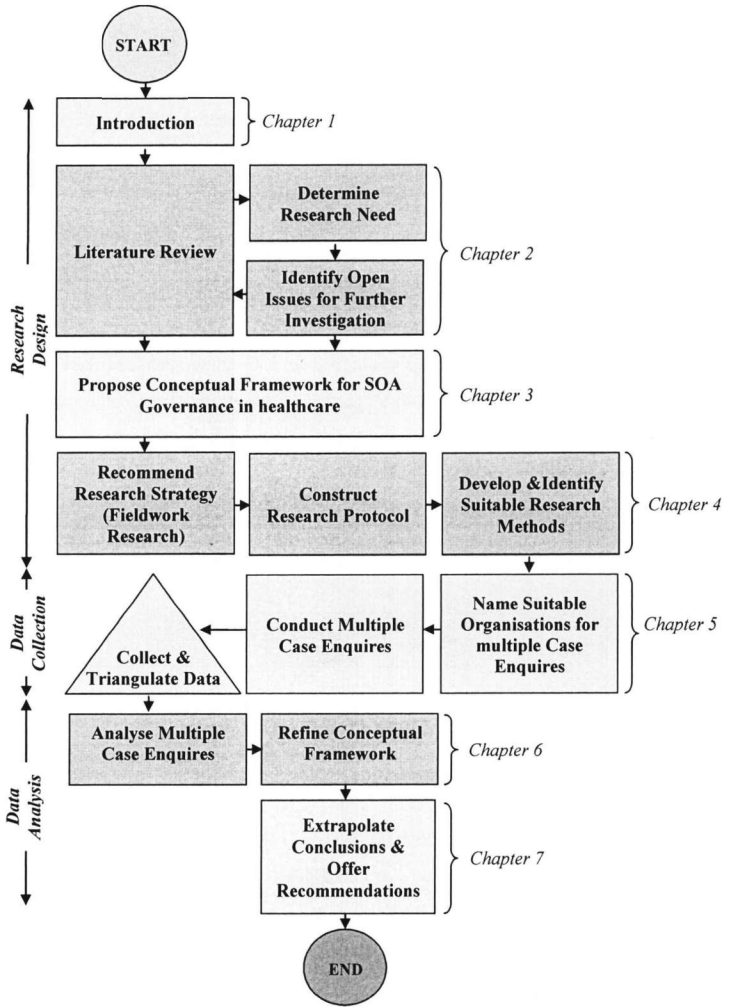


Figure 4.2: Research Methodology

4.5.1 Research Design

The literature indicates that the research design to be the first, independent part of the empirical research methodology, where the researcher decides on issues, like: (a) the research questions, (b) relevant data, (c) data to collect, and (d) how to analyse the results (Yin, 1994). As a starting point for this thesis, the researcher first studied the background material to develop an understanding of the area under investigation (presented in Chapters 1 and 2). From the literature review, several research issues were identified in a review focused on SOA CSFs and SOA Governance in healthcare. From that review, several sub-topics were determined and investigated as part of a literature review leading to a specific research area and consequently exposing the research need (e.g. SOA Governance elements), as reflected in Chapters 2 and 3. A conceptual framework was then developed to represent the intended empirical research, with nine elements of the framework to be tested (e.g. organisational structures, metrics etc.). Based on the data required to test the framework and validate the research questions, the type of data is determined (e.g. qualitative), the epistemological stance is chosen (e.g. interpretivism), and a research strategy is identified.

The second stage, the case study data collection, involves some background work and the actual execution of the fieldwork. This stage is mainly reflected in Chapters 3, 4 and 5 of this thesis. Finally, during the case study data analysis, the researcher has to decide when to ease out of the research setting and start analysing and presenting the findings. The results of this stage are shown in Chapters 5 and 6. These stages are not necessarily sequential, as the researcher has to start analysing the empirical material before the end of the study to be flexible enough to revise the approach as needed. The research methodology for this research is described in Section 4.6.

4.5.2 Data Collection

The next part of the empirical research methodology is the collection of a wide spectrum of data, addressing the research issue. 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 artefacts. Table 4.4 describes the data collection techniques as well as the sources used in this research. No single source has a complete advantage over all the others. In fact, the various sources are highly complementary, and a good case study will therefore want to use as many sources as possible (Tellis, 1997).

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, has a broad coverage—long span of time, many events and settings	<ul style="list-style-type: none"> • Organisational reports • White papers • Reference material downloaded from Internet • Newspapers articles
Archival Records	Same as for documentation	<ul style="list-style-type: none"> • Organisational records (e.g. charts, layouts)
Interviews	Through interviews, the researcher can access information about the topic under investigation, from key informants. Moreover, it facilitates communication between people working in healthcare organisations. Great attention must be given to the bias produced	<ul style="list-style-type: none"> • Structured interviews • Semi-structured interviews • Unstructured interviews
Direct Observations	The direct observations aim to capture what the users do. The researcher observed stakeholders in their office and tried to cover events in real time	<ul style="list-style-type: none"> • Formal and informal meetings with interviewees
Participant Observations	Same as for direct observations	<ul style="list-style-type: none"> • Simple participation
Physical Artefacts	The researcher tried to gain insight into cultural features and technical operations	<ul style="list-style-type: none"> • Infrastructure components • Hardware and software

Table 4.4: Data Collection Techniques Employed in this Dissertation

4.5.2.1 Interviews

The qualitative interview is the most common and one of the most important data gathering tools in qualitative research (Myers and Newman, 2007). According to Walsham (2006), interview is the method by which the researcher can best access the interpretations that participants have, regarding the actions and events under investigation. During interviews, the person being interviewed is considered the expert and the interviewer is considered the student. The researcher's interviewing techniques are motivated by the desire to learn everything the participant can share about the research topic. Researchers engage with participants by posing questions in a neutral manner, listening attentively to participants' responses, and asking follow-up questions and probes based on those responses (Mack *et al.*, 2005).

There are various forms and types of interviews. According to Robson (Robson, 2011), three distinct interview types are: (a) unstructured, (b) semi-structured, and (c) fully structured.

- In an **unstructured interview**, the interview questions are formulated as general concerns and interests from the researcher. In this case the interview conversation is developed based on the interest of the subject and the researcher.
- In a **semi-structured interview**, questions are planned, but they are not necessarily asked in the same order as they are listed. In this interview type, the researcher decides the order

that the different questions are handled, based on a list of questions. Thus, semi-structured interviews allow for improvisation and exploration of the studied issues.

- In a **fully structured interview** all questions are planned in advance and all questions are asked in the same order as in the plan. In many ways, a fully structured interview is similar to a questionnaire-based survey.

Interviews can also be undertaken in various forms, like personal interviews, face-to-face group interviewing, telephone surveys, etc (Mack *et al.*, 2005). The duration of an interview is also not specific, as it could last as a five-minute conversation on the telephone, or it could take place over lengthy, multiple sessions.

In the context of this research, interviews were the main data source that the researcher utilised to collect data and to capture the verbatim. The researcher used all three types of interview during the research. According to Myers and Newman (2007) and Fontana and Frey (2000) there are problems and pitfalls that the researcher may address before conducting an interview (seen in Table 4.5), such as: (a) artificiality of the interview, (b) lack of trust, (c) lack of time, (d) level of entry, (e) elite bias, (f) Hawthorne effects, (g) constructing knowledge, (h) ambiguity of language and (i) interviews can go wrong. All the issues, except elite bias were taken under consideration before the interview process and the researcher addressed them accordingly, as seen in Table 4.5. For example, the “lack of time” issue was dealt with discussing and deciding the mean time required for the interview beforehand, either by email or at the start of each structured and semi-structured interview. The only issue that the researcher concisely paid less attention is that of elite bias (e.g. utilisation of key informants). The interviewees in this research were key informants, holding key roles of the SOA implementation and could provide valuable insights regarding SOA Governance. However, the use of only key informants’ as interviewees carries the limitation of reflecting but a narrow span of the situation. The reason behind this researcher’s diverge is threefold: (a) top levels of an organisation’s hierarchy (e.g. top-managers) hold key roles and can provide rich data, (b) entry level to an organisation is usually from and by key informants and (c) the criticism of an informant’s value (key or not) can only be reflected after the interview. Thus, the researcher decided to conduct the interviews using key informants.

In Table 4.5, the first column presents the issue, the second column shows the issue’s description and the third column includes the way the researcher/interviewer addressed the issue in this research. Addressing these issues proved a good foundation upon which the fieldwork surfaced.

Issue	Description	Author's Response
Artificiality of the Interview	The qualitative interview involves interrogating someone who is a complete stranger, it involves asking subjects to give or to create opinions under time pressure.	A short CV of the researcher presented to the interviewer beforehand. When possible the interviewer did a background check (organisation's web-site) to collect information about the interviewee and familiarise with him/her.
Lack of Trust	As the interviewer is a complete stranger, there is likely to be a concern on the part of the interviewee with regard to how much the interviewer can be trusted. This means that the interviewee may choose not to divulge information that he or she considers to be "sensitive" (the data gathering remains incomplete).	The interviewer provided beforehand an official letter of research interest on which issues of anonymity, confidentiality and professional standards were addressed.
Lack of Time	The lack of time for the interview may mean that the data gathering is incomplete. However, it can also lead to the opposite problem – of subjects creating opinions under time pressure. In this case more data are gathered, but the data are not entirely reliable.	A mean time for the interview was discussed at the start of each structured and semi-structured interview.
Level of Entry	The level at which the researcher enters the organisation is crucial, e.g. a lower level, may prove difficult if not impossible to interview senior managers at a later date.	The researcher entered each organisation holding the same status that of a PhD researcher representing a well respected university.
Elite Bias	A researcher may interview only certain people of high status (key informants) and therefore fail to gain an understanding of the broader situation.	The majority of people interviewed can be characterised as key informants, no special attention was given in this issue.
Hawthorne Effects	Qualitative interviews are intrusive and can potentially change the situation. The interviewer is part of the interactions they seek to study and influences those interactions.	The interviewer held a neutral approach respectful of the social setting and thus did not interfere with peoples' behaviour.
Constructing Knowledge	Interviewers may not realize that, as well as gathering data, they are also actively constructing knowledge. Interviewees usually want to appear knowledgeable and rational, hence the need to construct a story that is logical and consistent.	The interviewer held a neutral approach respectful of the interviewee and the way he/she wanted to represent oneself.
Ambiguity of Language	The meaning of our words is often ambiguous, and it is not always clear that subjects fully understand the questions.	The interviewer formed the questions in simply manner and gave additional explanations were necessary.
Interviews Can go Wrong	Interviews are fraught with fears, problems and pitfalls. It is possible for an interviewer to offend or unintentionally insult an interviewee, in which case the interview might be abandoned altogether.	The interviewer held a neutral approach respectful of the interviewee and he's/heir's opinions.

Table 4.5: Interview Issues [In Similar Lines With: Myers & Newman (2007) and Fontana & Frey (2000)]

In more detail, structured and group interviews took place in the office of the interviewees. Before asking any interview questions, an oral consent to digitally record the interview was requested. Interviews were digitally recorded and transcripts prepared as soon as possible, after each individual interview. Taking notes during the interviews could reduce the time of interviews since note-taking requires more time, thus, the researcher considered digital recording as a more effective way of conducting interviews.

These interviews were based on the interview agenda designed for this research (Annex II). Using this agenda, the interviewees replied to specific questions related to SOA Governance. The interview agenda consists of seven sections and each section has multiple questions, to guide the researcher during the semi-structured interviews. These questions were designed to allow the informant to express him/her self freely without leading him/her towards a specific (e.g. biased) response. The overview of the agenda as well as the aim of each section is presented in Table 4.6.

Section		Questions	Description
A.	Company Data	A.1 – A.5	To collect data regarding the organisation under study. Such data include the: (a) nature of organisation and (b) number of organisational departments
B.	Interviewee Data	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	C.1 – C.3	To find out the type of systems and Information Technology (IT) infrastructure in organisation
		C.3 – C.4	To find out current integration projects
D.	Service Oriented Architecture	D.1 – D.7	To collect data regarding SOA implementation.
E.	Service Oriented Architecture Governance	E.1 – E.4	To collect data regarding SOA Governance and its elements. This section is different for each case, as the researcher provides specific questions reflecting its cases unique parameters
F.	Service Oriented Architecture Governance Framework	F.1	To collect data regarding the proposed Service Oriented Architecture Governance Framework
G.	Comments	G.1	General Comments

Table 4.6: Interview Agenda Overview

Unstructured interviews took place without the use of an interview agenda and were conducted during breaks and as group interviews and in one case over the phone. Although the researcher agrees that qualitative research is directly linked to face-to-face interaction, in some cases as reported by Berg and Lune (2012) qualitative telephone interviews are likely to be best when the researcher has fairly specific questions in mind, as in this case.

Multiple informants were interviewed during the structured interviews in each case study. These interviews lasted from one hour to one hour and thirty minutes. Initially the researcher identified interviewees upon a list proposed to the researcher by the organisation itself. The selection of the interviews was also in accordance with the list of roles identified in the SOA Governance framework, such as: (a) SOA Architect, (b) Business Analyst, (c) Infrastructure Architect, (d) Security Architect, (e) SOA Service Designer, (f) Application Developer, (g) IT Manager, (h) Quality Manager, and (i) Project Manager.

As depicted in Table 4.7, the following stakeholders were interviewed in PubHealthOrg: (a) Consultant-A, (b) Consultant- B, (c) Project-Manager internal (d) Project-Manager external and (e) IT-Manager. Additionally the interviewees that provided the information in PriHealthOrg were: (a) Quality General-Manager, (b) Quality-Manager, (c) Project-Manager and (d) IT-Manager.

CASE	PubHealthOrg	PriHealthOrg
Interviewees	Consultant-A	Quality General-Manager
	Consultant- B	Quality-Manager
	Project-Manager	Project-Manager
	IT-Manager	IT-Manager

Table 4.7: Interviewees for PubHealthOrg and PriHealthOrg

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. The interviewee's office acted as a valid area of the interview as it had advantages especially from the side of the interviewee (familiar space, no time to travel from and to) but also disadvantages (work related disruptions). However, this had no affect as in the interview it is important for the interviewer to show empathy, understanding, and respect to the interviewee and his needs (Myers and Newman, 2007). When a disruption occurred the interviewee was informed about the last point of discussion and the interview progressed from there. Also, the interviewer kept a balance, and created space for the interviewee to reveal their personality and identity but also to wind things up within the allotted time, so as to cover most of the key issues. This, was a recurring theme as the interviewees – interviewer's familiarity over time produced a more open conversation. Finally, its interview had a closing discussion along the merits and the positive views discussed. This section was installed as part of the interview processes as it may help the researcher reflect as a friendly observer and thus maintain access to the organisation. This is important, as stories about researchers pass rapidly around an organisation, and access to data is maintained through a good social skill set (Walsham, 2006).

Consequently, 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. These aided the interviewee to manage the interview process and gain valuable data. The analysis of which is the topic of the next section.

4.5.2.2 Observations and Archival Data

In addition to the interviews the researcher applied observation techniques to enrich the data pool gathered from each case. Literature indicates that observations can be conducted as part of a case study research, in order to investigate how a certain task is conducted (Runeson and Höst, 2009). The observation techniques can vary from simple observation of a task being performed, to observations regarding the interviewee's reactions to a question, or on a group interview the interviewees' reactions between them (Stake, 2006). For this research, the researcher applied all these techniques but especially focused on the observation of each interviewee reaction during each interview. This allowed the researcher to detect any deviation of the "official" statement and what was the "real" opinion of the informant. For example, if the interviewee used expressions (oral, facial, posture etc.) that might hint discomfort towards the question/answer/discussion, the researcher made a note and replied the questions asking the interviewee to comment further on the issue and/or investigated the issue with other interviewees in more detail. This gave the opportunity to (a) gain more empirical data and (b) reflect back on the interviewee's answer and consider any bias/favouritism expressed by him/her for the issue at hand.

Additionally, the researcher collected archival data (documents, reports and manuals) for both case organisations. Yin (2003) distinguish between documentation and archival records, while in this dissertation, they were treated as the same and used as a stable source of data that can be reviewed repeatedly. The archival records provided a reference point for the researcher to discover any deviation between the interviewees' comments and the documented organisation's view. This was utilised as a control mechanism to identify informants' favouritism or bias. These issues will be further analysed in the following section.

4.5.3 Data Analysis

The final step of this empirical research is the data analysis. For this process, the transcription of recordings and typing of field notes is required to begin as soon as possible after the data collection event. Organising data in a rigorous, standardized way is essential to their security and to the validity of the study results, but without compromising consistency (Mack *et al.*, 2005). Thus, interviews and field notes were processed as soon as they were archived. To transcribe the audio recording, the researcher listens to the audio file and simultaneously typed everything that was said on the recording. This produced a documented archive of the interviews. In order to preserve the contextual and data richness of the study and a clear chain of evidence the researcher rearranged the documented archived to fit the purposes of the research (e.g. the answers for the Policies Element were grouped together).

The data analysis supports the interpretation and understanding of the phenomenon under research. In doing so, the researcher 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 organisational setting and (b) the analysis of issues related to causality and human purpose (Pouloudi, 1998; Walsham, 2006). Thus, the proposed conceptual framework was redefined. Moreover, conclusions were drawn and verified and the implications for the research and action were generated so as to provide insightful conclusions.

Furthermore, to achieve high quality conclusions, it has been reported that the research findings should be: (a) trustworthy and (b) valid (Graneheim and Lundman, 2004; Kaplan and Maxwell, 2005). These will be analysed and explained in the following sections.

4.5.3.1 Trustworthiness

There are four major components that comprise trustworthiness criteria: (a) confirmability, (b) transferability, (c) dependability and (d) credibility (Guba and Lincoln, 1981). These are discussed in the following paragraphs.

- **Confirmability** refers to the extent that the research findings can be confirmed or corroborated by others. Strategies for enhancing confirmability include searching for negative cases that run contrary to most findings, and conducting a data audit to pinpoint potential areas of bias or distortion. Confirmability is analogous to objectivity, that is, the extent to which a researcher is aware of or accounts for individual subjectivity or bias.
- **Credibility** is a criterion of assessing the believability or credibility of the research findings from the perspective of the members or study participants. The inclusion of member checking into the findings, that is, gaining feedback on results from the participants, is one method of increasing credibility. Credibility is analogous to internal validity, that is, the approximate truth about casual relationships, or the impact of one variable on another.
- **Transferability** refers to the degree that findings can be transferred or generalised to other settings, contexts, or populations. A qualitative researcher can enhance transferability by detailing the research methods, contexts, and assumptions underlying the study. Transferability is analogous to external validity, that is, the extent to which findings can be generalized.
- **Dependability** pertains to the importance of the researcher accounting for or describing the changing contexts and circumstances that are fundamental to qualitative research. Dependability may be enhanced by altering the research design as new findings emerge

during data collection. Dependability is analogous to reliability, that is, the consistency of observing the same finding under similar circumstances.

For the purpose of this dissertation, to preserve the trustworthiness of findings two processes were utilised: (a) credibility and (b) dependability. The first was applied as the interviewees had the chance to comment on the findings (after the initial interview) and the latter was applied as the researcher altered the research design (mainly the questionnaire) to accommodate the new findings emerging.

4.5.3.2 *Validity*

To further insure validity, qualitative researchers' typically assess specific validity threats during data collection and analysis by testing these threats against existing data or against data collected specifically for this purpose. Particular strategies include: (a) collecting rich data, (b) paying attention to puzzles, (c) triangulation, (d) feedback or member checking, and (e) searching for discrepant evidence and negative cases (Kaplan and Maxwell, 2005). These are explained in the following paragraphs.

- ***Rich data*** are data that are detailed and varied enough that they provide a full and revealing picture of what is going on, and of the processes involved. By collecting rich data makes the researcher avoiding his/her prejudices and expectations and thus provides a basis for generating, developing, and supporting theories.
- ***Puzzles*** can be surprises, conundrums, and confusions surrounding and contradicting what suppose to be making sense. One underlying assumption of qualitative methods is that things make sense. They make sense to the people involved in the setting, who understand the situation in ways the researcher must discover or determine. If the researcher has not understood how sense is to be made of a situation, he/she may collect more data or approach the issue from a different perspective or theoretical framework.
- ***Triangulation*** is the process in which data are gathered from more than one source. Multiple sources and methods increase the robustness of results. Using more than one source of data and more than one method of data collection allows findings to be strengthened by cross-validating them. When data of different kinds and sources converge and are found congruent, the results have greater credibility than when they are based on only one method or source.
- ***Feedback or member checking*** is an important way of ruling out the possibility of misinterpreting the meaning of what participants say and do or what the researcher observed, and the perspective the participants have on what is going on. In feedback or

member checking, the researcher checks that the interpretation makes sense to those who know the setting especially well.

- **Searching for discrepant evidence and negative cases** is a process in difficult or complex cases where the only solution may be to report the discrepant evidence and allow readers to draw their own conclusions. This holds merit as instances that cannot be accounted for by a particular interpretation or explanation can point up important defects in that account. Identifying and analyzing discrepant data and negative cases is a key part of the logic of validity testing in qualitative research (Kaplan and Maxwell, 2005).

For the purpose of this dissertation, to preserve the validity of findings two processes were used to enhance the validity of the data: (a) triangulation and (b) feedback.

One of the great strengths of case studies as compared with other research methods is that data can be collected (e.g. triangulated) from multiple sources (Fossey *et al.*, 2002). Four types of triangulation are used namely: (a) data triangulation: where the verities of data are used in the study, (b) methodological triangulation: where multiple research strategies are used to study a single problem (c) interdisciplinary triangulation: where investigation issues are related with more than one discipline and (d) investigator triangulation entails involvement of two or more researchers in the analysis (Denzin, 1978; Farmer *et al.*, 2006; Janesick, 2000).

The researcher applied multiple data sources as data and methodological triangulation within each case study to insure the validity of data. In addition, the researcher employed well multiple methods to study a single problem as methodological triangulation and also conduct multiple levels of interviewees. As these interviewees and discussions were with interdisciplinary informants (e.g. IT, medical and managerial backgrounds) it can be argued that interdisciplinary triangulation was applied for this research. Moreover, to test the overall interpretation the researcher near the conclusion of the study, proceeded to ask feedback from key informants to ensure that the final presentation of the data reflects the experience accurately (Krefting, 1991). The triangulation and validity were incorporated in the research protocol as to be tightened with the overall research design. This protocol is presented and analysed in the next section.

4.6 Case Study Protocol

The researcher utilised a research protocol to increase the reliability of the case based research and to guide the data collection process. Literature indicates that the protocol is important for the following reasons: (a) it keeps the researcher targeted on the subject of the case study and

(b) preparing the protocol forces the researcher to anticipate several problems, including the way that the case study reports are to be completed. Hence, a case study protocol can act as a tool that would operationalise the research, acting as an action plan, and setting the rules and regulations by which data can be gathered. Yin (1994) suggests that case studies may have questions at five levels, as presented in Table 4.8.

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

Table 4.8: 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. Finally, based on Farmer *et al.*, (Farmer *et al.*, 2006) an outline of the triangulation method incorporated in the protocol is presented.

4.6.1 Case Study Overview

Case study overview covers the background information about this thesis, the substantive issues being investigated, and the relevant readings about the issue. In the case of this thesis, the researcher needs to collect data that are required to investigate SOA Governance in healthcare organisations (e.g. framework, elements, and relations). Thus, the issues requiring to be addressed, as seen in Table 4.9, are as follows: (a) Test each element as per AT: Attributes, SE: Sub-Elements, GU: Guidelines, AGU: Additional Guidelines, HA: Healthcare Aspects and their relations and (b) Test the SOA Governance framework.

		<i>Test: Organisational Structure</i>		<i>Test: Roles</i>		<i>Test: Maturity Model</i>		<i>Test: Roadmap</i>		<i>Test: SOA Governance Infrastructure</i>		<i>Test: Policies</i>		<i>Test: Metrics</i>		<i>Test: Best Practices</i>		<i>Test: Governance Processes</i>	
		OS	RL	MM	RD	SGI	PO	ME	BP	GP	<i>Test: Elements' Relations</i>								
Attributes	AT1	AT1	AT1	AT1	AT1	AT1	AT1	AT1	AT1	AT1									
	AT2	AT2	AT2	AT2	AT2	AT2		AT2	AT2	AT2									
	AT3	AT3	AT3	AT3		AT3			AT3	AT3									
	AT4	AT4				AT4													
	AT5	AT5																	
	AT6																		
	AT7																		
	AT8																		
	AT9																		
Sub-elements	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1									
	SE2		SE2		SE2	SE2													
	SE3				SE3	SE3													
	SE4				SE4														
					SE5														
					SE6														
Guidelines	GU1	GU1	GU1	GU1	GU1	GU1	GU1	GU1	GU1	GU1									
	GU2	GU2	GU2	GU2		GU2				GU2									
	GU3	GU3	GU3	GU3			GU3												
			GU4																
Additional Guidelines	AGU1	AGU1		AGU1				AGU1	AGU1	AGU1									
	AGU2																		
	AGU3																		
Healthcare Aspects	HA1		HA1			HA1	HA1	HA1	HA1	HA1									
	HA2						HA2	HA2	HA2	HA2									
	HA3																		
	HA4																		
	HA5																		
	HA6																		
	HA7																		
	HA8																		
	HA9																		

Table 4.9: Case Study Overview

4.6.2 Fieldwork Research Procedures

As reported in Section 4.4.1, case studies are studies of events within a real-life context. This raises an important issue for which properly designed field procedures are essential, since the researcher collects data from people and organisations in their everyday situations, not within the controlled confines of a laboratory, the sanctity of a library, or the structured limitations of a rigid questionnaire (Yin, 1994). As analysed in section 4.5.3, based on Myers and Newman (2007) and Fontana and Frey (2000) several issues were addressed before conducting an interview, such as: (a) artificiality of the interview, (b) lack of trust, (c) lack of time, (d) level of entry, (e) elite bias, (f) Hawthorne effects, (g) constructing knowledge, (h) ambiguity of language and (i) interviews can go wrong. This section of the protocol presents those procedures that will be employed during the multi-case study investigation and which include the following::

- Gaining access to key organisations or interviewees,
- Having sufficient resources while in the field,
- Developing a procedure for calling for assistance and guidance,
- Making a clear schedule of the data collection activities that are expected to be completed within specified periods of time,
- Providing for unanticipated events, including changes in the availability of interviewees, as well as changes in the mood and motivation of the case study investigator

At this point it has to be mentioned that the researcher does consider that there will always be elements of bias inherent in qualitative data analysis, due to its subjective nature. Nevertheless it can be argued that several measures were taken, firstly to determine the source of the bias and secondly to address it. Thus, regarding the elite bias the researcher determined the possibility that such bias maybe produced but intentionally allowed key informants to participate in the research (as explained in Section 4.5.3). In respect to bias that may be produced by the researcher himself, it was addressed by (a) holding a neutral facial expressions, body language, tone, and style of language (as explained in Table 4.5) and (b) the research agenda was designed in an unbiased manner (as explained in Section 4.5.2.1), without leading the interviewee towards an answer but rather allowing him/her to express freely. These measures, can provide a neutral reflection of the researcher and minimise the interview's bias (Seidman, 2012). Regarding the bias that may arise from the interviewees, the researcher applied multiple data sources as data, methodological and interdisciplinary triangulation to identify such bias and augment the trustworthiness (as explained in Section 4.5.3.1) and validity (as explained in Section 4.5.3.2) of the findings. Furthermore, the researcher observed the interviewees' reactions during the interview and took notes that

helped him reflect back on the interviewee's answer. This aided the researcher to identify any bias/favouritism expressed by the interviewee (4.5.2.2). An additional measure to control bias produced from the interviewees, was the design of the questions. The researcher intentionally allocated the same question (expressed differently) as to have multiple answers (same or different) on the same issue. This gave the researcher the opportunity to check the answers for consistency. For example, in Section E1 (Annex II) the interviewee is asked to comment on the Organisational Structure element and again in Section E5 (Annex II) to relate on the use of the Organisational Structure. This method aids the researcher to pinpoint any consistency issues and at a later stage of the research (follow-up interview) address it.

4.6.3 Case Study 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 researcher 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 reviews the issues under research, before starting a particular interview. For this reason, the researcher proposed two main research issues, which are presented in Table 4.10.

Proposed Issues for Investigation	
Issue	Description
SOA Governance Elements	Each of the nine elements consists of specific attributes, sub-elements, guidelines, healthcare aspects and relations. All these should be investigated, validated and/or tested and validated.
SOA Governance Framework	The framework should be tested and validated as a decision making tool by running multiple scenarios

Table 4.10: Proposed Issues for Investigation

After collecting the data, the researcher should deal with the analysis, outline, format, or audience of the case study report. The decision about the audience that the analysis may address was taken with emphasis on an IS literate audience but written in a style that can be comprehended by a wider spectrum of readers. The output of the empirical inquiry and the empirical data analysis are presented in Chapter 5.

4.7 Conclusions

This chapter focused on the importance of methodology design employed within this research. An interpretivism, qualitative multiple case study approach was selected, to test the conceptual SOA Governance framework.

In more detail, the chapter presented a discussion of the epistemological stances and their suitability was initially provided. In doing so, the researcher has justified the use of an interpretivism stance for the research presented in this thesis. The reason for this decision is based on the aim of this research as described in section 1.5 and deals with the development of a SOA Governance framework in healthcare. Subsequently, quantitative and qualitative research approaches are discussed.

The researcher suggests that in the context of this research, a qualitative approach is more appropriate for the reasons explained in Section 4.2. Such reasons include that qualitative approach can be used to: (a) investigate little known phenomena like SOA Governance in healthcare organisations (b) examine in depth complex processes (e.g. SOA Governance), (c) examine the phenomenon in its natural setting and (d) learn from practice.

In Section 4.3, the types of philosophical stances that are available and reasons for selecting particular ones were provided. Thus, the use of the interpretive stance in this research was justified and explained in Section 4.3.2. Furthermore, the multiple case strategy was justified and presented in Section 4.4, providing justification on the specifics of the method and its validity for this research. In Section 4.5, the use of research methods was outlined and discussed and arguments for the suitability of particular methods were provided. Thus, various methods for data collection are used by the researcher during this research including amongst others: (a) interviews, (b) documentation, (c) observation, (d) archival records and physical artifacts. Then, the researcher reported on issues like the: (a) empirical research methodology followed in this research and, (b) data triangulation.

In Section 4.6 the researcher presents the case study protocol for this research. This protocol can be used as an important tool that acts as an operationalised action plan for the empirical enquiry that incorporates the crucial element of triangulation. Based on this protocol, the researcher will use case study perspectives to allow others to relate their experience to the outcome of this research. Thus, the work presented in this thesis will provide a broader understanding of the phenomena of SOA Governance in healthcare. The chapter closes with Section 4.7 depicting the conclusions. In the next chapter, a detailed description of the empirical context of this research is presented.

CHAPTER 5

CASE STUDIES AND RESEARCH FINDINGS

Summary

In the previous chapter, the research methodology employed in this dissertation was presented, justified and summarised in Figure 4.2. Subsequently, the research methodology was employed in this chapter to test the conceptual framework as presented in Figure 3.4-Table 3.17. In doing so, Chapter 5 presents and analyses the empirical data collected from two healthcare organisations, namely PubHealthOrg and PriHealthOrg. The preliminary research findings are described and the data retrieved used to test the conceptual framework and the issues under investigation, as these were summarised in Table 4.8. In doing so, the researcher tests and evaluates the conceptual framework proposed in Chapter 3 (Figure 3.4). This chapter begins by providing background information for each case organisation. Thereafter, a detailed presentation of the two cases conducted in Greece is given. As a result, different case study perspectives are presented and analysed. This chapter offers an empirical analysis of different case study perspectives that describes organisations' behaviour and perceptions during SOA implementation. Consequently, rather than generalising the results of these cases, the researcher examines each case by describing respective approaches to SOA Governance in healthcare organisations. In doing so, allowing others to draw parallels in outcome.

5.1 Introduction

In Chapters 2 and 3, the researcher reviewed the normative literature and proposed a novel conceptual framework, to study SOA Governance in healthcare organisations. The proposed framework, as was presented in Figure 3.4, seeks to: (a) synthesise, explicate and extend the established norms and (b) combine this approach to fit the healthcare field. In order, to support the aim of this dissertation, as reported in Section 1.3, a suitable research methodology was justified in Chapter 4 and now used in this chapter.

Chapter 5, tests and assesses the proposed framework (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 Sections 5.3 and 5.4 respectively. The findings of this study are used as a basis to investigate SOA Governance in healthcare organisations. The researcher applies a set of criteria proposed by Miles and Huberman (1994) as a checklist, to identify the case organisations. This process was presented in Section 4.4.2 and summarised in Table 4.3. The main reasons for selecting the specific case organisations are listed below. Both healthcare organisations (a) hold excellent reputation of the specialised care services they provide, (b) recently implemented integration approaches, and (c) utilise SOA. The intention of the researcher was to conduct case studies to more healthcare organisations but this was not feasible as only these two were appropriate.

Chapter 5 is structured as follows: In Section 5.2, an overview of the Greek national healthcare sector is presented. Section 5.3 describes the technological background of PubHealthOrg, the need for integration and the process of implementing SOA Governance, followed by the case organisation outline. In the same section an extensive analysis of each proposed SOA Governance element is included alongside their relations and the framework itself. The section closes with a summary of the findings for PubHealthOrg case. The same structure is followed for the PriHealthOrg, in Section 5.4. In Section 5.5 conclusions for both cases are presented.

5.2 Overview of the Greek National Healthcare System

In 1983, the Greek National Health System (GNHS), was established to ensure equal access to high-quality services for all citizens (Ministry of Health, 2012). The secondary and tertiary healthcare services in Greece are provided, free of charge, to all citizens by the public and university hospitals of the GNHS (Aletras *et al.*, 2007). Healthcare services are funded by public health insurance and private medical insurance (Mossialos *et al.*, 2005).

In this respect, the Greek Ministry of Health is responsible for the provision of healthcare services as well as for the development of national health policy and strategy. The GNHS includes public hospitals, public primary health centres and rural posts and one Social Security Organisation (e.g. IKA). Additionally, the private sector operates on contracts with the health insurance funds (for hospitals, physicians, and diagnostic centres) or directly provides services to the citizens (private consultations, diagnostic tests, hospitalisation) (Mossialos *et al.*, 2005).

The GrNHS consists of the following three subsystems, which operate almost independently (Koutsouris *et al.*, 2005):

- The National Health System, which comprises of public hospitals, Health Centres and the National Centre of Emergency Care. GrNHS provides hospital, healthcare and emergency pre-hospital care on a general basis.
- The Social Security Organisation (IKA) and other Social Insurance Funds, which deal with insurance coverage¹ and
- The private sector, with numerous diagnostic centres, private clinics, laboratories etc.

GNHS consists of 139 general and specialised public hospitals with 30,886 beds and 9 psychiatric clinics with 3,500 beds (Ministry of Health, 2012). Healthcare services are provided by public hospitals, which include 13 military hospitals financed by the Ministry of Defence, five hospitals of the Social Security Organisation (IKA) and seven university hospitals. Emergency pre-Hospital Care is provided by the National Centre of Emergency Care (EKAB) which is a GNHS agency. Health centres also provide emergency services, short hospitalisation and follow up on recovering patients, dental treatment, family planning services, vaccinations, and health education. In addition, healthcare services are extensively provided by private healthcare organisations. Nowadays, 196 private centres and clinics operate in Greece, with a total capacity of 15,573 beds (Ministry of Health, 2012).

Since the establishment of the National Health System in 1983, several efforts for its modernisation (e.g. new technologies, integration etc) have taken place. These, efforts dealt with many issues that could enhance the healthcare services provided, like: managerial, automation and technological, decentralisation, quality assessment and other. Consequently, these efforts have succeeded in improving the health status of the population (Economou, 2010). In fact, successful Greek approaches were put forward as good examples of best practice (e.g. Integrated pre-hospital health emergency services in Crete island) (European

¹ At the moment a big change towards integrating the system under one "umbrella" organisation, the National Healthcare Services Organisation, is under way: http://www.eopyy.gov.gr/Home/StartPage?a_HomePage=Index

Communities., 2009). However, according to Economou (2010), the Greek health care system suffers from inefficiencies, such as:

- A high degree of centralisation in decision-making and administrative processes,
- Ineffective managerial structures which lack of information management systems,
- Lack of planning and coordination,
- Inefficient allocation of human and economic resources,
- Fragmentation of coverage and an absence of a referral system based on GPs or group practice,
- Inequalities in access to services derived from differences in social health insurance coverage,
- Underdevelopment of needs assessment and priority-setting mechanisms,
- Absence of incentives to improve efficiency and quality,
- Absence of a health technology assessment system, quality assurance and economic evaluation processes, leading to an excess of heavy medical equipment.

The awareness of these problems and the resulting need to improve and modernise the healthcare system, have led to a recurring stream of reforms undertaken over the last 30 years. Nonetheless, through the years these reforms were not fully implemented and even diverged from their original objectives (Tsavalias *et al.*, 2012). Thus, despite, the fact that, the total healthcare expenditure rose from 5,3% of gross domestic product in 1991 to 9,7% in 2008, Greece has actually got worse in terms of global health outcomes (Oikonomou and Tountas, 2011).

In addition, Greece is struggling to manage its financial problems, overcome a recession, and maintain a social welfare state. In order to overcome these challenges and recover from the crisis, drastic organisational restructuring had to be made in all aspects of the public sector, including health care. Thus, following recommendations by the European Commission, the main interest is directed to cost cuts in the form of budget cuts modernisation and control of healthcare. Recommendations made include but are not limited to 4.000 beds removed, clinics merge (360 clinics), administrative councils elimination (50 councils) and managerial posts removed (Tsavalias *et al.*, 2012). Additionally, the plan included issues, such as: (a) health supplies management and control, (b) drug management, (c) electronic prescriptions, (d) computerisation of systems (e.g. budgeting, management, accounting and financing systems), amongst others (Angelidis *et al.*, 2010).

Reforms of the GNHS have been on the agenda for many decades, but never accomplished to an extensive degree, due to obstacles, such as: the prevailing political conditions, the

unresolved conflict between political parties, economic factors, substantial resistance from the medical status quo and the inability of the public health system bureaucracy to introduce managerial reforms (Davaki and Mossialos, 2005). Due to the financial crisis the reduction of the overall expenditure seems to prevail upon all the obstacles of the past and produces the opportunity for an effective healthcare reform project, ensuring both equity and efficiency in financing and delivery of services, different political culture and the introduction of more participatory modes of governance (Economou, 2010).

The Ministry of Health launched its own reforms in 2006 based on a healthcare roadmap encompassing infrastructural issues and specific health applications, such as: (a) electronic health records, (b) health cards, (c) e-prescription, (d) EDI based Hospital Procurement and (e) integration, amongst others. The implementation of this ten-year roadmap included three major phases: During phase 1 (2006-2007) the standardisation and communication infrastructure had to be strengthened, strategic pilots took place and legislative interventions were prepared. The second phase (2007-2012) focused on large-scale pilots and the integration of the Health Network at the regional level. In the third phase (2012-2015) integration of the Health Network on a national level was planned (Angelidis *et al.*, 2010).

This section depicted the GNHS situation with its challenges, plans and projects. The next section presents the first case study organisation used to test the proposed SOA Governance Framework.

5.3 Case Study One: PubHealthOrg

In this section, the researcher: (a) describes the background related to this case organisation, (b) explains the decision for implementing SOA and (c) identifies SOA Governance elements and their association as they were established through the SOA implementation process. Due to confidentiality reasons, the researcher uses the coded name PubHealthOrg, to refer to the first case organisation.

5.3.1 PubHealthOrg: Organisation

The organisation was founded as a Legal Entity of Public Law supervised by the Greek Ministry of Health and Public Solidarity and the Greek Ministry of Finance, following a stream of mergers with other public bodies. Its main activity is to offer healthcare services to approximately 1,500,000 insured public servants. This is achieved through a wide network of contracted partners (pharmacists, doctors, diagnostic centres, private clinics and physiotherapists) that provide healthcare services to the insured members. PubHealthOrg's

structure includes a Central Office (CO) and 57 Regional Health Care Services. PubHealthOrg aims to: (a) organise, monitor and control the provision of healthcare to Public Servants, (b) improve the quality and efficiency of healthcare services provided, (c) manage and control the funding and (d) the rational exploitation of the available healthcare resources for its servants. PubHealthOrg monitors and interacts with 12.744 doctors, 2.685 diagnostic centres and labs, 710 physiotherapists, 1.100 opticians and 9.735 pharmacies. Figure 5.1 illustrates its hierarchical structure, separated in offices and departments. High up in the hierarchy is the General Manager, who is part of the Board of Directors, which is the ultimate decision making authority of PubHealthOrg.

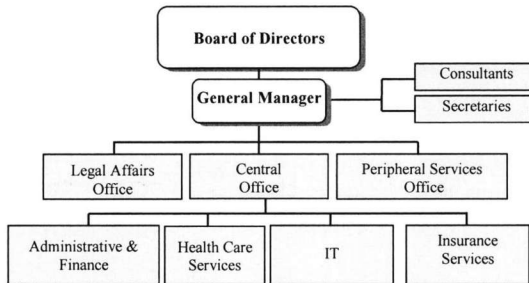


Figure 5.1: PubHealthOrg Hierarchy

Observing Figure 5.1 reveals that the healthcare organisation under investigation maintains an IT department responsible for the HIS functionality. This issue is further explored in the following section.

5.3.2 PubHealthOrg: Information Technology

At the time of research and based on the descriptions and reports given to the researcher it was revealed that PubHealthOrg utilised an IS, consisting of the following sub-systems: (a) Protocol and price management of hospital stays, (b) Protocol and economic management, (c) Insured members' registry, (d) Warehouse, (e) Management of insured members' hospitalization in private clinics, (f) Employees payroll, (g) Management Information System - Business Intelligence (MIS - BI), (h) Safety Management System and (i) Disaster Recovery System. When the IT-Manager was asked to comment on the issue (e.g. OS), he replied:

'PubHealthOrg has a good percentage of computerised processes and the IS is continuously evolving both at an operational and a technological level, so that it meets the needs of the organisation and those of public healthcare.'

Additionally, for the same issue, Consultant-A reported:

'PubHealthOrg management aims to improve the IS's functions and exploit the latest technological systems and platforms in order to meet its challenges.'

Therefore, it is clear that eventhought an IS was functioning at PubHealthOrg, the managers intentions were to expanit its use, integrate the processes and overcome the challenges the organisation was facing. These challenges are described in the following section.

5.3.3 PubHealthOrg: Challenges

Recent developments in Greece, in conjunction with the need to maintain social cohesion whilst establishing and following a financial discipline program, have greatly affected the function of the welfare state. PubHealthOrg as a public insurance body was pressured to address its functionality. Moreover as stated in PubHealthOrg's archival records²:

'the pressure, to which the income of employees and pensioners is subjected, will not produce any results whatsoever if it isn't accompanied by reforms that will lead to the consolidation of the function of the state, especially in healthcare, where public expenditure has increased out of proportion.'

Thus, when a new administration was appointed to manage PubHealthOrg, the organisation was facing two major challenges:

- The cost of the services provided was exceeding by far the amount of revenue it produced and
- A change in the institutional framework regarding the hiring of contractors resulted in a personnel reduction of 44%.

A closer study of the PubHealthOrg archival records reveals that in an attempt to address these issues several IT and other solutions were introduced to automate the processes and to provide interoperability of data and transparency of the processes. Nevertheless, the most strategic action that PubHealthOrg took and most relevant to this research, focused on the implementation of a SOA based electronic referral system that records diagnostically and medical referrals. For the purposes of this research and confidentiality reasons named this

² These were given to the researcher, as supplements to the information and interviews provided for this research.

system **integrated Services (iServ)**. The aim of this system is to automate the referral process, integrate the different aspects (organisation, doctors, patients etc.) and provide transparency of the process (e.g. reporting). This is an interesting finding that comes in accordance to the literature findings presented in Section 2.2. In that section, the researcher identified **integration** (Singer *et al.*, 2011) as a HIS challenge and discussed that many healthcare organisations use the SOA paradigm to resolve this challenge. In the same lines PubHealthOrg top management decided to invest in a SOA project to integrate their processes. The integration approach followed by PubHealthOrg's attempt to overcome these challenges is further analysed in the next section.

5.3.4 PubHealthOrg: Integration Approach

As analysed in Section 5.2, the Greek healthcare sector requires integration on many levels. To this end, the iServ system is considered as a revolutionary integration approach (as portrayed by the media at the time of the research), which can reduce the cost of the healthcare expenditure and automate the referral processes. To the best of the researcher's knowledge, at the time of research, there was no published criticism towards the system based on academic research.

In order to implement such an approach, PubHealthOrg decided to create a web-based open-source platform. This was achieved with the assistance of an external sub-contractor, who worked closely with PubHealthOrg member to implement iServ. The system's platform was designed, tested, implemented and provided for free to the contracted physicians and diagnostic centers. Explaining the system Consultant-A stated that the physicians use the platform to refer the patient to a diagnostic centre and the diagnostic centers execute the referred diagnostic tests and charge the PubHealthOrg accordingly, as seen in Figure 5.2. The physician that has specific access privileges to the iServ platform retrieves the patient's details based on the national insurance number and from a list of exams refers the patient to the diagnostic center. The enrolled to the iServ diagnostic center performs the medical exams and tests and bills PubHealthOrg. The PubHealthOrg's is connected to the iServ and through IS and data centers provide patient's details and exam lists.

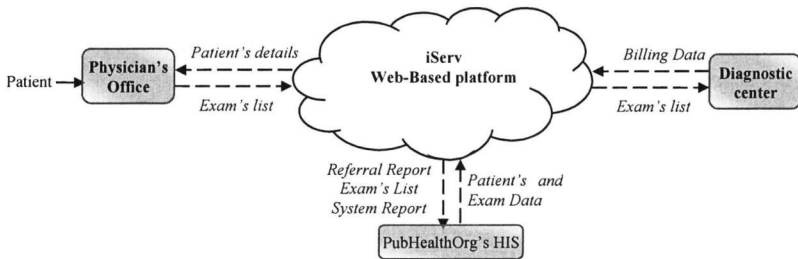


Figure 5.2: iServ Integration Approach

The initial objective of PubHealthOrg was to create a pilot version of iServ with appropriate functionality and evidence that could cut costs. The system's success is presented in the archival records, where it is shown that 11.000 contracted doctors were enrolled and the average cost per electronic referral dropped 42,6% (from €131.44 per paper referral to €75.40). Additionally, at the time of this research the system was fully functional and able to monitor and provide the following data:

- Total number of tests,
- Number of insured individuals who use the service,
- Average number of tests per prescription,
- Maximum value recorded,
- Minimum value recorded,
- Average cost per prescription,
- Average cost per insured,
- Frequency of test prescribed,
- Cost per test,
- Cost per medical practitioner,
- Average cost per medical specialty.

The success of the iServ was such that it was decided by the GrNHS officials to adopt the end-product as part of all the insurance funds in Greece.

5.3.5 PubHealthOrg: Integration Process and SOA

The iServ project was the first big scale integration process that PubHealthOrg implemented. Before this, the organisation's familiarity to SOA was through individual employees initiatives (web-services, small scale applications) providing only an introduction to SOA.

Nevertheless, when the organisation identified a line of business (electronic referrals) it prioritised the integration of this process, through a SOA pilot project (iServ) to benefit from the agility and flexibility that SOA can offer as a solution. Literature refers to this type of involvement with SOA as “initial”³ and is typical for SOA projects as the PubHealthOrg’s iServ (Bieberstein *et al.*, 2005). This project was seen as the pioneer of a national healthcare restructuring towards integrated e-health services for all citizens. As stated, by the Project-Manager of the iServ:

‘We had all eyes on us, we knew from the start that this was not another project, but the start of integrated e-health in Greece.’

These findings indicate that it is of high importance to study and analyse the SOA Governance aspects (elements and associations) since the way that PubHealthOrg addressed them not only concluded in the success of the iServ, but also stressed the project as the pioneer to reshape the Greek healthcare sector.

5.3.6 Testing the Proposed SOA Governance Framework in PubHealthOrg

The aforementioned views, regarding the PubHealthOrg’s endeavour towards integrating its core processes, further supports the aim of this research and demonstrates that there is scope for timeliness and novel research in this case. Therefore, PubHealthOrg is an appropriate case to test the proposed SOA Governance framework to be tested. In order to identify and study SOA Governance, the proposed SOA Governance framework (Figure 3.17) was introduced and evaluated through the empirical data collected from this case organisation.

Initially the researcher applied and tested the elements of the proposed framework (e.g. Organisational Structure, Roles, etc.). The validation of this step is important as it explains the way that PubHealthOrg addressed each of the proposed elements of the SOA Governance framework. Accordingly, multiple healthcare actors (such as: Consultant-A, Consultant-B, Project-Manager and IT-Manager) were interviewed to assess the research issues. Moreover, the framework was evaluated, through these interviews and the findings are presented in the Section 5.3.6.1 to Section 5.3.6.9. Thereafter, the researcher analysed the empirical data and identified the relations between the elements. This process and those findings are presented in

³ The types of involvement into SOA, that an organisation can have, based on Bieberstein *et al.*, (2005) proposition, are presented in detail in Annex IV.

Section 5.3.6.10. A summary of the obtained findings and issues for further research is presented in Section 5.3.6.11.

5.3.6.1 Testing the Organisational Structure (OS) Element

The interviewees were initially introduced to the concept of Organisational Structure (OS) and were then asked to comment on the use of a structure that supported the iServ project in PubHealthOrg. During interviews, the interviewees mentioned, that they had been part of such a structure. Summarising the findings from these interviews, the researcher graphically described the OS created to govern the project in Figure 5.3.

Figure 5.3 depicts a Project Team A and a Project Team B. Project Team A was located in PubHealthOrg and engaged three employees (IT Manager, Consultant A: IT in Healthcare background and Consultant B: IT and management background). The interviewees mentioned the valuable support from the secretarial office and their IT team (5 IT members). The Sub-contractor (external) appointed a Project Team B to cover the project’s needs. Team B consisted of a project manager, a dedicated IT team with four members and a call centre with 20 employees. The main communication channel between the two teams was achieved in between a member of Team A and the project manager from Team B. The General Manager took the final decisions, either in daily, weekly scheduled meetings or when the member of Team A requested a meeting for problem solving.

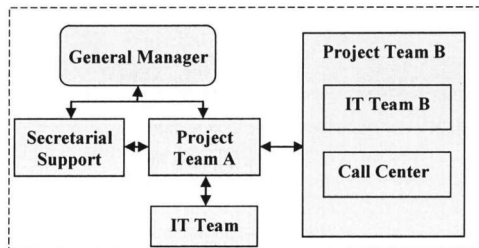


Figure 5.3: PubHealthOrg's Organisational Structure

From the empirical evidence and the description in Figure 5.3, it is clear that this OS is dedicated to SOA Governance. In this case, the aim of this structure was to design, develop and implement the iServ (a SOA based project). When Consultant-A was asked to comment on the OS **Sub-Elements (SE1-4)**, she replied:

'We were a small but effective team [e.g. OS] that worked well together on a daily basis. We had committees but not with permanent members. People

were called to formal or informal meetings [e.g. committee meetings] depending on the issue at hand. We [e.g. OS] had the knowledge at the time regarding almost all the parameters of the project...HIS, SOA, financial etc...'

In another statement Consultant-B further elaborated on the issue of OS Sub-Elements (SE1-4):

'The only permanent committee in charge that I can recall is the one established in PubHealthOrg in charge of the project and included the General-Manager, the consultants, the IT-Manager and the secretary.'

From the above statements it appears that the knowledge regarding SOA in general and SOA Governance in particular was accumulated and disseminated in and from the OS. The OS in this case provided expertise for the project, acting both as a repository of knowledge and as a resource pool for multiple business areas (as expressed by Consultant-A) and included a central committee managing the project (as expressed by Consultant-B). Literature describes that these (e.g. knowledge repository, dissemination of knowledge etc.) are the features of a CoE (Joachim *et al.*, 2011). The empirical data in this case reveal that the OS did not include a board or program office but rather acted as a CoE, where all the knowledge and expertise regarding SOA was located. Thus, the findings coincide with **SE1: Centre-of-Excellence** and **SE4: Councils/Committees**, while **SE2: Governance Board** and **SE3: Program Office** were not observed in this case.

Thereafter, the researcher tested the set of Attributes (AT1-9) that were proposed as part of the OS (Section 3.5), as they are presented in the left column of Table 5.1. The table begins with a numerical count of the attributes, then the proposed attributes are illustrated and the final column shows the findings.

In this case the OS included one committee with permanent members (e.g. General Manager, IT-Manager, Consultants and Secretary) and several unstructured committee meeting with various members. This indicates the ability given to OS to corroborate councils, committees in a permanent or acting capacity. Thus, the evidence presented so far are in line with the proposition **AT1: Corroborates a number of councils**. Furthermore, the researcher observed that the creation of one standing committee, with the ability to call several (mainly informal) event-triggered meetings with other stakeholders, gave the opportunity to the OS to be simple, flexible and effective for this project. Literature concurs with the researcher's observation and

emphasises that organisations at the beginning of SOA adoption require a balanced number of councils (or other sub-structures) rather than too many (Marks, 2008).

Furthermore, when asked about **AT2: Define and abolish governance policies**, Consultant-B stated:

'Of course we had the ability to define and abolish policies, we had the support of the General Manager who was participating in the meetings and could control the project.'

Thus, the empirical evidence concurs with the proposition and points out that the OS in PubHealthOrg, was capable to define and abolish governance policies. This ability, was given to OS by the General Manager's participation in OS. The issue of policies and the influence that PubHealthOrg had on the development of the national e-health law, will be analysed in detail in Section 5.3.6.6

Regarding the **AT3: Obtain and maintain business objectives, standards, best practices**, the interviewees were positive that the OS had the ability to obtain and maintain business objectives, standards and best practices. However the IT-Manager mentioned that the technical best practices were mainly proposed by the sub-contractor. Yet, as the sub-contractor team is included in the OS, this finding is in line with the proposed attribute.

When Consultant-B was asked to comment on the **AT4: Define and obtain feedback from metrics (e.g. about maturity and compliance policies)**, he stated the following:

'Metrics were a crucial part of our plan, we asked and received many kinds of metrics from system statistics to raw data [e.g. by Team-B]. We analysed these data to evaluate the iServ, test its functionality and to take decisions accordingly.'

This statement indicates that OS was able to define and obtain metrics. Therefore, the finding is in relation with AT6. Additional data regarding the metrics will be presented in Section 5.3.6.7 as part of the Metrics Element investigation.

Moreover, when the researcher asked the IT-Manager to comment on the proposed attribute **AT5: Train employees** he made the following comment:

'We have an internal training process for several issues...regarding the training provided for the iServ, the company [external sub-contractor] provided us with training for administrative tasks and with a manual that we published on-line and emailed. Additional training was provided by a help-desk we created and a one-day training seminar, which presented the end product to the doctors. From then on the individual peripheral offices assisted in the training.'

In interpreting the empirical data, it appears that training was provided as part of the iServ adoption in an appropriate manner (e.g. on-line, distance, in peripheral offices etc). This training process can be characterised as sufficient, based on the percentages of end-users acceptance (84% of the doctors). Thus, the findings coincide with the proposition (e.g. AT5). Even though, this finding shows that the OS in PubHealthOrg trains employees, the training was not structured to train employees on SOA, but only on the use of the SOA application. Discussing the issue of training with the interviewees revealed that the members of OS gained SOA knowledge through their daily involvement and interaction with the developers (sub-contractor) and through the training provided to the administrators of the system. Yet, the researcher did not identify any dissemination of that SOA knowledge outside the OS. This finding, reveals that SOA knowledge was confined in OS, and even though literature (e.g. Marks (2008), Mahadevan (2009)) identifies this occurrence as another characteristic of an organisation (as PubHealthOrg) in its initial SOA maturity stages, the researcher believes that further investigation is required. The researcher's proposition for further research lies on literature indications that lack of familiarity with SOA, the learning curve associated with its incorporation and the relative small number of skilled personnel may potentially influence governance negatively (Choi *et al.*, 2012). Thus, the researcher reflects on the importance of this issue on SOA Governance and proposes the issue of '**Employees' Training**' to be further examined.

Interviewees were asked about **AT6: Communicates SOA purpose**, with the Project-Manager providing commenting:

'Communication was a big part of our success, we had to proceed to cost cuts, we had to integrate, we had to make changes, we had to use technology and any available method like SOA to do that. We wanted allies in our endeavours. Communication was a tool of our success, we utilised any means possible to get the vision of a more effective system through.'

This statement, in conjunction with a renewed web-site that holds various reports, news and outcomes from the project, concurs that the OS used various methods to communicate the SOA purpose and thus coincides with the AT6. Also, the researcher observed that the online data provided by PubHealthOrg was often reproduced by local media (blogs, forums and newspapers). Alongside the General Manager (whose's role is further analysed in Section 5.3.6.2) gave interviews and participated in conferences to promote the project and its beneficial utilisation. The researcher attended such conference where the motivation, scope, goals, results and benefits of the project were effectively presented.

Regarding **AT7: Sets roadmap**, Consultant-B reported that the committee which was structured as part of the OS was responsible of such planning. Thus, the empirical findings agree with the proposition, and the OS AT7 is justified, in this case. The issue of the roadmap is also analysed in more detail, in Section 5.3.6.7.

Furthermore, in the matter of **AT8: Influence decisions on project prioritisation**, it was evident that (a) this project was of high importance and given high priority, and (b) this OS had the ability to influence decisions to prioritise project or other activities. The ability for the latter can be credited to the active involvement of the General Manager as a member of the OS. The General Manager was responsible to manage the organisation, therefore it is clear that he (and the OS) could prioritise the activities and projects. This finding is in line with the AT8.

Regarding **AT9: Influence decisions on funding**, Consultant-A stated that:

'To fund this project we had to secure external funding. Fortunately enough a bank, understanding the importance and benefits of such integration endeavour offered the funds.'

The IT-Manager, reported that:

'The bank provided the funding and helped locating the sub-contractor and we worked with these parties [bank, sub-contractor] and agreed upon the iServ details. Thus a contract was signed by all parties, we signed a trilateral contract.'

The aforementioned statement reveals, that PubHealthOrg did not have the ability to fund the project, but had the ability to influence and take decisions about the allocation of the funding,

as it was involved in the trilateral contractual agreement. This finding is in line with the proposed attribute (e.g. AT9), which presents OS as able to influence decisions on funding. A summary of the proposed attributes and the findings are presented in Table 5.1.

AT	Proposed Attributes	Findings
1	Corroborates a number of councils	One council with permanent and ephemeral members
2	Define and abolish governance policies	Defines and abolishes governance policies, based on the top-management support
3	Obtain and maintain business objectives, standards, best practices	Business objectives, standards and best practices are set and managed
4	Define and obtain feedback from metrics (e.g. about maturity and compliance policies)	Metrics are utilised to provide feedback
5	Train employees	The CoE members gained SOA experience and provided the means for training the employees regarding the iServ application
6	Communicates SOA purpose	Communication was utilised as a tool for the project's success
7	Sets roadmap	The council designed the roadmap
8	Influence decisions on project prioritisation	The CoE was responsible to manage the project
9	Influence decisions on funding	The funds were allocated by external source (bank), however OS was responsible for drafting the allocation agreement

Table 5.1: Testing Organisational Structure Element in PubHealthOrg – Findings for Attributes

Thereafter, the researcher investigated the OS Guidelines (GU1-3), as these were listed in Table 3.17. Moreover the empirical evidence presented so far (e.g. for OS AT), already coincide with two proposed guidelines. The **GU1: Main Governance Body** that proposes that OS deals with all the governance aspects and the **GU2: Specialists from both IT and business** that proposes that the members of OS are experts from both IT and business. For the first attribute, it has already been mentioned that OS in PubHealthOrg was the main governance body and for the second that its members were IT and business experts. Concerning **GU3: Structured in a centralised or decentralised manner**, the researcher observed that a centralisation of power, decision making capability and governance, in PubHealthOrg's OS existed. This finding is based on the consultants' statements that the General Manager, who was also a member of the OS, was in charge of the project and therefore able to take relevant (e.g. SOA related) decision. This shows that the OS in PubHealthOrg is structured in a centralised manner. The three tested guidelines and the findings for this case, are presented in Table 5.2.

GU	Proposed Guideline	Findings
1	Main governance body of the SOA initiative	Main governance body of the project
2	Specialists from both IT and business	Specialists from IT and business
3	Structured in a centralised or decentralised manner	Structured in a centralised manner

Table 5.2: Testing Organisational Structure Element in PubHealthOrg – Findings for Guidelines

Furthermore, the researcher investigated the proposed Additional Guidelines (AGU1-3) as proposed in Table 3.17. Moreover, in relevance to **AGU1: Designed as to compensate for the weaknesses of the current organisational and IT structure**, the data are in line with the proposition. In this case the OS was designed to address several limitations, such as: (a) integration need, (b) IT/SOA Governance, and (c) cost cuts.

Regarding the **AGU2: Engagement approach**, when asked, Consultant-B made the following comment:

'From the engagement proposition you [the researcher] presented, I think the council is a communication centre and the whole structure [OS], an outsourcing centre, because the sub-contractor did the development.'

From this statement, it appears that the OS is perceived as (a) a communication centre that was responsible to promote the need and purpose of the project and (b) an outsourcing centre that develops the services (this was the role of the sub-contractor). Thus, the proposed engagement types as proposed by the researcher (Section 3.3.1-Table 3.12) agree with the empirical data. Thus the researcher considers AGU2 to coincide with the empirical evidence.

Empirical data gathered regarding **AGU3: Balanced number of structures** show that a council and other informal structures (e.g. groups) were created in PubHealthOrg in order to aid the OS. Based on the view of the members of OS this was an effective number of structures, an issue explained in the SE1-4 data analysis earlier in this section. To this end, the three proposed additions are presented in Table 5.3, alongside the findings for PubHealthOrg's case.

AGU	Proposed Additional Guidelines	Findings
1	Designed to compensate for the weaknesses of the current organisational and IT structure	Created to address limitations, such as: (a) integration based on patient needs, (b) IT/SOA Governance, and (c) alignment with business process
2	Engagement approach	Communication and staffing centre
3	Balanced number of structures	One council and informal structures

Table 5.3: Testing Organisational Structure Element in PubHealthOrg – Findings for Additional Guidelines

Besides the aforementioned attributes and guidelines the researcher in Chapter 3 also proposed a set of Healthcare Aspects (HA1-9). These aspects were depicted from Table 3.17, but are also presented in the left column of Table 5.4. In the same table the right column presents the empirical evidence retrieved from PubHealthOrg for each of the nine HA. The researcher presents an analysis of the findings for these aspects in the next paragraphs.

The researcher from the views and data collected in this case, deduce that PubHealthOrg's OS main goal was to align the referral processes running separately, under one process automated with the aid of the iServ system. This finding describes that the OS was dedicated to align the business (e.g. referral process) with the IT (e.g. iServ). From this finding, it appears that the proposed **HA1: Dedicated alignment structures (e.g. committees, councils)**, is in line with the empirical data. Based on the same finding, it can be stated that the **HA2: Business/IT alignment goals** also coincides with the fieldwork findings, as the OS goals in this case, were set highlighting both business (patients' need of a referral system) and IT (utilization of SOA) goals.

When Consultant-A was asked to comment on the issue **HA3: Responsible to set clear goals for SOA Governance issues**, it was stated that the organisation carried out a SWOT⁴ analysis to clarify the strengths, weaknesses, opportunities and threats and place goals to resolve the challenges it was facing. This analysis (e.g. SWOT) gave them the opportunity to gain knowledge of the current strengths and weaknesses, analyse potential opportunities and set goals accordingly. The consultant also mentioned that in the later stages of the project the IT/SOA goals were edited in relevant context that affects SOA Governance. For example, she mentioned that one of the opportunities was the IT skills and sophistication of the employees and therefore they included in their planning a goal to utilize these skills in the iServ implementation. The researcher from this comment acknowledges that the goal (e.g. utilise employees' skills) affects SOA Governance elements, such as: organisational structure and roles. Therefore, it can be argued that the main goals that were set by the start of the project affected the SOA Governance elements of the project. Therefore, the findings are in agreement with the proposition (e.g. HA3).

Concerning **HA4: Involve individuals with skills that can set clear goals**, it was emphasized (and evident in the archival records) that the initial SWOT analysis was outsourced in a professional consulting agency. This action (e.g. external, skillful experts) alongside the multi-discipline members of the OS that edited the goals at a later stage validates that the goals were set by appropriate individuals. Thus, the findings are in line with the proposition. However, there is no clear indication that PubHealthOrg proceeded in any action relevant to **HA5: Dedicated formal (committees, interest groups) or informal (intranets, wikis) to control complexity**. When Consultant-B was asked to comment on the absence of such measures, it was mentioned that:

⁴ **SWOT analysis** is a structured planning method used to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved in a project or in a business venture. It involves specifying the objective of the business venture or project and identifying the internal and external factors that are favorable and unfavorable to achieving that objective.

'Internally [meaning the OS] we did not identify a great degree of complexity as we were a handful of people responsible for the project, with clear goals and responsibilities. The sub-contractors work was also well defined and documented, this made our work easier as the contract acted as a point of reference of what to expect and the way to achieve these expectations.'

From the interpretation of the empirical data, it appeared that PubHealthOrg did not consider complexity as an issue. This, as explained by the consultant, can be attributed to: (a) small project with a small number of stakeholders and (b) documented contractual agreement for the implementation of the SOA project. This is an interesting view that contradicts the literature findings presented by the research in Chapter 2. In Section 2.4.2, complexity was identified as a CSF for SOA in healthcare organisations. Yet, the researcher understands that this contradiction can be attributed to PubHealthOrg's specifics. As this is the first SOA project that PubHealthOrg implemented, it seems that complexity was kept either at lower level due to the reason given by the consultant, or because the OS did not pay attention to this issue due to inadequate measurement. The latter is supported by Hirzalla *et al.*, (2009), who emphasises the need for sophisticated metrics in predicting and measuring the complexity of a SOA system. Apparently and yet understandably, organisations like PubHealthOrg, in their first SOA stages do not implement such systems. Thus, even though the empirical data reveal low or no complexity associated with this project it is the researcher's view that more data are required to strengthen this claim. Therefore, the researcher proposes the issue of "Complexity" to be further investigated.

Regarding **HA6: Committees dedicated to cost control, sponsor identification and funding**, and the views expressed so far it can be acknowledged that: (a) OS was dedicated to implement iServ and therefore cost cuts, and (b) a sponsor identification effort successfully located sponsors and funds for the SOA implementation. Therefore, the empirical findings are in line with the proposition. Furthermore, Consultant-A was asked to comment on **HA7: Dedicated structures (e.g. Committees and interest groups) to minimise risk**, to which it was stated:

'We [e.g. OS] followed all the standards, laws and risk/safety guidelines imposed on us and also ones considered appropriate for such project. We had several meetings for these issues and spend a lot of time and effort to reduce any error prone parameters.'

It appears that, while a dedicated structure was not created with the intent to minimise risk, the dedication and concerns were allocated to interest groups, meeting for the same purpose. Thus, the empirical data concur with the healthcare aspect as it was proposed.

In relevance to **HA8: Dedicated structures (e.g. committees and interest groups) to identify and propose standards**, from the various discussions of the researcher, it was revealed that PubHealthOrg formed committees with that purpose. Thus, empirical findings are in line with the proposition. This issue is further analysed in Section 5.3.6.4. Additionally regarding **HA9: Cultivate SOA friendly culture**, from PubHealthOrg’s dissemination approaches (e.g. web-site, media coverage, internal communication, seminars etc.) with the support and involvement of the General Manager it appears that this aspect coincides with the findings. This is the case, as all these dissemination approaches are orchestrated by the OS aided to cultivate a friendly culture to the project in general and SOA in particular. Therefore, the nine proposed HA are presented in Table 5.4, alongside with the findings for PubHealthOrg case.

HA	Proposed Healthcare Aspects	Findings
1	Dedicated alignment structures (e.g. committees, councils)	OS was dedicated to align the business process with IT
2	Business/IT alignment goals	Alignment goals were set both for business and IT
3	Set clear goals for SOA Governance issues	Clear goals, were produced with the aid of a professional consultant agency and edited by SOA professionals
4	Involve individuals with skills that can set clear goals	Top management responsible to set the goals based on the accreditation program guidelines
5	Dedicated formal (committees, interest groups) or informal (intranets, wikis) to control complexity	Not Observed
6	Committees dedicated to cost control, sponsor identification and funding	OS was dedicated to cost minimization while a sponsor identification effort successfully draw funding for the project
7	Dedicated structures (e.g. committees and interest groups) to minimize risk	a dedicated structure was not created with the intent to risk minimisation, the dedication and concerns were allocated to interest groups meeting for the same purpose
8	Dedicated structures (e.g. committees and interest groups) to identify and propose standards	Dedicated structures (e.g. committees in this case) that proposed and evaluated various standards (e.g. medical, SOA, etc.)
9	Cultivate SOA friendly culture	Several dissemination approaches (e.g. web-site, media coverage, internal communication, seminars etc.) identified

Table 5.4: Testing Organisational Structure Element in PubHealthOrg – Findings for Healthcare Aspects

To this point, the OS element and its attributes, sub-elements, guidelines, additions and healthcare aspects proposed by the researcher were examined through the empirical evidence gathered from the PubHealthOrg case. In the following section the Roles element is examined and analysed to test and validate it.

5.3.6.2 Testing Roles (RL) Element

Initially the researcher asked the interviewees to comment on the attributes (AT1-5) attached to the Roles element of the proposed SOA Governance framework (Table 3.17). Their responses were positive acknowledging the attributes proposed by the researcher.

Regarding **AT1: Hold SOA responsibilities**, all the respondents were positive and identified several roles in PubHealthOrg that included SOA responsibilities in their description. Additionally, the same positive response was given by Consultant-A for **AT2: Roles responsible for governance processes**, as she stated that the members of OS had roles and responsibilities for governance processes. Additionally, regarding **AT3: Gain the support of all the relevant stakeholders**, the discussions with the interviewees revealed that the support and involvement of the top management in this project aided in gaining the support not only of their fellow employees but also from external stakeholders and the public (e.g. patients). Empirical evidence reveal that the General Manager acted as the main spokesman of the project disseminating the initial results (e.g. cost-reduction, automation, ease of use etc.) in the relevant public forums (e.g. media, conferences etc.). This supportive role of the top management is also highlighted in relation with **AT4: Decrease resistance to change**. The IT-Manager reported that:

'We are a public organisation, thus we are subject to follow the changes that the top management chooses. However in this case it was evident that such a change was required, we were convinced it could work and thus more than happy to be part of it....'

On this issue, Consultant-B commented the following:

'The external stakeholders as doctors, patients and the general public had to be supportive for this project to be successful. Thus, from day one the General Manager acted as an evangelist to gain their support and as the first result of the successful implementation came, his work became easier.'

The aforementioned views provide evidence that the role of the General Manager as an evangelist of the project and HIS integration played a crucial role in gaining the support of various stakeholders and minimising the resistance to change caused by the project (also discussed as part of OS AT6 and RL AT3). Nonetheless, the researcher deduces two important points from this finding. The first point is that the General Manager's role as an evangelist is

distinctive for this case and can be credited to the particularities of this project (e.g. iServ was a pioneer project for the Greek healthcare sector, need for cost cuts etc.). Therefore, the researcher acknowledges the importance of the role (e.g. evangelist) yet refrains from directly linking this role with a top-management figure (e.g. General Manager), as there are no further evidence (e.g. literature) to support such association beyond this case. The second point derives from literature indications and involves the responsibilities of the SOA evangelist. According to literature the SOA evangelist as a role, is not set to talk only about the technology or even has to mention the term SOA, instead the evangelist educates stakeholders regarding the key business drivers and the methods for helping to deliver these drivers (Kavis, 2008). This was observed in PubHealthOrg case. The SOA evangelist (e.g. the General Manager in this case) refrained from technical details of the project and concentrated in promoting the new solution (iServ) and its benefits. Therefore empirical data highlight the role of the SOA evangelist and its responsibility to educate the business about the SOA.

Regarding **AT5: Reduce the risk of program failure in a later stage**, the interviewees responded by emphasizing on the role of the external contractor as a guarantee of successful implementation and functionality of the SOA project. This assurance was based on the contractual agreement signed between the three parties (PubHealthOrg, sponsor and external subcontractor). Therefore, the risk for program failure was considered and actions (efficient contractual agreement) were taken to address such risk. Thus, empirical data concurs with the proposition.

In Table 5.5, the aforementioned proposed attributes for the RL element and the empirical evidence for each are depicted.

AT	Proposed Attributes	Findings
1	Hold SOA responsibilities	The members of the organisational structure held specific roles and responsibilities accompanying these roles
2	Responsible for governance processes	Roles responsible for governance processes
3	Gain the support of all the relevant stakeholders	Aided in gaining the support of employees
4	Decrease resistance to change	The role of SOA evangelist was crucial in this respect, especially for minimising the resistance to change of the external stakeholders
5	Reduce the risk of program failure in a later stage	External contractor guaranteed the functionality of the SOA

Table 5.5: Testing Roles Element in PubHealthOrg – Findings for Attributes

To test the proposed Guidelines (GU1-3) for the RL element the researcher gathered empirical data from the PubHealthOrg case. The findings are presented in the following paragraph and summarised in Table 5.6.

Empirical data presented in the previous element (e.g. OS) show that members from both the IT and business were involved and given specific roles. Thus, the proposed **GU1: Members from both IT and business** is justified in this case. Additionally, regarding the proposed **GU2: Require specific skills/training**, the researcher observed in the archival records given to him (SWOT analysis) that one of the strengths identified in PubHealthOrg was the IT sophistication and skill of the employees. This was also reported by the interviewees, who also commented that the required skills and training was at a sufficient level for this project. Therefore, based on the researcher's observations and interviewees' reports it can be stated that IT/SOA skilful employees were part of OS and given appropriate roles depending on their background. For example, Consultant-A who had a PhD in HIS integration, with knowledge of IS/SOA were given the roles of Business Analyst and Business Integrator. As far as **GU3: RACI** method/chart, the researcher did not observe a detailed approach to be implemented in this case, nor was such method reported by any of the interviewees. This is not uncommon at this early stage of a SOA involvement (as in PubHealthOrg), with literature indicating the use of RACI methods for governance purposes in bigger more complex projects (Lapão, 2011).

GU	Proposed Guidelines	Findings
1	Members from both IT and business	Members from both IT and business
2	Require specific skills/training	Skills/training requirements
3	RACI	Not identified

Table 5.6: Testing Roles Element in PubHealthOrg – Findings for Guidelines

In Chapter 3 the researcher proposed an Additional Guideline (AGU1) for the RL element, as seen in Table 3.17. The **AGU1: List of roles and responsibilities** (seen in detail in Table 3.13) was given to the interviewees, so that they identify and comment on them. The findings of this process are presented in Table 5.7, where the symbol (✓) indicates that the specific role is identified by the specific interviewee, and the symbol (-) shows the opposite. Moreover, the left side of the table (first, second and third column) illustrates the proposed roles and the right side the interviewees' initial (as Consultant-A: C-A, Consultant-B: C-B, Project-Manager: P-M, IT-Manager: IT-M,).

Category	Sub-category	Role	C-A	C-B	P-M	IT-M
SOA support	Front-end	Operator	✓	✓	-	✓
		Support Personnel	✓	✓	-	✓
	Back-end	Business Process Analyst	✓	✓	✓	✓
		Service Developer	✓	✓	✓	✓
		Application Developer	✓	✓	✓	✓
SOA strategy & governance	-	Strategy manager	✓	✓	✓	✓
		Process manager	✓	✓	✓	✓
		Security manager	✓	✓	✓	✓
		Governance manager	✓	✓	✓	✓
		Technology scout	✓	✓	✓	✓
SOA design & quality management	Design	SOA architect	✓	✓	✓	✓
		Infrastructure architect	-	-	✓	✓
		SOA designer	-	-	✓	✓
	Quality assurance	Business integrator	✓	✓	✓	✓
		Tester	-	-	✓	✓
	Administration	Administrator	-	-	✓	✓
		Service librarian	-	-	-	-
SOA development & evolution	-	Project manager	✓	✓	✓	✓
		Project member	✓	✓	✓	✓

Table 5.7: Testing SOA Roles List

The difference between the identification of roles, comparing the answers of the interviewees closely related to management activities (e.g. C-A, C-B) against those closely related with IT (P-M, IT-M) can be accredited to the familiarity of the latter with the SOA project activities. As explained by the Project-Manager:

'We had very frequent face to face meetings and over the phone discussions. They knew me as the project manager, while I had multiple roles, most of them related to the architecture.'

This statement reveals that one individual could hold multiple roles according to the need at the time. Regarding the proposed Sub-Elements (SE) and more specifically **SE1: Responsibilities** the Project-Manager noted positively on the use of the proposed

responsibilities, as seen in Section 3.2.2 (Table 3.13), while commenting that he was unaware of the RACI method or similar. On the issue, Consultant-B noted:

'We [the consultants] had various roles related to SOA and SOA responsibilities, however, it's fair to say that the responsibilities were attached to tasks, the council would meet, a task would be identified and thus the people working on this task had specific responsibilities and accountabilities collectively.'

Thus, according to the empirical data, the OS in this case was allocating responsibilities, to tasks and not to roles. These were not documented. However, from further investigating the issue, it was revealed that responsibilities to tasks were documented regarding the sub-contractor. This difference (e.g. un-documented responsibilities vs. documented) can be accredited to the arrangement between the parties and their contractual agreements that required detailed specification of the tasks (including details as responsibilities). This clear set of responsibilities proved useful for the project development, as reported by Consultant-B:

'We had the responsibilities for the sub-contracting company placed, but the main issue was to complete tasks and resolve problems when they appeared. We could find out the party responsible for a specific task, they [individual OS members from the sub-contractor] knew they were responsible. They knew what they had to do and usually the whole process to resolve an issue did not take long, we had a good cooperation.'

This statement highlights the contribution that well documented responsibilities can play in a projects success. Thus the findings are in line with the proposition in this case.

In this section, the RL element with its attributes, sub-elements, guidelines, additional guidelines were tested and the findings analysed. In the next part the findings corresponding to the Maturity Model element are presented and investigated.

5.3.6.3 Testing SOA Maturity Model (MM) Element

Initially the researcher explained to the interviewees the Maturity Model (MM) element as described in the SOA Governance framework (Table 3.17). Thereafter, the researcher proceeded to test this proposition, starting with the Attributes (AT1-3) of the MM element. Regarding **AT1: Assessment mechanism**, Consultant-A mentioned:

'We haven't utilised a specific SOA maturity model, however we did a similar process to identify the AS-IS status of the organisation, we did that for, technology, processes, organisation, governance and financial areas. This was part of a SWOT analysis we performed.'

This statement indicates that while PubHealthOrg did not employ a known MM as part of their governance process a similar (to a maturity model) conceptualisation methodology was applied. Based on the consultant's statements PubHealthOrg's OS realised the need for an initial assessment mechanism and thus carried a SWOT analysis to achieve it. Therefore, the AT1 is in line with the findings.

Additionally, regarding **AT2: Provides comparison between current and future state of SOA**, the interviewees were asked if such an attribute was applicable in their case. Their responses were positive with the IT-Manager stating that even though they were in the initial stages of SOA adoption they required a point of reference on what lies ahead. In several discussions that the researcher had with the interviewees it was reported that such comparison was needed. Also, the interviewees pointed out that near the end of the project (e.g. iServ), where the planning for future SOA applications was explored this need was more obvious. Thus, even though, in this case there was no comparison of the current and future states of SOA, the views expressed concur that such an attribute is required for better SOA Governance. Therefore, the researcher considers AT2 to be in line with the evidence.

As far as **AT3: Assist in steering and planning needed for running a SOA**, it was revealed that the initial assessment aided in the later planning. To further investigate this issue the archival records were reviewed, where the SWOT analysis was illustrated as a useful tool providing the motivation to develop iServ. The records show the computerisation and IT sophistication as Strengths, the anachronistic function and incomplete integration as Weaknesses, the partnership with other organisations and the e-prescribing as Opportunities and the increasing cost and financial momentum as Threats. These findings, aided the decision to develop a solution able to utilise technology, integrate, reform, and potentially be connected with the e-prescription system and minimise the cost. Additionally, these findings assisted the OS members to reveal different application areas of the organisation (e.g. technology, process etc.) and identify the way to enhance them. The researcher considers this process to be similar to that of a MM element as the one proposed in Chapter 3 (Table 3.17). The difference from what was done in the PubHealthOrg case and in the proposed MM can be roughly described as: (a) there was no use of MM levels, (b) not detailed account of MM application areas, and

(c) not direct goals related for each application area. Regarding the latter, PubHealthOrg focused on one business process (e.g. referral process) and decided to develop the iServ. Nevertheless, when asked to comment on the utilisation of a MM the interviewees mentioned that such a detailed tool could be proven even more useful (than the process they utilized) for the SOA Governance processes. Thus, the aforementioned empirical data coincide that the proposed attribute (e.g., AT3) can be included as part of the MM element. All the proposed attributes alongside the findings are shown in Table 5.8.

AT	Proposed Attributes	Attributes in PubHealthOrg
1	Assessment mechanism	An assessment mechanism is required
2	Provides comparison between current and future states of SOA	In this case there was no comparison of the current and future states of SOA, such an attribute is required for better SOA Governance
3	Assist in steering and planning needed for running a SOA	Such a tool (proposed MM) could be even more valuable for the SOA Governance processes

Table 5.8: Testing Maturity Model Element in PubHealthOrg – Findings for Attributes

Furthermore, the researcher tested the proposed Sub-Elements (SE1-2), to identify if such propositions were relevant to the case. The IT-Manager reported:

'The way you describe the SOA maturity model, with the levels and phases can be useful, we haven't got something like that but we have made the assessment for all the areas you present. At the moment I believe we correspond at the managed level in all areas.'

This point of view, is related to **SE1: Levels** and to the archival records (e.g. SWOT report), where no indications of maturity levels could be retrieved. The researcher understands that this lack of a structured SOA MM in this case can be explained by the early stages of SOA maturity that the PubHealthOrg was at. This is also supported by literature, where it was reported that the organisations on their early levels of SOA adoption do not consider the higher levels of maturity (Söderström and Meier, 2007). Yet, based on the manager's view such levels and planning based on such descriptions can be proven helpful for SOA Governance. Therefore, the researcher considers that SE1 coincides with the empirical findings.

However, having in mind Consultant-A's statement about AT1 (previous page), it is clear that PubHealthOrg performed an initial assessment to identify the AS-IS status in five areas namely: (a) technology, (b) processes, (c) organisation, (d) governance and (e) financial. Thus, the empirical data is in accordance with the **SE2: Application areas** and extends them by adding the Financial area. This Financial area, in the PubHealthOrg case, was mapped against the other areas (e.g. processes) so as to provide an easily comparable notion of the cost. For

example, in the same records it is reported that the utilization of the iServ will produce a drop on the cost of referrals, which it actually did. This initial assessment was a key figure, and the interviewees identified it as a crucial area of assessment. Thus, the empirical findings coincide with the proposed application areas but can be enhanced with the addition of the Financial area.

The researcher also tested the proposed Guidelines (GU1-4) to identify if such propositions relate with the SOA MM element. Thus, firstly the interviewees were asked to report on the **GU1: Detailed analysis**, **GU2: Levels** and **GU3: Application areas** of the SOA MM (seen in Annex II). On the issue, as reported by the IT-Manager, this detailed view “is a useful tool” for governance and according to his view the PubHealthOrg corresponds on the Managed level regarding all the application areas. Furthermore, Consultant-A, reported:

‘I agree with the IT-Manager, for the technology we correspond to the managed level and we created plans to advance to the next. For the business processes [e.g. referral process] we have developed the iServ project and hopefully these services will be reused in the next project and more business processes will be integrated. Regarding the organisation I think we correspond on the managed level and regarding the governance we correspond to the managed as we have set guidelines and our services will be consumed by the e-prescribing system .’

A graphical representation of the PubHealthOrg maturity state, based on the descriptions given by the interviewees is presented in Figure 5.4. The researcher does not claim that this is a precise representation of a SOA MM in PubHealthOrg as such claim requires more evidence and data from multiple sources. Such detailed research on the SOA MM is out of scope of this dissertation. Nevertheless, proceeds to graphically represent the SOA MM based on the data retrieved and believe that Figure 5.4 adds to the discussion and enhances the understanding of SOA Governance in PubHealthOrg.

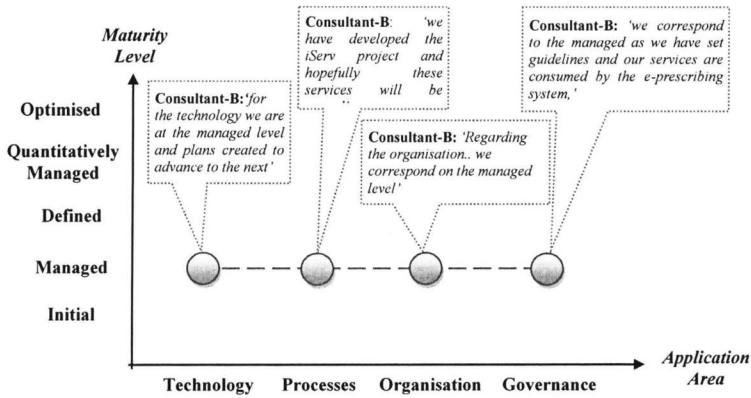


Figure 5.4: Maturity Levels in PubHealthOrg

When the interviewees were asked to comment on **GU4: Examples of CMMI and or COBIT**, they replied that they were not familiar with such models and only when the researcher elaborated on the issue they reported that they might consider them at a later stage. In order to better present all the proposed GU1-4 (e.g. Table 3.17) for the SOA MM element, the researcher summarises them alongside the findings for each in Table 5.9.

GU	Proposed Guidelines	Findings
1	Detailed analysis	Detailed analysis is justified
2	Levels such as: initial, managed, defined, qualitatively managed and optimised	Levels tested and justified
3	Application areas: organization, process, governance, service/ service management architecture, infrastructure and business view	Application areas tested and justified
4	Examples of CMMI and/or COBIT	Not Observed

Table 5.9: Testing Maturity Model Element in PubHealthOrg – Findings for Guidelines

HA1: Funding is an application area, was identified as part of the SE2 under the term 'Financial area'. Thus, empirical evidence concurs with the proposition placed by the researcher in this aspect.

In this section, the SOA MM element and its attributes, sub-elements, guidelines, additions and healthcare aspects proposed by the researcher were investigated and tested by gathering data from the PubHealthOrg case. In the next section the Roadmap element is examined and analysed.

5.3.6.4 Testing Roadmap (RD) Element

In order to test the proposed Roadmap (RD) element, the researcher first examined the proposed Attributes (AT1-3) as these were depicted in Table 3.17. When the IT-Manager was asked to comment **AT1: Provides an incremental SOA adoption**, he reported:

'You have to consider that this [e.g. iServ] is our first integration approach of its kind. We designed, planned and implemented it and it proved to be a success. It helped us to introduce new technologies, integrate the systems and the referral process. We aim to expand this in the near future.'

This statement reveals that even though PubHealthOrg is at an initial stage of SOA adoption, they planned their first steps (e.g. chosen iServ as a pilot SOA project) with the intention to introduce SOA in an incremental way. Additionally, from the aforementioned statement and the inspection of the archival record, where it is mentioned that future plans include the augmentation of the iServ system as part of an e-prescribing platform, reveals that PubHealthOrg planned for an incremental SOA adoption. Thus, the empirical findings coincide with the proposed attribute.

Regarding **AT2: Detailed planning process**, the interviewees were asked to comment on the way they structured their project's roadmap and in particular the SOA related planning. From the responses it was identified that a SWOT analysis was utilised for the AS-IS assessment of the organisation. This approach, as explained in Section 5.3.6.3, aided the organisation in identifying strengths, weaknesses, opportunities and threats. This assessment included the AS-IS identification in five areas namely: (a) technology, (b) processes, (c) organisation, (d) governance and (e) financial. Consultant-B reported on the issue:

'We required the employees involved in all the offices and departments [as seen in Figure 5.1] to supply us with all the data needed to identify the current status [AS-IS]. However our main concern and focus was on cost-cuts and we planned in order to achieve this aim.'

It appears that PubHealthOrg proceeded in a detailed departmental analysis that aided the planning of the integration process in general and SOA planning in particular. This is more obvious as many of these details (e.g. cost cuts) were transferred to the end-product and concluded in the system's success. It was observed (archival records) that success was identified not only in one area (e.g. technology) but in many (e.g. user satisfaction, user

acceptance, net profits etc.). This result was clearly attributed in the detailed planning preceding the implementation. Thus, the empirical findings concurs with the proposed AT2. In an attempt to better illustrate the proposed attributes and findings in this case, the researcher presents them in Table 5.10. The left side of the table depicts the proposed attributes and the right side the corresponding findings.

AT	Proposed Attributes	Findings
1	Provides an incremental SOA adoption	An incremental planning for SOA adoption was identified
2	Detailed planning process	A detailed process involving every department was identified

Table 5.10: Testing Roadmap Element in PubHealthOrg – Findings for Attributes

Furthermore, the researcher tested the proposed Sub-Element (SE1) regarding RD element, as this was presented in Table 3.17. In more detail, regarding the **SE1: Transition plans**, the IT-Manager explained:

'After assessing PubHealthOrg status, the decision was obvious, we had to proceed to cost cuts, so we planned to automate and integrate the referral process, This affected many other sectors like the IS, the processes, the organisation, etc. we knew and anticipated this.'

This statement in conjunction with the justification given for RD AT2, reveals that PubHealthOrg identified the AS-IS state and revealed that to achieve the required cost cuts, they had to automate and integrate their process (referral system) and enhance their technology's positive impact. This planning method aided the organisation to have a clear view of their next steps, anticipating the changes required. To achieve this, OS created transition plans referred to as iServ project. Therefore, the empirical data justify the proposed SE1 in this case. At this point, it needs to be highlighted that an interesting finding that came up during the interviews was the lack of a reference law that could support this pioneer project. In more detail, Consultant-B explained:

'One of the biggest challenges we faced was the lack of a legal reference directive upon which to define iServ. Thus, in coordination with the GrNHS ministry and especially their legal department, a new law was proposed to facilitate the requirements set for iServ. This law was produced and came into effect by the time iServ was implemented. This law is the foundation and shaped the national e-health policies.'

This finding is interesting as it reveals that PubHealthOrg had the motivation and power to persuade the government to change the legislation so as to support the implementation of iServ based on the definitions required. It has to be mentioned that the top management support and involvement was of high importance in this case.

In order to investigate the proposed Guidelines (GUI-3) the researcher analysed the archival records presented to him and asked the interviewees to comment on the proposed guidelines (as seen in Table 3.17). In response to the researcher's questions and in regard to **GUI:Based on current and target SOA and SOA Governance maturity assessments**, it was revealed that in PubHealthOrg case the SOA roadmap was (a) not based on current SOA, as this was their first SOA project (iServ considered as a pilot SOA project), (b) based on target SOA as their detailed analysis and planning shows, and (c) there are evidence of SOA Governance assessments and indications of these assessments to be incorporated into the roadmap. Moreover, starting with (a) it can be argued that since this is the first SOA project a comparison of current and future SOA could not be made (see also SOA MM AT2). Whereas, for (b) the Project-Manager explained:

'We knew we had to change a lot, the process, the coding, and the medical procedures' registry. We had to plan for these changes, consolidate with the doctors and communicate the modifications required.'

This finding shows, that PubHealthOrg after the initial assessment utilised this gained knowledge to identify the requirements (e.g. changes), in order to proceed to the next level. These included their target SOA which was their goal, for which Consultant-A stated that:

'The goals set for this project were clear, cost cuts and utilisation of technology. You can identify these goals, if you look at our reports, the dissemination material, anything really. In all of them cost-reduction, economy through integration and IT is overemphasised.'

This statement is in conjunction with the archival record provided to the researcher. Emphasis is indeed given in the cost-reduction that the iServ produced and the technology required to implement it. Moreover, Consultant-A discussed the requirements that OS set for the iServ:

'The requirements for iServ included a clear view of the process [e.g. referral system] a consolidation of the process and plans for its automation

and enhancement. This involved a lot of meetings with doctors' representatives, ministry officials etc.'

The aforementioned statements also address (c) as indications of SOA Governance assessments and ways that these assessments were incorporated into the roadmap. Therefore GUI is in line with the findings, with the exception of it could not be applied due to the initial stages of SOA in PubHealthOrg's case. Yet, as expressed by the interviewees as PubHealthOrg invests in SOA and implements more SOA projects such guidelines (e.g. (a)) will be relevant and applicable.

Regarding **GU2: Designed for each organisation's particularities**, the researcher investigated the way that SOA roadmap was created by PubHealthOrg for the iServ. Thus, taking under consideration all the statements given (presented in this section) created a graphical representation of the SOA roadmap, as seen in Figure 5.5. This figure illustrates the steps the OS took to create the iServ. First they employed the use of a SWOT analysis (identified in the archival records), that provided the AS-IS assessment (discussed in RD AT2) and highlighted the next maturity level. For the latter they included a plan of the requirements and modifications (as reported by Consultant-A). Thereafter, they documented and placed a set of goals (as reported by Consultant-A). These goals were utilized by the OS to create the iServ definition (identified in the archival records) and implement the project.

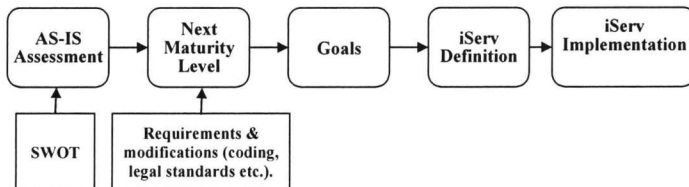


Figure 5.5: SOA Roadmap as Identified in PubHealthOrg

To this end, the proposed RD element's guidelines (GU1-2) and findings are depicted in Table 5.11

GU	Proposed Guidelines	Findings
1	Based on: current and target SOA and SOA Governance maturity assessments	Based on target SOA and SOA Governance assessments
2	Designed for each organisation's particularities	Designed for PubHealthOrg particularities

Table 5.11: Testing Roadmap Element in PubHealthOrg – Findings for Guidelines

The researcher explored Additional Guideline (AGU1) as this was proposed in Section 3.3.3 and presented in Table 3.17. Moreover, **AGU1: Design guidelines**, were presented to the

interviewees and they replied with positive remarks in the usefulness of such guidelines. On this issue the IT-Manager pointed out that their (e.g. OS) approach, holds similarities with the researcher's proposition. The aforementioned view comes in accordance to the empirical data presented so far in PubHealthOrg case, as the OS in order to create a SOA roadmap (e.g. initial maturity level) created a (a) rough priority order of service implementation (e.g. services related to the referral process) and (b) high-level plan for building the architecture (the plans for iServ). Yet, as mentioned in the previous section (Figure 5.4) the OS members place the PubHealthOrg in the managed level, which means that they now require updates to include: (a) existing services, (b) new business models and other forces and (c) new goals. This was also identified in this case, as (a) the interviewees revealed that they intent to incorporate the existing services with the e-prescribing system, (b) integrate their system with other organisations (e.g. cooperating business models) and (c) they have set new goals (e.g. e-prescribing system integration). Therefore, this is in line with the proposition for AGUI.

Therefore, the RD element and its attributes, sub-elements, guidelines and additional guidelines proposed by the researcher were investigated and tested by gathering data from the PubHealthOrg case. In the next section the SOA Governance Infrastructure element is investigated and analysed.

5.3.6.5 Testing SOA Governance Infrastructure (SGI) Element

To test the SOA Governance Infrastructure (SGI) and more specifically the proposed Attributes (AT1-4) as presented in Table 3.17 the researcher discussed the issue with the interviewees and examined relevant archival records. Moreover, on the topic of the **AT1: Manages governance information**, it appears that the SGI in PubHealthOrg was divided in two main parts: (a) the IS that PubHealthOrg owned, as this was analysed in Section 5.1.2 and (b) infrastructure provided from another organisation (that will be discussed in the following paragraphs). Explaining on issue the IT-Manager, stated:

'This was a small pilot project, thus the need to acquire new technology was minimum. We didn't purchase any SOA Governance Infrastructure. Even the end-product will be later on integrated with the e-prescribing system that belongs to a different organisation. Thus, the infrastructure was based on our already running HIS and where needed their infrastructure.'

The empirical data concurs with the interviewee's view, and few months after this statement was made, the iServ was integrated as part of the e-prescribing system. This system was

managed by an independent coordinating organisation in-charge of all the insurance funds. Even though the SGI used in the PubHealthOrg case was divided between parts of their HIS and outsourced IS, it appears, that it was a tool to manage governance information. Thus, the AT1 is justified in this case.

Regarding **AT2: Automates the governance processes**, Consultant-A reported on the issue:

'The infrastructure regarding the web-services and the system created were provided by the coordinating organisation. We integrated our IS with theirs through the iServ, and utilised it for governance purposes, like monitoring the referral process with its use, quality and management.'

In interpreting the empirical data, it appears that SGI in this case, was employed to automate the governance processes, manage the policies, and measure the quality of the services through metrics. The researcher observed evidence of the latter in archival records (e.g. reports). Therefore, the AT2 is in agreement with the empirical evidence in this case. Additionally, in regard to **AT3: Enforce the governance policies**, empirical data point towards this attribute to be linked with the SGI element, with further analysis of the attribute to be included in Section 5.3.6.6. Also, concerning **AT4: Collects metrics**, it can be retracted from the consultant's view that the SGI was utilised to monitor the iServ, a process that required metrics to be realised. Thus, the empirical findings coincides with the attributes as these were proposed. The propositions and the findings are presented in Table 5.12.

AT	Proposed Attributes	Findings
1	Manages governance information	Governance information and processes were managed through the SGI
2	Automates the governance processes	SGI was applied to automate governance processes
3	Enforce the governance policies	Identified as applicable for this case
4	Collects metrics	SGI was utilised to monitor the iServ and collect metrics

Table 5.12: Testing SOA Governance Infrastructure Element in PubHealthOrg – Findings for Attributes

Investigating the proposed **Sub-Elements (SE1-6)** as they are presented in the left side of Table 5.13 the researcher discussed their relevance with the interviewees. Table 5.13 presents interviewees' views when they assess the SGI SE1-6. Based on the interviewees' answers it appears that the **SE1: Service registry** and **SE6: SOA management system** were utilised partially by the IS/BI owned by PubHealthOrg and to more extent as provided by the coordinating organization. In addition, in the same table it is revealed that **SE2: Repository**, **SE3: ESB**, **SE4: Policy & contract management system** and **SE5: Quality management system** were not identified in this case. In more detail, as seen in Table 5.13, the proposed

technology solutions are presented in the left column and in the right column the researcher presents the finding as stated by the interviewees.

SE	Proposed Sub-Elements	Findings
1	Service Registry	Provided by the coordinating organisation
2	Repository	Not Observed
3	Enterprise Service Bus	Not Observed
3	Policy & contract management systems	Not Observed
4	Quality management system	Not Observed
5	SOA management system	Provided by the coordinating organisation and partially by the IS/BI owned by PubHealthOrg

Table 5.13: Testing SOA Governance Infrastructure Element in PubHealthOrg – Findings for Sub-elements

Additionally, the researcher investigated the Additional Guideline (AGU1) proposed as part of the SGI (seen in Table 3.17). Moreover, regarding **AGU1: The sub - elements are determined by the specific governance requirements**, interviewees acknowledged that was the case for PubHealthOrg. Consultant-B reported:

‘Till the final version of the iServ the sub-contractor and the coordinating organisation were in charge of such systems. They provided most of the resources to satisfy the requirements set. After the implementation, since we knew we were going to integrate iServ as part of the e-prescribing the resources were provided by the coordinating organisation.’

This finding is closely related with the maturity level identified in the previous section. In particular, the aforementioned view comes in accordance with the literature (Section 3.2.3 and Annex II), where it is stated that at this maturity level (e.g. managed) the technology assists the organisation to manage SOA and check against conformance requirements and planning. This was the case for PubHealthOrg. The technology either PubHealthOrg own HIS, or the sub-contractors/coordinating organisation’s technology were utilised based on PubHealthOrg’s requirements for SOA Governance. Thus, the empirical data concurs with the proposition for this case.

Empirical findings show that PubHealthOrg required the aid of the coordinating organisation so as to implement its first reusable processes (referral process-iServ). This shows the inter-dependable nature of public healthcare that requires outsourcing in order to integrate its healthcare services. Literature findings for IT outsourcing in healthcare concurs with this finding and emphasise the need of such successful cooperation, in order to enhance healthcare services (Guimares and de Carvalho, 2011). Yet, the researcher highlights the ‘shift of power’ that such outsourcing contracts involve and the possible impacts to SOA Governance that this

shift may engage. This concern originates from the PubHealthOrg case where the shift of power (related to governance, decision making etc.) was observed. Several interviewees mentioned such shift not during the iServ implementation but as part of the future integration of iServ with the e-prescribing system. Literature also indicates concerns involved in IT/IS outsourcing and especially emphasise the risk allocated to contractual agreements related to this kind of outsourcing (Ackermann *et al.*, 2011; Kweku-Muata and Ojelanki, 2006). For example, Lacity *et al.*, (2009) in an extensive literature review have identified a set of contractual governance related risks in IT outsourcing, in issues like contract details, type, duration etc. Therefore the researcher proposes the issue of '**SOA Governance and IT outsourcing**' for further research.

Additionally, the way that iServ was designed i.e. to be shared by multiple actors (PubHealthOrg, doctors, patients etc.) shows that this case is relevant to a HIS challenge presented in Section 2.2.2 (e.g. patient centred HIS). There it was mentioned that healthcare organisations try to adapt and provide HIS centred to patient needs and seek integration paradigms to achieve this (Leventhal *et al.*, 2012). The iServ, as a SOA based system, shows the way to overcome this challenge as it integrates the healthcare processes in a safe patient centred way. Thus, the literature agrees with the empirical evidence, highlighting that SOA can transform heterogeneous and incompatible systems in a patient-centred environment of cooperating services based on healthcare business processes and services (Bhandari and Snowdon, 2011).

Based on the interviewee's comments, the SGI element and its attributes, sub-elements and guidelines proposed by the researcher were investigated and tested by gathering data from the PubHealthOrg case. In the next section the Policies element is examined and analysed.

5.3.6.6 Testing Policies (PO) Element

To test the Policies element, the researcher addressed the issue with the interviewees and asked them to comment on the proposed Attribute, (seen in Table 3.17) **AT1: Comprise rules for developing, deploying and managing a SOA**. During this process the interviewees replied that the OS was responsible for and developed several types of policies for deploying and managing SOA (the explicit types will be analysed in the following paragraphs). This finding is in line with the proposed AT1.

The researcher also investigated the proposed Sub-Elements (SE1-3) of the PO element. Regarding **SE1: Enforcement**, all interviewees highlighted its importance and responded

positively in including enforcement as a sub-element of the policies. Thus the researcher considers the findings to be in line with the proposition.

When **SE2: Aspects** and **SE3: Areas** were discussed with the interviewees, the latter mentioned aspects like architecture, technology and business and areas like: security, process and compliance. For example Consultant-B reported that:

'The majority of the policies were documented instructions provided to the developers, based on the laws and directives, these provided the process part, the compliance part and security part of the iServ. After the development phase we reviewed if these policies were implemented correctly and produced the result we wanted, if not we proceeded to alterations accordingly. A good example of such policies is the ones dealing with security, like access control.'

The aforementioned view comes in accordance with the literature findings in Section 2.4.1 where it was identified that the laws, regulations, mandates and other legal obligations imposed by government bodies are a critical parameter for healthcare, that can be addressed by the adoption and implementation of SOA (Ruth, 2009).

Furthermore, the consultant's statement depicts three areas of policies in PubHealthOrg, such as: (a) **process policies** created to guide the service development, (b) **compliance policies** implemented, as part of the healthcare regulatory compliance to standards set by national and international laws and the (c) **security policies** that manage the access control and security standards. Also, the Project-Manager stated:

'We developed policies regarding the services' functionality, this was based on our practice, quality requirements and mainly addressed business and user related issues. For example we [OS] wanted the service to be directly linked with the users' national insurance number, SLA requirements and so on. We checked if these were implemented and/or produced the desired result and amended accordingly. In many cases, we had calls coming to the call centre [seen in Figure 5.3] from doctors requiring modifications, we reconvened and amended the policies again.'

This finding reveals that PubHealthOrg ensured that their practices (utilisation of national healthcare number) and business functionality (SLA's), was incorporated in the services.

Literature indicates these, as **enterprise and business policies** respectively (Marks, 2008). Additionally, as stated by the Project-Manager the OS proceeded to check the services' functionality based on the requirements set. This shows manual policy enforcement. Whereas, the utilisation of the call centre as a trigger mechanism for the OS to review the policies can be seen as technology assisted policy enforcement.

Moreover, the IT-Manager, reported that the web-services created were based on specific compliance standards (e.g. WSDL, SOAP etc.) mainly proposed by the sub-contractor. Thus, **technology standards compliance** policies were identified in this case.

The policy enforcement observed in PubHealthOrg both for design-time and run-time is presented in Table 5.15. In this case most of the policies were based on laws, directives and guidelines. These were enforced at the design-time. From the discussion with the interviewees it was clear that their view on automated run-time policies referred to the infrastructure provided by the coordinating organisation. This infrastructure mainly automated business and security policies in run-time. Another interesting finding comes from a statement Consultant-B made about the quality assurance of the services:

'We tested the system with different scenarios (user and data capabilities) to evaluate if the quality standards we planned for our services were met. When they were not met, or if the system did not perform as required, we requested the sub-contractor to fix the problem and test again. This was like an initial proof-of-concept exercise, but the testing lasted well after the initial trials.'

This statement shows that PubHealthOrg conducted testing in run-time. This helped the organisation to evaluate quality criteria (e.g. performance according to user and data capabilities). Thus, it is the researcher's understanding that testing played the role of an automated run-time policy enforcement mechanism. The automation in this case comes from the technology performing the testing and the policy is the quality standard. The same notion is shared by Marks (2008) who states that testing provides a SOA Governance enforcement capability by ensuring that services will perform within the stated requirements (e.g. by SLAs, quality contracts etc.).

To this end, the researcher has presented the proposed guidelines (GU1-3) and the findings for each in PubHealthOrg's case. These are depicted in Table 5.14.

GU	Proposed Guidelines	Findings	
1	Aspects such as: (Architecture, Technology, Organization, Portfolios, Information and Project)	The policies identified cover various aspects such as: architecture, organization, and information	
2	Areas	Enterprise	Written documentation regarding the practices
		Business	Written documentation regarding the quality and performance and testing to evaluate them
		Process	Written documentation regarding the development and execution
		Compliance	Laws and directives
		Technology Standards Compliance	Web-services created were based on specific compliance standards (e.g. WSDL, SOAP etc.)
		Security	Access control and security standards
3	Enforcement	Manual	CoE provided the services but then reviewed the services to check if they were functioning based on the requirements set. This reveals manual policy enforcement
		Technology assisted	The operation of the call centre (checking policy functionality and providing feedback to OS) can be seen as technology assisted policy enforcement
		Automated	Infrastructure was provided by the coordinating organisation

Table 5.14: Testing Policies Element in PubHealthOrg – Findings for Guidelines

Furthermore, the researcher tested Healthcare Aspects (HA1-2) (seen in Table 3.17) proposed as part of the SOA PO element. In regard to **HA1: Alignment policies**, the evidence presented in this section (e.g. business policies) show that such policies were developed in this case. Thus, HA1 is in line with the empirical evidence in this case. Also, concerning **HA2: Policies based on risk minimisation**, it can be justified from the empirical evidence presented in this section (security and compliance policies) mentioned in Table 5.13, that such policies were created. Therefore HA2 is in agreement with the findings in this case. The proposed HA1-2 alongside the findings of this case are illustrated in Table 5.15.

HA	Proposed Healthcare Aspects	Findings
1	Alignment policies	Written documentation regarding the quality and performance and testing to evaluate them
2	Policies based on risk minimization	Security and Compliance policies identified that support risk minimization

Table 5.15: Testing Policies Element in PubHealthOrg – Findings for Healthcare Aspects

To this end, the PO element and its attributes, sub-elements, guidelines and healthcare aspects proposed by the researcher were investigated and tested through data gathering from the PubHealthOrg case. In the next section the metrics element is investigated and analysed.

5.3.6.7 Testing Metrics (ME) Element

In Chapter 3 (Table 3.17) the researcher proposed two Attributes (AT1-2) for the ME element. **AT1: Improve transparency**, was described as the organisation's need of a clear view of the functionality and impact of SOA on specific parameters. This was evidently an attribute effectively applied in PubHealthOrg's case, as Consultant-A reported on the issue:

'In the development/testing stage of the project, metrics helped us gain a good view of the system's functionality and proof of cost cuts. Metrics as raw data on the number of users, referrals etc provided valuable assistance to better manage the project and achieve our goal.'

This statement indicates that PubHealthOrg used metrics to obtain feedback (raw data) regarding services' functionality. Consequently, this improved the transparency of the system and assisted the OS to understand the impact of iServ and to better govern SOA. Thus, the empirical findings concur with the proposition.

Additionally, **AT2: Provide visibility of essential states and parameters of the SOA initiative**, was also investigated for the PubHealthOrg case and has been proven to be in agreement with the empirical findings in this case. For this attribute the researcher investigated the archival records (e.g. reports), provided to him. There, based on monthly increments, various metrics were reported and the findings disseminated accordingly. Elaborating on the issue, Consultant-A reported:

'The feedback from the metrics was utilised accordingly. For example, if the doctors did not use the application as expected, then we implemented processes to motivate them. This increased the usability. If the quality of the system was not suitable to users' requirements [e.g. got complains in the call-centre] then we amended the system accordingly. Metrics were analysed, grouped and compared. Some were used to assist the development, others to assist the management and others edited for the media.'

The aforementioned findings depict that metrics were utilised in this case and that they were placed to capture different aspects of the SOA functionality. In more detail, as stated in the archival records metrics were formed based on the services (e.g. consumed), their operation (e.g. quality, usability) and the effect it had on the organisation (e.g. cost). This view relates to

the proposed Sub-Element (SE1) that the researcher included as part of the ME element (Table 3.17) and describes various aspects of metrics. In more detail, the proposition in Chapter 3 reads **SE1: Metrics categories** and in essence proposes that metrics are divided in several categories, examples of which are proposed, like: Services, Service operation, Projects and Governance processes. In this case, the “Services”, “Services Operation” and “Projects” examples given by the researcher are identified (based on the consultants view and archival records observation) and depicted in Table 5.16. Thus, the aforementioned proposition and examples coincide with the evidence retrieved from the PubHealthOrg case.

SE	Proposed Metrics	Findings
1	Services	<ul style="list-style-type: none"> • Existing • Consumed
2	Service Operation	<ul style="list-style-type: none"> • Quality • Functionality • Performance
3	Projects	<ul style="list-style-type: none"> • Cost (per patient, referral, etc.)

Table 5.16: Testing Metrics Element in PubHealthOrg – Findings for Sub-Elements

Regarding the proposed Guideline, **GU1: Design metrics for categories, such as: Services, Service operation, Projects, Governance processes**, from the empirical data presented for SE1, it appears that PubHealthOrg designed metrics for categories as Services, Service Operation and Projects. Based on the reports presented to the researcher focus was placed on the metrics for projects (e.g. iServ) and the cost cuts that the project produced. Additionally, the absence of metrics for the “Governance Processes” category can be attributed to PubHealthOrg’s initial stage of SOA maturity (and SOA Governance Maturity). Based on these findings the researcher considers the GU1 to be in line with the empirical findings.

Regarding the Additional Guideline, **AGUI: Goal/Question/Metric (GQM) method** proposed in Section 3.2.7, it can be stated that a similar process was applied in this case. GQM follows a top-down approach by first defining goals, then deriving questions and finally deriving metrics (Aier *et al.*, 2009). A similar method was used in PubHealthOrg to produce metrics. On the issue, Consultant-B provided an example, presented in Figure 5.6. As explained by the consultant one of the goals was to have the highest number of doctors using the system as soon as possible. Thus, they asked the sub-contractor to provide data of such nature. Accordingly the sub-contractor utilised a metric that measured the usage and produced statistics regarding the aforementioned question. The researcher constructed a graphical representation of the aforementioned example and presents it in Figure 5.6.

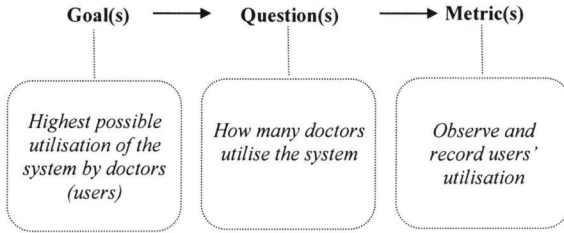


Figure 5.6: Example of the Goal/Question/Metric (GQM) Method in PubHealthOrg

Based on this evidence, the QGM method can be considered as a useful guideline for developing metrics for SOA Governance.

Also, the researcher tested the proposed Healthcare Aspects (HA1-2) as described in Chapter 3 (Table 3.17). Regarding **HA1: Metrics to measure alignment level**, in this case it was identified to coincide with the retrieved findings. Proof of which are the metrics that were set and assisted the OS to manage the project and align with the goals (e.g. cost reduction, usage etc.). Yet, the empirical evidence did not support the **HA2: Metrics measuring complexity**, the reasoning behind this is similar with the OS HA5. The researcher presents the proposed aspects and findings for the PubHealthOrg case in Table 5.17.

HA	Proposed Healthcare Aspects	Findings
1	Metrics to measure alignment level	Metrics were set to measure the alignment
2	Metrics to measure complexity	No such metrics identified

Table 5.17: Testing Metrics Element in PubHealthOrg – Findings for Healthcare Aspects

So far, the ME element and its attributes, sub-elements, guideline and healthcare aspects proposed by the researcher were investigated and tested by gathering data from the PubHealthOrg case. In the next section, the Best Practices element is examined and analysed.

5.3.6.8 Testing Best Practices (BP) Element

The interviewees were initially asked to provide their view on the issue of BP and the proposed Attributes (AT1-2), **AT1: Collects experience**, **AT2: Support the creation of new policies** and **AT3: Cost-effective operations**, as these were presented in Chapter 3 (Table 3.17). The interviewees revealed that (a) best practices were used to collect experience (e.g. from the legal department, sub-contractor, doctors), and (b) supported the creation of new policies. An example of which were the practices proposed by PubHealthOrg’s legal department to be incorporated and used to create the system (an issue also analysed in the

Policies element). Additionally, the financial reports provided to the researcher reveal that the iServ system produced a cost reduction (presented in MM SE2), therefore it can be argued that the practices utilised to create the system played a role in this cost-effective operation. To this end, the empirical evidence supports the proposed AT1-3. The propositions and findings for all attributes are presented in Table 5.18.

AT	Proposed Attributes	Findings
1	Collects experience	BP used to collect experience (e.g. from the legal department, sub-contractor, doctors)
2	Support the creation of new policies	Identified practices supported the creation of new (e.g. security) policies
3	Cost-effective operation	Practices involved in the creation of iServ played a role in the cost minimization

Table 5.18: Testing Best Practices in PubHealthOrg – Findings for Attributes

Moreover, the researcher tested the proposed Sub-Element (SE1) as this was presented in Table 3.15 and as it is included in the BP element in Table 3.17, **SE1: Best practices' categories**. To this, IT-Manager reported that they used best practices on technical, operational and management issues. This view also relates to **GUI: Maintained by the organisational entity**, as it depicts the OS to maintain best practices, and apply them accordingly. Thus, the empirical evidence concurs with the proposition. The researcher investigated the Additional Guideline, **AGU1: Best practices categorisation**, as this was included in the BP element proposal (Table 3.17). For this proposition the researcher employed the O'Dell & Grayson (1998) justification that includes four categories, like: Good Idea, Good Practice, Local Best Practice and Industry Best Practice. When the researcher asked the interviewees to comment on this proposition, the IT-Manager reported:

'You have to understand that this [e.g. PubHealthOrg] is a public organisation with a culture, criticism, politics amongst the employees as any other public body. Highlighting practices and categorising them can be a sensitive issue. We did not use a categorisation to identify the best practices. Practices were examined in individual basis based on the relevance, source they originated from and the results they produced.'

The manager at this instance refers to a limitation of the public sector according to which they perceive practices based not on the merit, but on the source (co-worker, department etc.) they originate from. Therefore they relate to the practice according to their personal relation to the source, supportive if they relate positively to the source or if the source is placed high on the hierarchy or unsupportive and critical if they relate negatively to the source. Literature, depicts this limitation in healthcare organisations, pointing out that evolving to a "best practice"

culture can substantially increase the quality of healthcare services and practices (Ginter *et al.*, 2013). In order to test the best practices categorisation as proposed in AGU1 the interviewees were asked whether a categorisation as the proposed one can be a beneficial SOA Governance tool. As reported by the interviewees the use of such a categorisation can aid the governance and better highlight the best practices. Therefore, the researcher considers AGU1 as a relevant and applicable guideline in this case.

Empirical evidences are in line with **HA1: Best practices based on standards**, as it was depicted in the interviews that several best practices were based on standards. For example, interviewees mentioned that standards were used for the security policies and coding. Therefore, this aspect agrees with the empirical findings.

In relevance to **HA2: Practices focusing on testing and error minimization**, interviewees reported that the practices used for this project were based on technology best practices (based on the OS members and sub-contractor's experience and IT knowledge) and there was no time to review, or identify new error minimisation practices. The interviewees reported to the researcher that there was a time pressure to implement the project (by internal and external stakeholders) and their intention was to have the pilot working properly and free from any mistakes at run time (after the project started). The lack of any predefined error minimisation practices can also be attributed to the nature of data transmitted through the iServ application that are not of a medical nature (referral information) and thus amendments of the system could be implemented after its introduction. Also, it is the researcher understanding that the creation of the call centre was a practice that minimised the errors of the system not in advance but at least as soon as they were reported. Therefore the researcher believes that the data justify this aspect. The researcher presents the proposed HA alongside the empirical evidence for the PubHealthOrg case in Table 5.19.

HA	Proposed Healthcare Aspects	Findings
1	Best practices based on standards	Such practices identified (e.g. security)
2	Practices focusing on testing and error minimization	Not considered but indication (e.g. call centre) exist

Table 5.19: Testing Best Practices Element in PubHealthOrg – Findings for Healthcare Aspects

To this point, the BP element and its attributes, sub-elements, guideline and healthcare aspects proposed by the researcher were investigated and tested by gathering data from the PubHealthOrg case. In the next section, the empirical evidence regarding the Governance Processes element is presented.

5.3.6.9 Testing SOA Governance Processes (GP) Element

In Chapter 3, Section 3.2.9 the researcher identified that Governance Processes element is the main element for any SOA Governance framework. This is understandable since these processes include all relevant to governance activities that an OS undertakes to govern SOA. The researcher distinguished and highlighted specific Attributes (AT1-5) for the GP element that were tested in PubHealthOrg and the findings are presented in the following paragraphs.

When Consultant-A was asked to comment on **AT1: Deal with the management of the service life-cycle**, she replied:

'Consider our team and the sub-contractors team as one [e.g. OS] working for the same goal...this team was responsible for the management of the services from the analysis and design to the implementation and smooth functionality of the system.'

This finding concurs with AT1, as the consultant named the management of the service-lifecycle (e.g. analysis, design, implementation). Furthermore, regarding **AT2: Manage service portfolio**, the IT-Manager reported:

'A catalogue with a detailed description of all the services that are currently available to end users was created. This included information about the services' description, their objectives, how they perform and so on... At a later stage of the project we updated this report [e.g. final-report] with services that were in the development stage.'

This finding is in accordance with the normative literature, which indicates that a service portfolio describes the services that are currently available to end users, the services that are present in the planning phase as well as those services that are in development phase, as in this case (Kohlborn *et al.*, 2009). Thus, AT2 is in line with the empirical evidence.

Furthermore, for **AT3: Ensure that services are designed properly** and **AT4: Ensure SOA will deliver the features required by an organisation**, the interviewees responded positive and indicated that several governance processes like: requirement analysis, expert and user meetings and testing, were implemented in order to ensure the design and the required features. Thus, empirical evidence concurs with the propositions. Regarding **AT5: Create and enforce policies**, it was analysed and verified in Section 5.3.6.6 that the OS adopted, created

and enforced policies and implemented processes to do so. Therefore, AT5 is in agreement with the empirical data.

In order to summarise the aforementioned proposed attributes and the findings for the GP element the researcher presents them in Table 5.20.

AT	Proposed Attributes	Findings
1	Deal with the management of the service life-cycle	Identified to be an OS governance process
2	Manage service portfolio	Service portfolio management was identified as a process
3	Ensure that services are designed properly	Design of services identified as a process
4	Ensure SOA will deliver the features required by an organization	Identified as a process
5	Create and enforce policies	Creation and enforcement of policies was identified as a process

Table 5.20: Testing Governance Processes Element in PubHealthOrg – Findings for Attributes

Moreover, in Chapter 3 (Table 3.17) the researcher based on the literature findings proposed **SE1: Governance lifecycle** as a Sub-Element of the GP element. In this case the empirical data for AT1-5 justify that this lifecycle exists in PubHealthOrg and a detailed account of this governance lifecycle (e.g. phases) is presented in the following paragraphs.

The researcher tested the proposed Guideline, **GUI: Governance lifecycle may include phases such as: plan, design, implement and measure**, to which the interviewees replied positively that such phases existed. In more detail, the Project-Manager reported:

‘The governance phases you propose is a good way to distinguish our [e.g. OS] processes. We planned the project based on requirements...we designed the parameters...implemented the services and measured their effectiveness.’

Interpreting from the aforementioned view it appears that the manager agrees with the proposed guideline to have distinctive phases as: plan, design, implement and measure. In parallel, the IT-Manager stated that these phases can provide a good guideline to group governance process. Thus, empirical evidence are in line with the proposition. Also, the researcher investigated the proposed Additional Guideline, **AGUI: SOA Governance phases and their attributes**, as this was presented in Figure 3.2. In order to better present the findings, the researcher summarised the views of all the interviewees in Table 5.21. In this table the positive identifications marked with (✓), the negative with (x) and the no answer with (-). In more detail, the first column includes the proposed phases followed by the

attributes and the interviewees responses' are depicted in the third to sixth column respectively.

Phases	Attributes	C-A	C-B	P-M	IT-M
Plan	SOA Strategy	-	-	✓	✓
	SOA requirements/Specifications	✓	✓	✓	✓
	Initial governance framework	✓	✓	✓	-
	Financial and SOA Investment	✓	✓	✓	✓
	Communication and Direction	✓	✓	✓	✓
	Responsibilities, roles and skills	✓	✓	✓	✓
	Organizational structures	✓	✓	✓	✓
Design	Services ownership	✓	✓	✓	✓
	Transition Plans	✓	✓	✓	✓
	SOA Reference Architecture	✓	✓	✓	✓
	SOA Processes	✓	✓	✓	✓
	Organization and Relationships	-	✓	-	✓
	SOA policies	✓	✓	✓	✓
	Metrics	✓	✓	✓	✓
Implement	Maturity model	-	-	-	-
	Governance processes	✓	✓	✓	✓
	Transition plans	✓	✓	✓	✓
	Enable operation and use	✓	✓	✓	✓
	Activate processes	✓	-	✓	✓
Measure	Enforce policies	✓	✓	✓	✓
	Monitor metrics	✓	✓	✓	✓
	Evaluate performance	✓	✓	✓	✓
	Manage policy compliance	✓	✓	✓	✓

Table 5.21: Testing Governance Processes Element in PubHealthOrg – Findings for Governance Processes Phases

The uniformity of responses is understandable as the interviewees were part of OS and thus aware and able to identify and link the attributes with the phases in a similar manner. Some minor differences exist (no answer in some of the questions). This may be due to the different roles and different phases of governance they were involved in this case. Also, as no SOA MM was utilised for this case, the interviewees did not identified this as an attribute relating to their governance processes. Yet, except the SOA MM all the other attributes seem to be recognised by one or more interviewees.

In addition, the researcher examined the proposed Healthcare Aspects (HA1-4) as these were analysed in Chapter 3 (Section 3.4) and presented in the second from the left column, in Table 5.22. Thus, in regard to the **HA1: Alignment governance process**, the data presented so far (e.g. PO HA1 and ME HA1) show that the OS created alignment processes. For example, in ME HA1 it was revealed that OS created goals and metrics to identify if the goals were met. Thus, the findings coincide with the proposition.

Regarding the **HA2: Promotional processes that endorse SOA and its beneficial parameters (e.g. educational and communication planning)**, as explained in OS AT6

several endorsement process were implemented. Thus, the empirical evidence concurs with the proposition. Also, concerning **HA3: Standardisation process**, as shown in OS HA8, the OS dedicated structures (e.g. committees in this case) proposed and evaluated various standards (e.g. medical, SOA, etc.). Empirical findings in this case indicate that these committees implemented standardisation processes, thus the proposition (e.g. HA3) is in agreement with the findings. Finally, the researcher investigated and verified that **HA4: Testing processes** is in line with the empirical evidence. This is stated in the data provided in the PO element (e.g. the system was tested with different scenarios like user and data capabilities). The proposed aspects alongside the identified evidence are presented in Table 5.22.

HA	Proposed Healthcare Aspects	Findings
1	Alignment governance process	Created several processes aiding alignment
2	Promotional processes that endorse SOA and its beneficial parameters (e.g. educational and communication planning)	Identified several endorsement processes
3	Standardisation process	Dedicated committees with relevant processes
4	Testing processes	Testing processes were identified (e.g. for policies)

Table 5.22: Testing Governance Processes Element in PubHealthOrg – Findings for Healthcare Aspects

To this end, the GP element and its attributes, sub-elements, guideline and healthcare aspects proposed by the researcher were examined and tested for the PubHealthOrg case. In the next section, the SOA Governance framework and the relation of each element are investigated.

5.3.6.10 Testing the SOA Governance Framework and Elements' Relations

Concluding the investigation of the proposed elements of the SOA Governance framework, the researcher proceeded to investigate the framework itself and the proposed relations between the elements (as seen in Table 3.17). The question set in Chapter 3 was if (a) the proposed SOA Governance framework can be applied as a decision-making tool for SOA Governance by healthcare organisations and (b) if this framework can provide an easy to follow reference blueprint that can diagrammatically express the elements.

Regarding the first part of the question the research proceeded into a rigorous examination of all the interviews and archival records to identify the elements' relations, as these were portrayed in the case of PubHealthOrg and their relevance to the decision-making. This processes concluded in a positive result as all the evidence support the notion that each and every element played a part in SOA Governance for this case. Furthermore, the researcher presented the framework and invited the interviewees to comment on its configuration. The interviewees responded positively in the configuration and clarity, of the framework. For example the Project-Manager stated:

'I can see merit in the way you present the framework and it can be of value in an organisation requiring support in SOA Governance and management of SOA projects. Nevertheless, I would like to remind you the need for communication between the stakeholder and also the public. Communication played a significant role in our case and maybe you should consider it as part of your framework.'

Bearing in mind the aforementioned view and the findings regarding the “Communication” (e.g. OS AT6 and OS AGU2) the researcher acknowledges that even though this aspect is addressed through the elements’ analysis it requires to be highlighted. Yet, this will be further explored in Chapter 6.

In order to test the second part of the question (e.g. easy to follow reference blueprint) the researcher invited the interviewees to create scenarios and based on the framework, depicted in Figure 3.4, work-out if these scenarios cover their requirements on SOA Governance. Consultant-A provided the scenario below on a new policy on a new policy is given. The interviewee used the proposed SOA Governance framework and its elements to work-out if for this process (e.g. new policy) the SOA Governance requirements were satisfied.

'First, the OS and Committee will meet to document the new policy, e.g. a security policy, this is a governance process that requires the GP element. Thus I agree that the OS, GP and PO elements are needed. Also, after the creation of the policy, that might be applied through the SGI, connected here [pointing at the arrow of the SGI-PO] with the PO, the OS will need to measure the result of the policy, so the OS requires metrics to measure and provide feedback. This process will be designed by OS, the metrics gathered by the SGI and given to us [meaning the OS]. I see this [e.g. framework] working, but maybe the metrics should be connected with the policies as well.'

In regard to the last remark made by the consultant, that PO could be connected with ME, the researcher provided further details to the interviewee so as to further explore her remark. These included details of the SOA Governance framework conceptualisation, based on which the PO is connected with ME not in a direct way (described with arrows as in Figure 3.4) but indirectly, as the GP element includes phases responsible for the design of metrics that can be based on policies. This means that processes that create policies and place metrics for these processes are proposed as part of the GP description. Also this issue was further highlighted by the researcher by proposing the ME HA1: Metrics to measure alignment level. Given this

conceptualisation details the interviewee commented positive on the integrity of the proposed SOA Governance framework. Yet, the interviewee's remark and the need for the researcher's response (with a detailed analysis) emphasises that the proposed SOA Governance framework requires to be accompanied with the theoretical analysis of each element (as presented in Table 3.17 and exposed in Chapter 3) to be fully represented and comprehend.

5.3.6.11 Summarising Findings Obtained from PubHealthOrg

The empirical investigation indicated that the views of the PubHealthOrg's interviewees agree that the proposed SOA Governance framework can be applied as a decision-making tool for SOA Governance by healthcare organisations. The case data revealed that few additional findings and propositions for further research arose. These findings are summarised below and presented in Table 5.23. In this table, attributes, sub-elements, guidelines, additional guidelines, and healthcare aspects are represented horizontally and each of the elements, such as Organisational Structure (OS), Roles (RL), Maturity Model (MM), Roadmap, (RD) SOA Governance Infrastructure (SGI), Policies (PO), Metrics (ME), Best Practices (BP) and Governance Processes (GP) are depicted vertically. Additionally, next to each element (Attribute, Sub-Element etc.) the researcher placed a column in order to illustrate the Finding (F) for each. The symbols of that column state: (✓) In line with empirical data, (T) Tested, (NO) Not Observed and (UC) Under Consideration.

SOA Governance Elements																				
		OS	F	RL	F	MM	F	RD	F	SGI	F	PO	F	ME	F	BP	F	GP	F	
Attributes	AT1	✓		AT1	✓	AT1	T✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	
	AT2	✓		AT2	✓	AT2	T✓	AT2	✓	AT2	✓			AT2	✓	AT2	✓	AT2	✓	
	AT3	✓		AT3	✓	AT3	T✓			AT3	✓					AT3	✓	AT3	✓	
	AT4	✓		AT4	✓					AT4	✓							AT4	✓	
	AT5	✓		AT5	✓													AT5	✓	
	AT6	✓																		
	AT7	✓																		
	AT8	✓																		
	AT9	✓																		
Sub-elements	SE1	✓		SE1	✓	SE1	NO	SE1	✓	SE1	✓	SE1	✓	SE1	✓	SE1	✓	SE1	✓	
	SE2	NO				SE2	T✓			SE2	UC	SE2	✓							
	SE3	NO								SE3	UC	SE3	✓							
	SE4	✓								SE4	UC									
											SE5	UC								
Guidelines	GU1	✓		GU1	✓	GU1	T✓	GU1	T✓	GU1	✓	GU1	✓	GU1	✓	GU1	✓	GU1	✓	
	GU2	✓		GU2	✓	GU2	T✓	GU2	✓			GU2	✓							
	GU3	✓		GU3	NO	GU3	T✓	GU3	✓			GU3	✓							
						GU4	NO													
Additional Guidelines	AGU1	✓		AGU1	T✓			AGU1	✓					AGU1	T✓	AGU1	T✓	AGU1	T✓	
	AGU2	✓																		
	AGU3	✓																		
Healthcare Aspects	HA1	✓				HA1	✓					HA1	✓	HA1	✓	HA1	✓	HA1	✓	
	HA2	✓										HA2	✓	HA2	NO	HA2	T✓	HA2	✓	
	HA3	✓																HA3	✓	
	HA4	✓																HA4	✓	
	HA5	✓																		
	HA6	✓																		
	HA7	✓																		
	HA8	✓																		
	HA9	✓																		

Table 5.23: Proposed SOA Governance Elements & Findings for PubHealthOrg Case [(✓) In Line With Empirical Data, (T) Tested, (NO) Not Observed and (UC) Under Consideration]

Moreover, the case data uncovered additional aspects regarding Organisational Structure, Roles (RL) and Governance Processes (GP) elements. In Organisational Structure (e.g. OS AT6) and Governance Processes (e.g. GP HA2) the data gathered from interviewees and empirical evidence point towards highlighting the role of ‘Communication’ for this project. The researcher acknowledges that even though this aspect is addressed (as part of the elements themselves) it requires to be highlighted in a more substantial way. Alongside, for the Roles element the crucial role ‘SOA evangelist’ was identified and his contribution to the project’s success emphasised. Both findings will be further explored in Chapter 6.

The empirical evidence also revealed the way the Roadmap element is conceptualised in the PubHealthOrg. In more detail, (regarding the GU2), a graphical representation of the Roadmap element, as seen in Figure 5.5, that illustrates the steps the Organisational Structure

took to create the SOA roadmap was revealed. This is an important finding as it provides an insight look of the steps followed to construct a roadmap of a successful SOA project.

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

- Regarding Organisational Structure AT5, the researcher proposes the issue of 'Employees' Training' to be further examined, as this proved to be of high importance and thus, should be investigated in depth.
- Regarding Organisational Structure HA5 and Metrics HA2, the researcher proposes the issue of 'SOA Complexity' to be further investigated to facilitate a deeper level of analysis, as complexity imposes a CSF for the success of a SOA implementation.
- Regarding Roles AT5 and SOA Governance Infrastructure GU1, the researcher proposes the issue of 'IT outsourcing contractual agreements impact on SOA Governance' to be further researched, as it was identified a trigger of SOA success but also concern for SOA Governance.

5.4 Case Study Two: PriHealthOrg

Due to confidentiality reasons, the researcher uses the coded name PriHealthOrg, to refer to the second case organisation. In doing so, the researcher: (a) describes the background related to this case organisation, (b) explains the decision for implementing SOA and (c) identifies SOA Governance elements and their association as they were established through the SOA implementation process.

5.4.1 PriHealthOrg: Organisation

PriHealthOrg is a large private hospital with a thirty years established functionality in the Greek healthcare sector. Its main objectives are (a) the provision of high quality services and (b) the development of an integrated network of health services in Greece and abroad. The hospital is established at an international level and is a member of several international associations and alliances (e.g. American Hospital Association, European Health Management Association and International Society for Quality in Health Care).

The hospital offers its services through various healthcare departments, units and clinics. Under this departmentalisation, it offers a wide range of services including, rehabilitation and outpatient services, cardiology services, diabetes treatment services, diagnostic treatment and services, ophthalmic services, radiology services, cardiac ultrasound, obesity, nutrition and metabolism services, prostate brahytherapy, physical therapy, hepatology services, allergy services, bone marrow transplant, one-day surgery, dental services, cancer care and otorhinolaryngology services and Ct scan - magnetic tomography & magnetic angiography. Under health care units it operates the intermediate care unit, intensive care unit, bone marrow transplant unit and one-day surgery unit. Its clinics include both medical and surgical sectors.

During the research time, the hospital was equipped with 165 beds and 16 operating theatres, where 11.000 operations are performed annually, 31 beds in its Intensive Care Unit, as well as an Organ Transplant Unit. PriHealthOrg has a salaried staff of 1.250 as well as 750 collaborating doctors, working in 49 different specialities.

PriHealthOrg is part of a group of three specialised private hospitals, a children's clinic, a specialised lab, several cooperating hospitals in neighbouring countries, various companies related to pharmaceutical and other hospital supplies.

PriHealthOrg has recently been awarded a prestigious globally respected healthcare quality accreditation, which primarily focuses on quality improvement, safety and expertise (its

standards are developed by healthcare experts from around the world). The same certification has been accredited to 375 hospitals in 47 countries. Also PriHealthOrg is partnering with a newly constructed fully functional hospital in a neighbouring country.

5.4.2 PriHealthOrg: Information Technology

PriHealthOrg has an integrated Information System (SAP-ISH), a Back Office software (SAP), an Integration Middleware (Middleware Ensemble Platform), a dedicated LIS (medilab CCS) a RIS (MediRIS CCS), a PACS (AGFA) and BI (SAP-BI). These systems are interconnected to provide integrated functionality, as seen in Figure 5.7.

Business Intelligence (BI)	Patient management (IS-Healthcare)				
	Back Office Administration				
	Financial Management (FI)	Controlling (CO)	Plant Maintenance (PM)	Purchasing and Material Management (MM)	Human Capital Management (HCM)
	Integration Platform				
	LIS		RIS	PACS	

Figure 5.7: Hospital IT Infrastructure

SAP IS-H - is a Hospital Information System (HIS) and an enhancement of the standard SAP R/3 System designed specifically for use in hospitals. It supports patient management, medical and nursing documentation, and patient accounting.

Business Intelligence (BI) – PriHealthOrg utilises the **SAP Netweaver Business Warehouse** (known as **SAP-BI**) which is part of the SAP NetWeaver technology platform. SAP NetWeaver is SAP's integrated technology computing platform and is the technical foundation for many SAP applications. SAP NetWeaver is a service-oriented application and integration platform, that provides the development and runtime environment for SAP applications and can be used for custom development and integration with other applications and systems.

Back Office Software (SAP) – The SAP ERP, is an application included in mySAP Business Suite software that delivers solutions, such as: SAP ERP Financials, SAP ERP Human Capital Management, SAP ERP Operations, and SAP ERP Corporate Services.

Integration Platform – It is a platform that accounts for the needs of the heterogeneous networks that must be integrated and deals with the processes and tools that are required to allow these systems to communicate, both optimally and securely. As part of this a middleware was also utilised. The MiddleWare software is a communication software

between the databases (RDBMS). The software is responsible for the transition of the data in real time in-between the databases.

LIS – The system offers automation of an entire laboratory section of a hospital with the coverage of all stages of the laboratory procedure, from the specimen receipt up to the final result delivery. System supports: (a) automated orders receiving and/or typing-in, (b) automated work list creation and handling, Incorporated communication capability with biochemical, haematological, microbiological, hormonal and all other types of analysers, via digital signals, (c) counts more than 180 analytical diagnostic systems, (d) reliability control of the final results through quality control procedures (QC), (e) automated procedures and validations during all phases of laboratory procedure up to final release, (f) Appropriate distribution of the results to the demand points and (g) Automated update of the patient medical record by the approved results.

RIS - A computerised database used by radiology departments to store, manipulate and distribute patient radiological data and imagery. The system consists of patient tracking and scheduling, result reporting and image tracking capabilities. RIS complements and is critical to efficient workflow to radiology practices.

PACS - Image Management and Applications offers short-term, long-term and hierarchical image management options that provide quick and easy access to and retrieval of images. Due to the PACS solution the users (doctors) are able to view diagnostic images in Athens from all modalities in other countries and assist to the prompt care of the patient. Similar interconnectivity is also accomplished throughout imaging departments, as the modular structure of PACS permits the fast access of data and images.

5.4.3 PriHealthOrg: Challenges

Although PriHealthOrg implemented the aforementioned IS, summarised in Section 5.4.2, to improve its services, this method did not solve all problems. It was evident that the IS implementation addressed the needs of specific departments and services (medical, managerial, etc.) that each department handled but the top management's intentions were to implement a more integrated approach towards a patient centred system. As expressed by the Quality-Manager interviewed:

'What the departmental IS integration brought forward as a new challenge is the horizontal integration, the patient centred integration. Previous

endeavours and ISO approaches focused on departmental automation. Now our needs expanded.'

In the same issue (e.g. of new challenges) the IT-Manager responded:

'We need the patient centred integration but we also need to have a continuity of care and welcome/accommodate a foreign patient, that carries a medical record [means EHR]. Our system must be ready to receive information produced by a third party [system].'

This finding is in accordance with the normative literature, which indicates that healthcare organisations have a tendency to implement IS and integration solutions in a departmental basis and even provide/allocate decision authority to departments to choose the solutions they believe fits them (Beratarbide and Kelsey, 2011).

However, as the empirical data show the top management realised the need to implement a patient-centred system, for which apparently they did not possess the required sophistication and knowledge for such restructuring. Thus, they took a strategic decision to follow a restructuring process through an international healthcare quality accreditation program. This is an interesting finding that concurs with literature. Normative literature on SOA includes examples of organisations that after the initial SOA project, require guidance from external advisory bodies on issues like business restructuring (Kokko *et al.*, 2009). The researcher observed that PriHealthOrg's decision to call for external guidance was twofold: (a) get the required assistance and (b) advertise the accreditation as a reward on its quality standards. Other advantages that this accreditation offered based on the interviewees' comments include:

- Provide sophisticated guidance and expertise towards a patient centred system,
- Incorporate an international set of well established standards (e.g. on quality, safety),
- Set the hospital as equal on the global map (after accreditation each accredited facility can be considered to provide the same set of standards).

As expressed by the Quality-Manager interviewed:

'We already have established a good name as a hospital in the Greek sector, now we need to accommodate a new market, the international patient. Many embassies promote us, as a hospital of choice, we would like to be able to accommodate the needs of patients from different countries'

and backgrounds. Thus, we chosen a strict accreditation process that we would be proud to advertise.'

The challenges identified in the empirical evidence concur with the literature findings presented in Section 2.2. In that section, as in this case **patient mobility** (Lunt *et al.*, 2011) **Integration** (Singer *et al.*, 2011) and **Patient centred** (Leventhal *et al.*, 2012)) are challenges healthcare organisations are trying to address.

In an attempt to overcome these challenges, PriHealthOrg proceeded in the restructuring of its business process, following the guidelines provided by the international accreditation program. In effect, this restructuring sets a clear understanding of the main business process, which are centred towards the patient and implemented in 375 hospitals worldwide. This amplifies the value of the case organisation, as in many ways resembles a set of business process implemented in a large amount of hospitals. The researcher acknowledges this value but not assumes that the findings can provide a generalised view of every organisation this accreditation was applied, as this requires individual inspection for every case. Yet, the fact that PriHealthOrg is part of such worldwide integration endeavour provides merit and value in this case.

5.4.4 PriHealthOrg: Integration Approach

The challenges of the existing approaches (e.g. IT infrastructure, HIS integration, etc.) led PriHealthOrg to consider a restructuring approach with the aid of a worldwide accreditation program. This program identified specific business process and requires the organizations involved in this accreditation process to address them. These processes are presented in Figure 5.8 and explained in the following paragraphs based on the archival record's description. The conceptualisation of Figure 5.8 is the result of the archival records given to the researcher and a similar figure presented during an interview with the Quality-Manager. Moreover, Figure 5.8 depicts the key activities and needs required for a patient treatment.



Figure 5.8: Integration Approach for PriHealthOrg

- **International Patient Safety Goals** – Set of goals that address and highlight problematic areas in healthcare and then describe evidence and expert based consensus, in the form of system wide solutions, to resolve these problems.
- **Access to Care and Continuity of care** – The hospital recognises its mission and resources and thus patients are admitted for inpatient care accordingly. The care it provides is an integrated system of services, health care practitioners and professionals, and levels of care, which make up a continuum of care. The goal is to correctly match the patient’s health care needs with the services available, to coordinate the services provided to the patient in the organisation, and then to plan for discharge and follow-up.
- **Assessment of Patients** - Patient assessment is an ongoing, dynamic process that takes place in many inpatient and outpatient settings and departments and clinics. Patient assessment consists of three primary processes: (a) collecting information and data on the patient’s physical, psychological, social status, and health history, (b) analysing the data and information, including the results of laboratory and imaging diagnostic tests, to identify the patient’s health care needs, and (c) developing a plan of care to meet the patient’s identified needs.
- **Anaesthesia & Surgical Care** - The use of anaesthesia, sedation, and surgical interventions require complete and comprehensive processes, such as: patient assessment, integrated care planning, continued patient monitoring, and criteria-determined transfer for continuing care, rehabilitation, and eventual transfer and discharge.
- **Medication Management & Use** - Medication management encompasses the system and processes the hospital uses to provide pharmacotherapies to its patients. It is characterised as a multidisciplinary, coordinated effort of staff, applying the principles of effective process design, implementation, and improvement to the selecting, procuring, storing, ordering/prescribing, transcribing, distributing, preparing, dispensing, administering, documenting, and monitoring of medication therapies.
- **Continuity of Care** – The hospital provides appropriate care in a setting that supports and responds to each patient’s unique needs. This requires a high level of planning and coordination. The basic activities, for all disciplines that care for patients, include: (a) planning and delivering care to each patient, (b) monitoring the patient to understand the results of the care, (c) modifying care when necessary, (d) completing the care, and (e) planning the follow-up.
- **Patient & Family Rights** – The hospital aims to establish trust and open communication with patients and to understand and protect each patient’s cultural, psychosocial, and spiritual values. This is achieved by defining those rights, then educating patients and staff about those rights. Thus, patients are informed of their rights and how to act on

them. Additionally, staff is taught to understand and to respect patients' beliefs and values and to provide considerate and respectful care that protects the patients' dignity.

- **Patient & Family Education** – Patient and family education helps patients better participate in their care and make informed care decisions. Many different staff in the hospital educates patients and families. Education takes place when the patient interacts with his or her physician(s) or the nurse(s). Others provide education as they provide specific services, such as rehabilitation or nutrition therapy, or prepare the patient for discharge and continuing care. Education includes the knowledge needed during the care process and the knowledge needed after the patient is discharged to another care site or home. Effective education in the hospital employs available electronic and visual formats and a variety of distance learning and other techniques.

Furthermore, surrounding the patient-centred process, the hospital placed the healthcare management process, such as:

- **Governance, Leadership & Direction** – Leadership comes from governing leaders (governance), leaders, and others who hold positions of leadership, responsibility, and trust. These individuals are involved in ensuring that the organisation is an effective, efficient resource for the community and its patients. Effective leadership begins with understanding the various responsibilities and authority of individuals in the organisation and how these individuals work together. Those who govern, manage, and lead an organisation have both authority and responsibility. Collectively and individually, they are responsible for complying with laws and regulations and for meeting the organisation's responsibility to the patient population served. This approach (on leadership) helps overcome perceived barriers and communication problems between departments and services in the organisation, and the organisation becomes more efficient and effective. Services become increasingly integrated. In particular, the integration of all quality management and improvement activities throughout the organisation results in improved patient outcomes.
- **Quality Improvement & Patient Safety** - Quality and safety are rooted in the daily work of individual health care professionals and other staff. As physicians and nurses assess patient needs and provide care, this process can help them understand how to make real improvements that help patients and reduce risks. Similarly, managers, support staff, and others can apply the standards to their daily work to understand how processes can be more efficient, resources can be used more wisely, and physical risks can be reduced. This approach includes: (a) leading and planning the quality improvement and patient safety program, (b) designing new clinical and management processes as well, (c)

measuring how well processes work through data collection, (d) analysing the data, and (e) implementing and sustaining changes that result in improvement. Both quality improvement and patient safety programs are (a) leadership driven, (b) seek to change the culture of an organisation, (c) proactively identify and reduce risk and variation, (d) use data to focus on priority issues, and (e) seek to demonstrate sustainable improvements.

- **Prevention & Control of Infections** – The goal of a hospital’s infection prevention and control program is to identify and to reduce the risks of acquiring and transmitting infections among patients, staff, health care professionals, contract workers, volunteers, students, and visitors. The infection risks and program activities may include: identified leaders, well-trained staff, methods to identify and to proactively address infection risks, appropriate policies and procedures, staff education, and coordination throughout the hospital.
- **Facility Management & Safety** – Effective management includes multidisciplinary planning, education, and monitoring. Thus, the leaders plan the space, equipment, and resources needed to safely and effectively support the clinical services provided. Additionally, all staff are educated about the facility, how to reduce risks, and how to monitor and to report situations that pose risk. To aid in this, performance criteria are used to evaluate important systems and to identify needed improvements. Written plans are developed and include the following six areas, when appropriate to the facility and activities of the organisation: (a) Safety and Security, (b) Hazardous materials, (c) Emergency management, (d) Fire safety, (e) Medical equipment and (f) Utility systems.
- **Staff Qualifications & Education** – The hospital needs an appropriate variety of skilled, qualified people to fulfil its mission and to meet patient needs. The leaders work together to identify the number and types of staff needed based on the recommendations from department and service directors. Recruiting, evaluating, and appointing staff are best accomplished through a coordinated, efficient, and uniform process. It is also essential to document applicant skills, knowledge, education, and previous work experience. It is particularly important to carefully review the credentials of medical and nursing staff, because they are involved in clinical care processes and work directly with patients.
- **Management of Communication & Information** – To provide, coordinate, and integrate services, a hospital relies on information (e.g. about the science of care, individual patients, care provided, results of care, and their own performance) whether paper based or electronic. This information is a resource that is managed by the hospital’s leaders. In this respect, the hospital becomes more effective in: (a) identifying information needs, (b) designing an information management system, (c) defining and capturing data and information, (d) analysing data and transforming it into information,

(e) Transmitting and reporting data and information, and (f) integrating and using information.

PriHealthOrg's business processes restructuring did not eliminate the departmentalisation already in place in PriHealthOrg, but had an impact on governance and the organisation as a whole (this issue will be further analysed as part of the SOA Organisational Structure in Section 5.4.6.1).

5.4.5 PriHealthOrg: Integration Process and SOA

From the archival record and the interviews it was revealed that, PriHealthOrg before the restructuring had already implemented systems that promoted integration and utilised Web-Services and SOA. Moreover, as stated by the IT-Manager:

'We already had placed system...using web-services and SOA and specific systems to capture parts of the patient's workflow, now [after the restructuring] we can connect these parts.'

This statement reveals an existing approach to automation and integration on a departmental level. More precisely, PriHealthOrg before the restructuring had a business view of the SOA, with prioritisation of SOA projects based on business value and needs of the departments. The researcher applying literature indicators identify this involvement as an **an organisation** type, where the organisational activities are separated into business domains and components that constitute the organisation (Bieberstein *et al.*, 2005). However, with the restructuring PriHealthOrg focused on the broad transformation of the existing and deployment of the new business model (e.g. patient centred) involving not only the organisation, but also its business partners, suppliers, and/or customers. When the Project-Manager was asked to comment, he replied:

'...all the process that has been adopted and implemented in this hospital are now structuring the partner hospitals and affiliated partners...especially, regarding the newly created hospital [the interviewee refers to the hospital instituted in a neighbouring country] you can consider it, as a mini-me [identical but smaller in size] version of PriHealthOrg.'

This is acknowledged in the literature⁵ as an **Organisation-and-partner-network** (Bieberstein *et al.*, 2005). Therefore, based on the empirical findings in this case the SOA

⁵ The types of involvement into SOA, that an organisation can have, based on Bieberstein *et al.*, (2005) proposition, are

type of involvement progressed from an **Organisation** to an **Organisation-and-partner-network**. This finding indicates two points of interest: (a) this case study differs from the PubHealthOrg case and (b) it is of high importance to study and analyse the SOA Governance aspects since the way that PriHealthOrg addressed them not only concluded in the success of the restructuring, but also reflects a SOA ecosystem of partnering organisations. Thus, by closely investigating this case, research issues that affect a wider spectrum of stakeholders are discussed.

Therefore, in the next section the researcher presents the empirical data gathered for the nine SOA Governance elements.

5.4.6 Testing the Proposed SOA Governance Framework in PriHealthOrg

PriHealthOrg's restructuring and process integration, towards patient centred business processes, clearly supports the aim of this research and demonstrates, that there is scope for timeliness and novel research in this case. PriHealthOrg can be considered as an appropriate case for testing the proposed SOA Governance framework. In order to identify and study SOA Governance, the proposed SOA Governance framework (Table 3.17) was introduced and evaluated through the empirical data collected from this case organisation.

Initially the researcher applied and tested the elements of the proposed framework (e.g. Organisational Structure, Roles, etc.). The validation of this step is important as it explains the way that PriHealthOrg addressed each of the proposed elements of the SOA Governance framework. Accordingly, multiple healthcare actors (such as: Quality General Manager, Quality Manager, Project-Manager, IT General-Manager and IT-Manager) were interviewed to assess the research issues. Thus, the framework was evaluated, through these interviews, the archival records presented to the researcher and his observations. All the findings of this process are presented in Sections 5.4.6.1 to 5.4.6.9. Thereafter, the researcher analysed the empirical data and identified the relation between the elements. This process and results are presented in Section 5.4.6.10. A summary of the obtained findings and issues for further research are presented in Section 5.4.6.11.

5.4.6.1 Testing the Organisational Structure (OS) Element

The interviewees were initially introduced to the concept of the Organisational Structure and then asked to comment on the question if such a structure supported SOA Governance, existed in PriHealthOrg. In the discussions, the interviewees mentioned, being part of such a

presented in detail in Annex IV.

structure and pointed out towards the ‘**Integration Approach for PriHealthOrg**’, as this is presented in Figure 5.8. In more detail, regarding the OS element, the Quality General-Manager mentioned that:

‘We formed ten councils based on the ten main bodies of requirements, as seen in the patient centred approach [Figure 5.9]. Each team was multidiscipline with members as doctors, nurses, special technicians (radiologists), non-medical, IT, generally all the professions involved in the hospital. Every council had a leader (chairman). All the leaders formed a Quality Board (QB). In between the QB and the councils we established a Coordination Group (CG) with three members (General Manager, Quality General Manager, CEO) in charge of the whole process. I was a member of the CG and most of the councils. The whole structure included about 100 individuals almost 10% of our work force.’

Then the interviewee presented a diagram of the way that the Organisational Structure was formed, as seen in Figure 5.9.

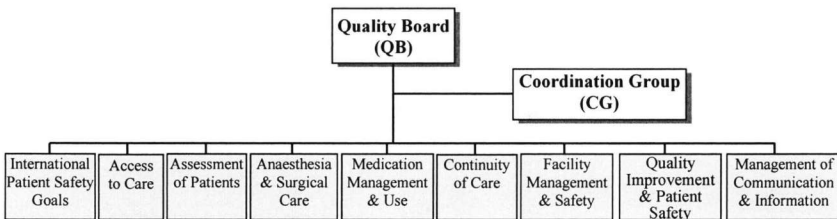


Figure 5.9: PriHealthOrg’s Organisational Structure

The findings show that this structure resembles both a Governance Board (GB) and a Centre-of-Excellence (CoE), as these were depicted in Chapter 3 (Section 3.2.1). In this case, the Quality Board is functioning as a GB and when the rest of the councils and Coordination Group is added to the equation, form a similar to CoE structure. Thus, the OS in PriHealthOrg holds three of the proposed sub-elements (e.g CoE, GB, and councils). This finding is in line with the proposed Sub-Element, **SE1: Centre-of-Excellence**, **SE2: Governance Board** and **SE4: Councils/Committees** as these were proposed by the researcher in Chapter 3 (seen in Table 3.17) with the exception of **SE3: Program Office** that was not observed in this case. Additionally, from these findings, it is clear that this OS is not only dedicated to SOA Governance, but to governance in general (clinical, management, IT, etc.). This is because, the restructuring gave the opportunity to the hospital to have a clear view of its core business

processes, which then shaped the councils' conception. As explained by the interviewee, while the motivation to form the councils came from the accreditation, the actual number and design were an internal decision (PriHealthOrg's top management).

The researcher tested the set of Attributes (AT1-9) that were proposed as part of the OS element (Table 3.17). For the proposed attribute **AT1: Corroborates a number of councils**, empirical data reveal that in PriHealthOrg the OS forms ten councils, one board and one group, thus the proposition is in line with the empirical findings. The councils that PriHealthOrg structured are the result of the restructuring towards core business processes in a patient centred way. This shows the motivation of the hospital to grasp the core business process and address them adequately. It also reveals a good way to implement councils (e.g. based on relevant business process). Furthermore, as reported in the interviews, while the councils were set for the accreditation program, they are still functioning beyond that.

Regarding **AT2: Define and abolish governance policies**, the Quality General-Manager stated that the OS had the ability to define and abolish governance policies. This ability, was given by the placement of top management inside the structure (e.g. CG: General Manager, Quality General Manager and CEO) and the coordination of the council leaders with them. Thus the empirical data coincide with the proposition.

Thereafter the Quality-Manager was asked to comment on **AT3: Obtain and maintain business objectives, standards, best practices**, reporting that:

'With the restructuring, the business processes were defined. Our aim [e.g. OS] is not only to maintain what we accomplished but to enhance these issues, better ourselves. One way, is what you [e.g. the researcher] are addressing, we need the technology to automate and integrate.'

This statement matches the several discussions that the researcher had, with the other interviewees. In PriHealthOrg the business objectives are set and documented in the archival records (as the ones provided to the researcher) and standards for each objective can be retrieved from them, so are best practices in some cases. These are handled by the members of the councils and managed accordingly. Thus, the evidence concur with the proposition (AT3).

Regarding the proposed **AT4: Define and obtain feedback from metrics (e.g. about maturity and compliance policies)**, the researcher investigated the archival records where it is stated that data and information are gathered for clinical and management functions. By analysing and comparing these data (with other data and/or other organisations' data) the OS

can understand how well the hospital is doing. Additionally, in the records it is stated that this tracking and comparison requires established metrics and technology and it's the leaders responsibility to prioritise for these. This finding indicates that PriHealthOrg uses metrics (raw data or technology supported measurement) to obtain feedback and it's up to the leaders to interpret these measurements and take action accordingly. The issue of metrics will also be analysed in more detail in Section 5.3.6.7. Even so, the evidence indicates that this attribute is in line with the empirical data.

To test the proposed attribute **AT5: Train employees**, in parallel to the interviews the researcher reviewed the archives and identified the statement that:

'One or more qualified individuals ... ensure that all staff in the department understand their responsibilities and establish the orientation and training for their employees. The orientation includes the organisation's mission, the departments or service's mission, the scope of services provided, and the policies and procedures related to providing services. Also, when new or revised policies or procedures are implemented, staff is trained.'

Interpreting the empirical data, it appears that, a training procedure in PriHealthOrg is documented and applied to old and new employees, with emphasis on new, revised policies and/or procedures. The research discussed the issue with the IT-Manager, who confirmed that the same procedure is applied to SOA related knowledge for the IT team. Thus, the empirical data are in line with the proposition.

To test the proposed **AT6: Communicates SOA purpose**, the researcher reviewed archives and identified that leaders develop formal (for example, standing councils, joint teams) and informal (for example, newsletters and posters) methods for promoting communication among services and individual staff members. Additionally, the records show that regular communication channels which were both clinical and nonclinical in nature are established between governance and management. This indicates that the proposed attribute is an activity of the OS in PriHealthOrg, as the leaders of the councils develop formal and informal methods for promoting communications between councils and members, thus between the members responsible for the business processes. These clinical and nonclinical members, through the communication channels, work on planning and disseminating the requirements, arrangements and associations of the business processes, that later will be structured by services. As a result, communicating the purpose of SOA, to align business and IT through

the design of services around business processes. Thus, this finding coincides with the proposition.

Furthermore, when asked to comment on **AT7: Sets roadmap**, the Quality General-Manager reported that leaders of the councils were the initiators of such planning. Thus, the literature agrees with the empirical findings, in this case. The issue of the roadmap will also be analysed in more detail, in Section 5.3.6.7.

When the IT-Manager was asked to comment **AT8: Influence decisions on project prioritisation**, he stated:

'Till now we outsourced the IT systems and mainly acquired well-established box solution that can utilise Web-Services and SOA. There is some internal project development, but mainly we bought them. Now [after the restructuring] we have the processes, we just need the project specifications [based on the business process] and the ok by the management to implement them.'

In interpreting the empirical data, it appears that the OS and its councils, are responsible for the project specifications. However, is up to the management (CG) to decide which projects are going to be implemented. Either way the empirical evidence are in line with the proposed attribute (e.g. AT8) that OS can influence decisions on project prioritisation.

In regard to **AT9: Influence decisions on funding**, the researcher inspected the archival record, where it is stated that those responsible for governance, approve the budget and allocate the resources required to meet the hospital's aim. Thus, as in AT8 explained above, the funding attribute follows the same path. The initial motivation in funding a project, starts from the councils (e.g. leaders or members), but it's up to the top-management (e.g. CG) to decide where and when to allocate the funds. This ability to implement projects and allocate funding is placed in the OS, due to the allocation of the top-management, as part of this element. All the proposed attributes and findings are depicted in Table 5.24.

AT	Proposed Attributes	Findings
1	Corroborates a number of councils	Ten councils and two boards based on core business processes
2	Define and abolish governance policies	Defines and abolishes governance policies, with the decisions' capability of its top-management members
3	Obtain and maintain business objectives, standards, best practices	Business objectives are set and documented in the archival records and standards for each objective can be retrieved from them, so can best practices. These are handled by the members of the councils and managed accordingly
4	Define and obtain feedback from metrics	Metrics are utilised to obtain feedback for specific processes, set up by the OS
5	Train employees	Documented procedure for old and new employees, with emphasis on new, revised policies and/or procedures.
6	Communicates SOA purpose	Formal and informal methods for promoting communications between councils and members
7	Sets roadmap	The planning of the roadmap starts in the councils
8	Influence decisions on project prioritisation	The OS and its councils are responsible for the project specifications and the management (CG) for the final decision
9	Influence decisions on funding	Initial motivation starts from the councils (e.g. leaders or members), but it's up to the top-management (GC) to decide for the allocation of funds

Table 5.24: Testing Organisational Structure Element in PriHealthOrg – Findings for Attributes

In addition, the researcher proceeded to test the proposed Guidelines (GU1-3) as these were presented in Chapter 3 (Table 3.17) for the OS element. Moreover, the empirical evidence presented so far in this section, already agree with two guidelines, such as: **GU1: Main governance body**, (as explained for SE1-3) and **GU2: Members from both IT and business** (as explained for Integration Approach for PriHealthOrg).

The empirical data describe OS as the main governance body, yet the researcher observed another interesting finding in this case, that relates to **GU3: Structured in a centralised or decentralised manner**. Observing the way that PriHealthOrg was governing SOA, the researcher identified a hybrid organisational approach that in literature (e.g. George *et al.*, (2013)) is characterised as a federated decentralisation. This is based on the researcher's observation that council leaders were at the same time in charge of the departments. In this case, the leaders had the ability to compose and promote their agenda (SOA/IT governance principles, applications etc.) but at the same time require the support of top-management (in the form of QB and/or CG approval). For example, it was observed that decisions were taken by QB (e.g. federated unit that provided central guidelines), formed by council leaders (councils formed containing representatives of different groups such as: radiology, surgery, nurses etc.), with each leader retaining management of its own internal affairs (e.g. department). In this hybrid approach the borderline between the organisational unit (as an element of SOA Governance) and the departmentalised structure of the hospital was not clear. Additionally, the researcher acknowledges the early stages of the PriHealthOrg restructuring that requires to 'settle-down' and important decisions on whether or not the OS will be an active, strongly supported (e.g. mainly by funding allocation) part of the organisation, still

pending. Yet, as this issue was highlighted to affect SOA Governance, the researcher proposes the ‘**Federated decentralisation of governance**’ issue for further research.

The researcher presents the proposed OS GU1-3 and the findings gathered for the PriHealthOrg case, in Table 5.25.

GU	Proposed Guidelines	Findings
1	Main governance body	Main governance body of all business process in a centred patient way
2	Members from both IT and business	Specialists from IT and business (doctors, nurses, technicians and managers)
3	Structured in a centralised or decentralised manner	Structured in a federated decentralised manner

Table 5.25: Testing Organisational Structure Element in PriHealthOrg – Findings for Guidelines

The researcher investigated Additional Guidelines (AGU1-3) as these were proposed in Chapter 3 (Table 3.17). Moreover, the empirical data concur with **AGU1: Designed as to compensate for the weaknesses of the current organisational and IT structure**. The OS in PriHealthOrg (Figure 5.9) was created to address limitations, such as: (a) integration based on patient needs, (b) IT/SOA Governance, and (c) alignment with business process. Thus, the proposition agrees with the empirical evidence.

Regarding **AGU2: Engagement approach**, the fieldwork evidence describe OS as a combination of communication and staffing centre. The first is supported by the implementation of the council named ‘Management and Communication’ that clearly supports this action (a description was given in Section 5.4.4). The staffing centre engagement (e.g. train other staff by working alongside them) is attributed to the big number of members in the OS (10% of the hospital staff) and their efforts to disseminate the gained knowledge to the rest of their co-workers. The IT-Manager reported on the issue, with the following example:

‘We [OS] wanted to set quality controls in blood tests based on the time it takes for each of the steps (e.g. of the test) to be completed. The process and time for individual steps, was something the quality department needed to inspect [e.g. quality improvement] and CG wanted to implement it as an automated quality control system, so we placed a requested to the IT department and worked with them to implement the solution.’

The manager describes OS as a staffing centre, with its members developing the requirements (in the councils) and then working alongside other staff (non OS members) and implementing the determined project (as illustrated by the blood test example).

Regarding **AGU3: Balanced number of structures**, empirical data (e.g. Figure 5.9) depicts the creation of several councils and other form of structures (e.g. groups, boards). These councils are based on the core business processes proposed by the accreditation program and thus their amount is in accordance to the proposed (by the accreditation program) business processes. Thus, the empirical evidence concurs with the proposition. To this end, the proposed AGU and findings are presented in Table 5.26.

AGU	Proposed Additional Guidelines	Findings
1	Designed to compensate for the weaknesses of the current organisational and IT structure	Created to address limitations, such as: (a) integration based on patient needs, (b) IT/SOA Governance, and (c) alignment with business process
2	Engagement approach	Communication and staffing centre
3	Balanced number of structures	Based on business processes (proposed by the accreditation program)

Table 5.26: Testing Organisational Structure Element in PriHealthOrg – Findings for Additional Guidelines

Furthermore, the researcher in order to infuse the healthcare perspective in the generic structure of the SOA Governance framework, proposed in Chapter 3 a set of Healthcare Aspects (HA1-9) that can aid in this direction. These aspects were depicted in Table 3.17, but can also be seen here, in Table 5.27. Additionally, the empirical evidence gathered from the PriHealthOrg case corresponding to the propositions made by the researcher are analysed in the following paragraphs.

PriHealthOrg's OS was the product of their dedicated effort to align not only business with IT, but also with patients' needs (as PriHealthOrg undergone a patient oriented restructuring). Therefore, the data indicate that dedicated alignment structures containing specific goals were present in this case. This finding is in line with the proposed healthcare aspects **HA1: Dedicated alignment structures (e.g. committees, councils)** and **HA2: Business/IT alignment goals**.

Additionally, regarding the **HA3: Responsible to set clear goals for SOA Governance issues**, the archival records clearly describe goals related to SOA Governance. The researcher reviewed these goals and identified that they were set by the PriHealthOrg's top management (e.g. council leaders or higher management) with the aid of the accreditation program guidelines to guide the restructuring and the integration processes. Thus, **HA4: Involve individuals with skills that can set clear goals** aspect also coincides with empirical evidence, as the goals were set by skilful stakeholders (e.g. council leaders and top management) and the accreditation program's guidelines.

On the contrary, **HA5: Dedicated formal or informal groups to control complexity** was not observed. The empirical evidence shows that although the PriHealthOrg proceeded to a restructuring of their business processes in a more patient centred way, this effort did not reach the same levels regarding the automation and utilisation of IS. What was evident is that at the time of the research several SOA projects were under way and thus the complexity of such systems were not yet identified or anticipated by the PriHealthOrg. This may be the justification emanating from the fieldwork, still the researcher observed that a big parameter that lowered the complexity in this case derives from the accreditation program involvement. The program is designed by specialists of the medical and management field so as to be clear and precise, thus it is infused with solutions and best practices that may deflect complexity issues. In the archival records there are numerous considerations regarding the complexity issue. For example, it is stated that the organisation incorporates strategies (examples of which are given) based on the complexity of services, size and complexity of the organisation and also trains the employees based on the complexity of the processes. These findings depict that despite the absence of a dedicated group to handle complexity issues, the investment in the accreditation program aided in the low percentage of complexity in the PriHealthOrg case.

Regarding **HA6: Committees dedicated to cost control, sponsor identification and funding**, the empirical evidence show that PriHealthOrg not only had a committee in charge (the CG) based on top management members, but also detached the sponsoring from IT/HIS/SOA projects and based it on quality improvements and patient safety projects. This gave the opportunity to allocate funds in an integrated approach and prevent departmentalisation favoring and disputes. Therefore, the field data concur with the proposition in this case.

Interviewees in response to **HA7: Dedicated structures (e.g. committees and interest groups) to minimise risk** acknowledged that risk management was incorporated in the councils (Figure 5.9) and it was the responsibility of council leaders to satisfy the risk management requirements set (e.g. by government, laws, etc.). In conjunction to the aforementioned evidence, the archival records include the following account:

'To use this or similar tools [risk analysis] effectively, the leaders need to adopt and to learn the approach, to agree on a list of high-risk processes in terms of patient and staff safety, and then to use the tool on a priority risk process. Following analysis of the results, the organization's leaders take action to redesign the process or similar actions to reduce the risk in the

process. This risk-reduction process is carried out at least once per year and documented.'

This finding reveals that PriHealthOrg had a risk management plan (documented, disseminated and based on metrics) that allowed them to evaluate the processes based on risk priorities and proceed to risk-reduction measures at least in a yearly basis.

Additionally, interviewees were asked to comment on the **HA8: Dedicated structures (e.g. committees and interest groups) to identify and propose standards**, to which the IT Manager replied:

'The accreditation program we got involved with, is a standard by itself and as other medical and/or management standardization is a top-management decision...as far as the other standards [referring to SOA related standards] we incorporated specific WS and other IT policies to adhere to those, this was a task that the IT team got involved with...'

This reveals that there were dedicated structures (e.g. teams in this case) that proposed and evaluated various standards (e.g. medical, managerial, IT). Thus, the empirical evidence are in line with the proposition.

Regarding **HA9: Cultivate SOA friendly culture**, the researcher identified as part of PriHealthOrg's OS (Figure 5.9) a council, named 'Management of Communication & Information Council', that based on the description given (Section 5.4.4) aims to aid in the dissemination of the benefits of the restructuring process in general but also to cultivate a SOA friendly culture in particular. Thus, the evidence supports the researcher's proposition.

The aforementioned tested aspects (HA1-9) and the findings gathered for PriHealthOrg case are summarized in Table 5.27.

HA	Proposed Healthcare Aspects	Findings
1	Dedicated alignment structures (e.g. committees, councils)	PriHealthOrg's Organisational Structure was the product of their dedicated alignment efforts
2	Business/IT alignment goals	Alignment goals were set by the accreditation program
3	Set clear goals for SOA Governance issues	Clear goals, with the aid of the accreditation program guidelines were set
4	Involve individuals with skills that can set clear goals	Top management responsible to set the goals based on the accreditation program guidelines
5	Dedicated formal (committees, interest groups) or informal (intranets, wikis) to control complexity	Not a dedicated group but in the archival records there are numerous considerations regarding the complexity issue
6	Committees dedicated to cost control, sponsor identification and funding	The CG was in charge of financial issues and allocated funds based on quality improvements and patients safety propositions
7	Dedicated structures (e.g. committees and interest groups) to minimize risk	Risk management plan (documented, disseminated and based on metrics) that allowed risk-reduction measures to be taken at least on a yearly basis
8	Dedicated structures (e.g. committees and interest groups) to identify and propose standards	Dedicated structures (e.g. teams in this case) that proposed and evaluated various standards (e.g. medical, managerial, IT)
9	Cultivate SOA friendly culture	The Management of Communication & Information Council aided in the effort to cultivate a SOA friendly culture

Table 5.27: Testing Organisational Structure Element in PriHealthOrg – Findings for Healthcare Aspects

Thus far, the Organisational Structure element and its attributes, sub-elements, guidelines, additions and healthcare aspects proposed by the researcher were examined through the empirical evidence gathered from the PriHealthOrg case. In the next section the Roles element is examined and analysed.

5.4.6.2 Testing the Roles (RL) Element

Initially the researcher asked the interviewees to comment on the attributes (AT1-5) attached to the Roles element of the proposed SOA Governance framework (Table 3.17). The respondents were keen to answer positively in all five attributes.

Regarding **AT1: Hold SOA responsibilities**, the interviewees described that in PriHealthOrg the OS members held specific roles and responsibilities, accompanying these roles. As it will be presented later on in this section, some roles in OS were SOA related with the technical term, yet the majority reflected more on SOA business aspects and governance processes. This finding coincides with AT1 but also correlates with **AT2: Responsible for governance processes**. Thus, both attributes (AT1 and AT2) are in line with the findings. The issue of SOA roles (the list) and responsibilities will be addressed in full at the end of this section.

Concerning **AT3: Gain the support of all the relevant stakeholders**, it revealed from the discussions with the interviewees that the support and involvement of the top management and the big number of active OS members (10% of the employees) aided in gaining the support of their fellow employees, external stakeholders and patients. Thus, the aforementioned data

concur with the proposed attribute. Additionally, the supportive role of the top management was also evident in reference to **AT4: Decrease resistance to change**. The Quality General-Manager reported on the issue:

'The success of this endeavor was based on well defined roles and structures [meaning councils, boards etc.]. We wanted to involve as many stakeholders as possible, we ended up with a group of 100 individuals almost 10% of our working force. All these had specific roles and responsibilities...this helped us promote the project and accomplish the positive participation of all the employees.'

The aforementioned view clearly reflects on the use of specific roles (they will be named and addressed later on this section) and their ability to aid SOA Governance in multiple ways. This finding also supports **AT5: Reduce the risk of program failure in a later stage**, as it reflects on the distribution of roles (e.g. OS members) and the ability towards the success of SOA. In an informal conversation a PriHealthOrg employee revealed that he felt part of the project (e.g. the informant worked in an integration SOA based process to automate doctors scheduling system) when he was officially given a role (e.g. relevant to business process analyst) and asked to fulfil the role's requirements. Due to the informal nature of the discussion this is not used as a finding, but as an indication that indeed the participation in the OS with the appointed roles reflected positively both to the employees and the SOA implementations themselves.

Table 5.28 includes all the aforementioned proposed attributes for the RL element in the left side of the table and the findings in the right side.

AT	Proposed Attributes	Findings
1	Hold SOA responsibilities	The members of the organisational structure held specific roles and responsibilities accompanying these roles
2	Responsible for governance processes	Roles responsible for governance processes
3	Gain the support of all the relevant stakeholders	Aided in gaining the support of employees
4	Decrease resistance to change	Served as a tool to minimising the resistance to change
5	Reduce the risk of program failure in a later stage	The members/roles contributed to the success of the restructuring but also to several successful SOA projects (e.g. doctors' appointment system)

Table 5.28: Testing Roles Element in PriHealthOrg – Findings for Attributes

To test the proposed Guidelines (GU1-3) for the RL the researcher gathered empirical evidence from the PriHealthOrg case. The findings are presented in the following paragraph and summarised in Table 5.29.

The analysis of the empirical evidences in the previous element (e.g. OS) reveals that members from both the IT and business were involved and given specific roles. Thus the proposed guideline **GU1: Members from both IT and business** is in agreement with the findings in this case. Additionally, regarding the proposed guideline **GU2: Require specific skills/training** it is revealed (as in OS AT5) that in this case, training and skill development is attached to specific roles and especially when this (in many cases) new role involved alteration of the business process it was dealing with. Yet, in relevance to the **GU3: RACI** method/chart, the researcher did not observe such an approach to be implemented in this case nor was such method reported by any of the interviewees. The proposed guidelines and findings are depicted in Table 5.29.

GU	Proposed Guidelines	Findings
1	Members from both IT and business	Members from both IT and business
2	Require specific skills/training	Skills/training requirements
3	RACI	Not Observed

Table 5.29: Testing Roles Element in PriHealthOrg – Findings for Guidelines

In Chapter 3 the researcher proposed an Additional Guideline (AGU1) for the RL element, as seen in Table 3.17. The **AGU1: List of roles and responsibilities** (seen in detail in Table 3.13) was presented to the interviewees in order to identify and comment on them. The findings of this process are presented in Table 5.30, where the symbol (✓) indicates that the specific role is identified by the specific interviewee, and the symbol (-) shows the opposite. Moreover, the left side of the table (first, second and third column) illustrates the proposed roles and the right side the interviewees' initial (as Quality-Manager: Q-M, Quality General-Manager: QG-M, Project-Manager: P-M, IT-Manager: IT-M, IT General-Manager: IT-GM).

Category	Sub-category	Role	Q-M	QG-M	P-M	IT-M	ITG-M
SOA support	Front-end	Operator	-	-	-	✓	✓
		Support Personnel	-	-	-	✓	✓
	Back-end	Business Process Analyst	✓	✓	✓	✓	✓
		Service Developer	-	-	-	✓	✓
		Application Developer	✓	✓	✓	✓	✓
SOA strategy & governance	-	Strategy manager	✓	✓	✓	✓	✓
		Process manager	✓	✓	✓	✓	✓
		Security manager	-	-	✓	✓	✓
		Governance manager	✓	✓	✓	✓	✓
		Technology scout	-	-	✓	✓	✓
SOA design & quality management	Design	SOA architect	-	-	✓	✓	✓
		Infrastructure architect	-	-	✓	✓	✓
		SOA designer	-	-	✓	✓	✓
	Quality assurance	Business integrator	-	-	✓	✓	✓
		Tester	-	-	✓	✓	✓
	Administration	Administrator	-	-	✓	✓	✓
		Service librarian	-	-	✓	✓	✓
SOA development & evolution	-	Project manager	✓	✓	✓	✓	✓
	-	Project member	✓	✓	✓	✓	✓

Table 5.30: Identified SOA Roles in PriHealthOrg

The difference between the identification of roles, comparing the answers of the interviewees closely related to governance activities (e.g. Quality Manager, Quality General Manager) against those closely related with IT (Project Manager, IT Manager, IT General Manager) can be accredited to the familiarization of the latter with the SOA roles. Additionally, as revealed from discussion with the interviewees one individual could hold multiple roles. Moreover the IT-Manager reported that the hospital has a dedicated IT team divided into groups, such as: (a) Infrastructure Team (9 individuals), (b) Analysis design (4 individuals), (c) Implementation (1 individual) and (c) Customisation/parameterisation of applications and User Training/Support (5 Individuals).

Regarding the proposed Sub-Elements (SE) and more specifically **SE1: Responsibilities** the IT-Manager noted positively on the use of the proposed responsibilities, as seen in Section

3.2.2 (Table 3.3), while commenting that he was unaware of a possible utilisation of the RACI method or similar. In parallel to the interviews, the researcher reviewed the archives and identified that regarding the responsibilities it is declared that:

- One or more qualified individuals provide direction for each department,
- Each department is directed by an individual with the training, education, and experience comparable to the services provided,
- When more than one individual (director) provides direction, the responsibilities of each are defined in writing,
- The directors of each clinical department identify, in writing, the (healthcare) services to be provided by the department,
- Services are coordinated and integrated within the department or service and with other departments and services,
- Directors provide orientation and training for all staff of the duties and responsibilities for the department or service to which they are assigned,
- Directors monitor the department's or service's performance.

Thus, according to the empirical data, the director(s) of each department is responsible for the healthcare services of their department, and thus they are also responsible for the services (as business process) that automate the healthcare services. This view is also supported by the notion that the directors were responsible for the quality and performance of the services and hold the responsibility to sustain the services' quality. Thus, the director of each department was recognised as the one holding the responsibility for the quality of the processes and services (healthcare, electronic, etc.).

Consequently, even though the roles are being set by the OS, there is not sufficient evidence that this was the case for responsibilities. The researcher based on the discussion with several interviewees identified that the difference of the proposition and empirical evidence is an organisational issue. The proposition refers to an optimal level of organisation, where roles and responsibilities are set by the OS. Whereas, PriHealthOrg has implemented its business processes according to the accreditation, set the roles to adhere to the needs of the implementation, but did not set the responsibilities. The later were set as part of departmental tasks. This finding, is also supported by the lack of a RACI (or similar) method that sets the responsibilities on roles and not tasks.

To this end, the Roles element with its attributes, sub-elements, guidelines, additions were tested and the findings analysed. In the next section the findings corresponding to the Maturity Model element are presented and investigated.

5.4.6.3 Testing SOA Maturity (MM) Model Element

Initially the researcher explained to the interviewees the Maturity Model element as this was presented in Chapter 3 (Table 3.17 and Annex II). Thereafter, the researcher asked them to comment on the proposed Attributes (AT1-3) with the Quality General-Manager replying on **AT1: Assessment mechanism**, that:

'The concept of a maturity model is a good exercise. However, we apply a similar concept for quality improvements. We [the leaders] check available data and information to identify priority areas. We then assess and prioritise those critical, high-risk, problematic, and primary processes that most directly relate to quality of care and safety. However, organisations like ours typically find more opportunities for improvements than they have human and other resources to accomplish them.'

This statement, reveals that PriHealthOrg, even though it does not apply a specific SOA MM (e.g. CMMI etc.), it utilises the same concept (e.g. of maturity measurement), which addresses as 'Quality Improvements' and applies it to core processes (e.g. quality and safety). This is a very interesting finding as it describes an intelligent maturity assessment tailored for this healthcare organisation. Mehadevan *et al.*, (2009) identified the creation of such 'intelligent' models and described the need to create them in order to facilitate SOA implementation progress and accommodate the focus from business processes to business needs (as quality and safety in PriHealthOrg case). The authors report these intelligent models to support more than just decomposition, but to be able to capture processes with flexible sequences that are result based (as critical, high-risk, problematic, and primary processes in PriHealthOrg case) (Mahadevan *et al.*, 2009). In this case, Quality Improvements seems to be similar to such an intelligent model described by Mehadevan *et al.*, (2009). Yet, as this research is not set to investigate SOA maturity models, the researcher highlights this issue and acknowledges this finding both as an important finding but also as an issue requiring further research.

Additionally, regarding **AT2: Provides comparison between current and future state of SOA**, the interviewees were asked if such an attribute was applicable in their case. Their responses were positive, with the Quality General-Manager reporting that the Quality

Improvements are based on comparison of current (e.g. quality) and future states, and endorsed the idea for the same comparison to be applied to SOA. Thus, the empirical evidences are in line with the proposition.

The interviewees were asked to comment on **AT3: Assist in steering and planning needed for running a SOA** and revealed that the Quality Improvements (acting similar to the MM concept) aided in the later planning. Thus, based on this view, the proposition concurs with the findings, as the assessment and measurement that PriHealthOrg used in several critical, high-risk, problematic, and primary processes assist them to steer and plan the SOA Governance. The proposed attributes (AT1-3) and findings are shown in Table 5.31.

No	Proposed Attributes	Findings
1	Assessment mechanism	It acts as an assessment mechanism for core business processes
2	Provides comparison between current and future states of SOA	Identified to provide comparison between current and future states
3	Assist in steering and planning needed for running a SOA	Assist in steering and planning needed for running the business processes and therefore the SOA

Table 5.31: Testing the Maturity Model Element in PriHealthOrg – Findings for Attributes

Discussing the issue with more technically oriented interviewees, the notion of the SOA MM (Table 3.17-Annex II) was tested and more specifically the proposed Sub-Elements (SE1-2), **SE1: Levels** and **SE2: Application Areas** of such model. In one of these discussions, the IT-Manager was very positive about the use of a SOA MM for SOA Governance and reported that:

‘The SOA maturity model as you present it is useful, with the five phases...from what I can see we are more closely in the SOA managed level, in technology, and governance. The differences are in the processes and organisation, now with the accreditation I think we have a very good set of business process and the organisation is closely behind, probably defined level. Having said that, we still need the funding to help the other categories mature [e.g. as technology].’

Furthermore, regarding the proposed SOA Governance aspect of the model the IT-Manager stated:

‘I agree with the way you describe governance in the model. In our case it corresponds to the managed level, as we have a limited by growing number of services that are consumed by several applications or other composite

services and thus we have placed guidelines, especially where the services involve critical or high-priority content.'

Thus far, the findings from PriHealthOrg, regarding the SOA MM point towards a misalignment between the levels and the areas (technology, processes, organisation and governance). That is, because the processes and organisation in this case are in a more mature phase in comparison to the technology, and governance.

The researcher also tested the proposed Guidelines (GUI-4) to identify if such propositions relate with the SOA MM element. Thus, firstly the interviewees were asked to report on the **GUI: Detailed analysis**, **GU2: Levels** and **GU3: Application areas** of the SOA MM (presented in Annex II). In this case, the big difference on the maturity levels is observed as the organisation proceeded firstly to restructure the business processes and at a later stage started to fund the rest of the issues (e.g. like technology). A graphical representation of the PriHealthOrg maturity state, based on the proposed SOA maturity model and the interviewees' comments is presented in Figure 5.10. The researcher does not claim that this is a precise representation of a SOA MM in PriHealthOrg as such claim would require more evidence and data from multiple sources. Such detailed research on the SOA MM is out of scope for this dissertation. Nevertheless, proceeds to graphically represent the SOA MM based on the data retrieved and believe that Figure 5.10 adds to the discussion and enhances the understanding of SOA Governance in PriHealthOrg.

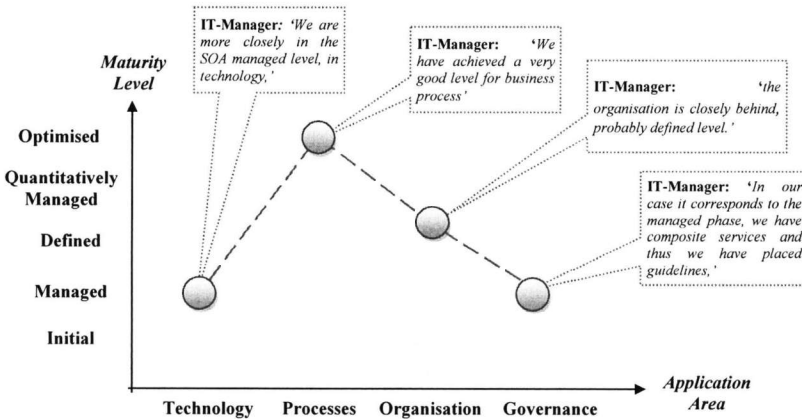


Figure 5.10: Maturity Levels of PriHealthOrg

To further explain the maturity misalignment of the application areas, the Quality General-Manager gave an example of a standardized process (based on accreditation documented standards) that can be characterised as critical and high-risk, and requires automation through Web-Services and SOA. This process (two person validation), involves the doctor who produces a prescription (e.g. for a patient), and another individual (usually the clinical pharmacist) who checks and certifies the appropriateness of the prescription, according to patient information (patients' history, drug interactions etc.). As explained to the researcher, in the current process the doctor subscribes the drug and the evaluator walks around the hospital checking only high risk drugs. As reported by the Quality General-Manager:

'The two person validation is a good example. We have the processes but at the moment is executed in the minimum requirements [e.g. by one individual]. We need to change our philosophy, regarding the prescribing, organise better, automate the process and integrate IS that will incorporate the full availability of patient history, risk alerts and validation mechanisms.'

This example shows the way that PriHealthOrg sets to enhance the rest of the application areas, as these are presented in Figure 5.10. Based on critical, high-risk, problematic, and primary processes PriHealthOrg sets priorities (e.g. two person validation example) that will be transformed into individual SOA projects. These projects will help some or all of the application areas (e.g. technology, organisation etc.) to mature. The difference and/or intelligence of this method is that PriHealthOrg, after the optimisation of the business process, retrieved its focus from the rest of the application areas and focused on what identifies as critical, high-risk, problematic, and/or primary processes. Thus, the other areas progress and mature as a side-effect of these concerns. Furthermore, when the interviewees were asked to comment on **GU4: Examples of CMMI and or COBIT**, they commented that these approaches are under consideration but not applied at the moment in PriHealthOrg.

In order to better present all the proposed GU1-4 (e.g. Table 3.17) for the SOA MM element the researcher summarises them alongside the findings for each in Table 5.32.

GU	Proposed Guidelines	Findings
1	Detailed analysis	Detailed analysis is a requirement
2	Levels such as: initial, managed, defined, qualitatively managed and optimised	Levels tested and justified
3	Application areas: organization, process, governance, service/ service management architecture, infrastructure and business view	Application areas tested and justified
4	Examples of CMMI and/or COBIT	Not Observed

Table 5.32: Testing the Maturity Model Element in PriHealthOrg – Findings for

Guidelines

When asked to comment on the **HAI: Funding is an application area** the Quality General-Manager and IT-Manager mentioned that SOA funding is considered as an important area that needs to be measured and mapped against the others. Thus, this finding agrees with the proposition.

Thus far, the Maturity Model element and its attributes, sub-elements, guidelines and healthcare aspects proposed by the researcher were investigated and tested by gathering data from the PriHealthOrg case. In the next section the Roadmap element is examined and analysed.

5.4.6.4 Testing Roadmap (RD) Element

In order to test the proposed Roadmap (RD) element, the researcher first investigated the proposed Attributes (AT1-3) as these were depicted in Table 3.17. Thus starting with the **AT1: Provides an incremental SOA adoption**, the Quality General-Manager was asked to comment if such attribute was relevant in PriHealthOrg, for which she reported:

'We had a roadmap for the accreditation program. Based on that we formed ten councils... [Figure 5.9]. Initially they [councils] measured and identified the current state, they had a good analysis of the standards as they were placed by the accreditation program, so they did a GAP analysis⁶ to investigate the current situation. This analysis provided what was required of them to do, and how to achieve it e.g. change the process, new documentation, plan enhancements, projects etc. and thus set goals accordingly.'

In this case, the steps followed to build the roadmap (planning and scheduling) for the restructuring were: (a) AS-IS assessment, (b) check standards set by accreditation program, (c) GAP analysis, (d) set goals accordingly, and (e) plan action (changes, enhancements, projects etc.). This process is followed to create the roadmap (planning and scheduling) for every new SOA project, as it was revealed in Section 5.4.6.3. Thus, the empirical evidence show that in PriHealthOrg the RD element provides an incremental SOA adoption based on planning and standardisation. Thus, this finding is in agreement with the proposition (e.g. AT1).

⁶A technique that determines what steps need to be taken in order to move from the current state to its desired, future state. Gap analysis consists of (a) listing of characteristic factors (attributes, competencies, performance levels) of the present situation ("AS-IS"), (b) listing factors needed to achieve future objectives, and then (c) highlighting the gaps that exist and need to be filled.

Additionally, the researcher observed in the records provided to him, well document plans of future integration projects. These plans were the result of the Gap analysis and the guidelines provided by the accreditation program. This finding reflects on the **AT2: Detailed planning process** that proposes such planning process for the RD element. Therefore, the empirical data concur with the proposition. In an attempt to better illustrate the proposed attributes and the findings in this case, the researcher presents them in Table 5.33. The left side of the table shows the proposed attributes and the right side the findings.

AT	Proposed Attributes	Findings
1	Provides an incremental SOA adoption	The way PriHealthOrg addresses the SOA roadmap provided an incremental adoption based on well defined business processes
2	Detailed planning process	The business processes and priorities were well defined and documented

Table 5.33: Testing the Roadmap Element in PriHealthOrg – Findings for Attributes

Furthermore, the researcher tested the proposed **SE1: Transition plans** for the RD element, as this was presented in Table 3.17. The evidences gathered in this case describe a planned, detailed roadmap that helps the organisation to have a clear view of the next steps, anticipating the changes required. In PriHealthOrg, the AS-IS assessment for the restructuring, was the first assessment attempt based on the standards of the accreditation program and consequently acted as a foundation for the forthcoming ones. After the assessment for the restructuring, the Quality Improvements concept was used (as explained in the MM element) and the final selection of projects was subject to the Quality and Safety processes screening (critical, high-risk, problematic, and primary processes). This reveals that in PriHealthOrg transition plans were formed and implemented and so the proposed attribute coincides with the empirical evidence.

Moreover, in order to explore the proposed Guidelines (GUI-3) the researcher asked the interviewees to comment on the propositions (as seen in Table 3.17). In response to the researcher's questions and in regard to **GUI: Based on current and target SOA and SOA Governance maturity assessments**, the Quality General-Manager replied:

'The hospital uses the information from data analysis [as GAP] to identify the differences between current functionality and standards and plan for potential improvements or to reduce (or prevent) adverse events. We use routine measurement data, as well as data from intensive assessments [e.g. clinical], which contribute to this understanding of where improvement should be planned and what priority should be given to the improvement. However, it's the leaders' decision to identify the improvement and safety activities to be undertaken.'

In interpreting the empirical data, it appears that the proposition and the empirical findings concur that the planning in PriHealthOrg’s case was based on measurement of the maturity level or “current functionality” and its goals or “improvements”. Thus, the proposed guideline is in line with the data gathered from the fieldwork.

Regarding the **GU2: Designed for each organisation’s particularities**, the researcher investigated the way that the RD element was created in the PriHealthOrg’s case taking under consideration all the statements given (depicted in this Section) and based on the particularities of this case (e.g. Quality Improvements, Quality and Safety Process etc.) created a graphical representation of the RD element, as seen in Figure 5.11.

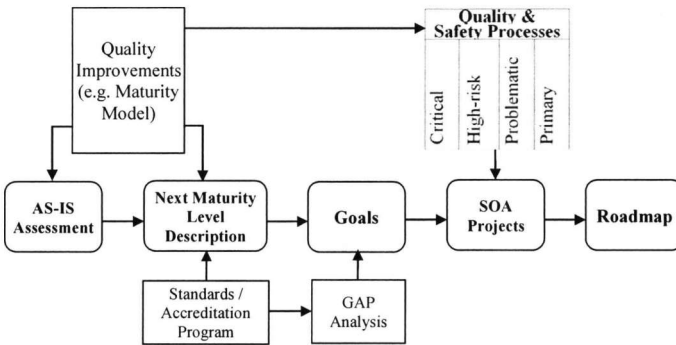


Figure 5.11: SOA Roadmap as Identified in PriHealthOrg

This figure illustrates the steps the OS took to create the SOA roadmap. First the OS proceeded in an AS-IS assessment and based on the Quality Improvements framework highlighted the next maturity level (discussed in RD AT2). This level’s description was a result of standards identified in the accreditation program’s guidelines and suggestions. Thereafter, they continued with a GAP analysis to identify in detail the requirements and set the goals to complete them (as reported by Quality General-Manager). These goals were utilised by the OS to identify the candidate SOA projects out of a list based on specific parameters (Quality and Safety Process). Thus, combining the goals and specific candidate projects they created the roadmap to reach the next maturity level. These observations and findings concur that in this case the Roadmap was created based on the PriHealthOrg’s particularities.

The proposed RD GU1-2 and findings are depicted in Table 5.34.

GU	Proposed Guidelines	Findings
1	Based on: current and target SOA and SOA Governance maturity assessments	Based on current and target business processes in general and SOA in particular and maturity assessments
2	Designed for each organisation's particularities	Designed to incorporate quality and safety processes (e.g. PriHealthOrg particularities)

Table 5.34: Testing the Roadmap Element in PriHealthOrg – Findings for Guidelines

In addition, the researcher explored the Additional Guideline (AGU1) as this was proposed in Section 3.3.3 and included as part of the RD element of the SOA Governance framework (Table 3.17). Moreover, in regard to **AGU1: Design guidelines**, considering the empirical data gathered for SOA RD element and combining the preceding analysis of the SOA MM (Section 5.4.6.5) it can be argued that the maturity levels were (and as declared by the interviewees still are) a defining and valuable parameter to structure the SOA roadmap. This is also evident in the representation of the roadmap in Figure 5.11. Thus, the proposition agrees with the empirical data.

The researcher asked the interviewees to comment on the Additional Guideline (AGU1) as this was proposed in Section 3.3.3 and included as part of the RD element of the SOA Governance framework (Table 3.17). Moreover, the **AGU1: Design guidelines**, was presented to the interviewees, to which they commented on the similarities of this proposition with the one implemented in PriHealthOrg. In this case, the OS in order to create a SOA RD initially created a (a) rough priority order of service implementation (e.g. services related to Quality and Safety) and (b) a high-level plan for building the architecture (specific planning for each SOA project). To this end, the IT Manager added that they update these plans based on new data and create new goals based on these changes. This comes in accordance to the proposition which mentions that the RD requires updates to include: (a) existing services, (b) new business models and other forces and (c) new goals. Based on these findings the AGU1 is in line with the empirical data.

In this section, the Roadmap element and its attributes, sub-elements, guidelines and additional guidelines proposed by the researcher were investigated and tested by gathering data from the PriHealthOrg case. In the next section the SOA Governance Infrastructure element is investigated and analysed.

5.4.6.5 Testing SOA Governance Infrastructure (SGI) Element

In order to test the SOA Governance Infrastructure (SGI) the researcher addressed the proposed Attributes (AT1-4), with the interviewees, requiring information on any technology supporting the governance processes. As a result of the discussions with the interviewees, it

appears that the SGI in PriHealthOrg was applied through the already acquired IT systems. Moreover, on the topic of the **AT1: Manages governance information**, the IT-Manager, explained:

'We have box set solution that can utilise Web-Services and SOA. There is some internal project development, but mainly we bought them. Now [after the restructuring] we have the processes, we just need the project specifications [based on the business process] and the ok by the management.'

The above view of mostly acquiring IT/IS systems is in accordance with the list of IS provided by the IT-Manager and presented in Section 5.4.2. From the description provided for these systems it is evident that they were used to manage governance information and thus this attribute is in agreement with the empirical data.

For the **AT2: Automates the governance processes**, the researcher investigated the PriHealthOrg's archival records, in which it is stated that:

'Information management technology represents a major investment of resources for PriHealthOrg. Appropriate clinical and managerial staff participates in selecting, integrating, and using information management technology. For this reason, technology is carefully matched to the hospital's current and future needs and its resources. Available technology is integrated with existing information management processes and helps integrate the activities of all the hospital's departments and services. This level of coordination requires that key clinical and managerial staff to participate in the selection process.'

This finding agrees with the literature (Table 2.6) where SOA is seen as beneficial for (a) aligning IT with business and (b) integrating legacy systems. This is the case in PriHealthOrg, where the management has already invested in IS systems and with the restructuring, added further investment in SOA and placed the business process to integrate IT and business. Thus, now that the integration affects more systems and the number of associations between services is increasing so does the demand for SGI. Therefore, the empirical evidence agrees with AT2 for this case. Additionally, in regard to **AT3: Enforce the governance policies**, the Quality-Manager reported that:

'Before the restructuring we invested in IT, according to our needs in automation and our ability [e.g. in resources]. Now, the game play has changed, HIS are more involved and structured with business processes, running policies, quality requirements, metrics and so on. We [e.g. OS] have indicators of what needs to be done, thus we [leaders] have regular meeting with the councils, to decide what to implement according to what is set [according to the business processes set].'

In interpreting the empirical data, it appears that SGI (e.g. HIS involvement) is directly linked with policies (e.g. running policies), an issue that will be further explored in Section 5.4.6.6. Concerning the **AT4: Collects metrics**, the aforementioned manager's view reveal that SGI was used to collect data and monitor the HIS/SOA implementations. Thus the empirical data agree with the proposition. To this end the researcher presents the propositions, alongside the findings in Table 5.35.

AT	Proposed Attributes	Findings
1	Manages governance information	Identified as valid for this case
2	Automates the governance processes	Evidence indicate that governance processes were automated
3	Enforce the governance policies	Policy enforcement was achieved through SGI
4	Collects metrics	SGI was utilised to monitor the organisation functionality

Table 5.35: Testing the SOA Governance Infrastructure Element in PriHealthOrg – Findings for Attributes

In order to explore the proposed Sub-Elements (SE1-6) as they are presented in the left side of Table 5.36 the researcher asked interviewees to comment on those. Based on the interviewees' answers it appears that the **SE1: Service registry** and **SE6: SOA management system** was utilised as part of the acquired IS (presented in Section 5.4.2), while research and plans has been identified for **SE2: Repository**, **SE3: ESB**, **SE4: Policy & contract management system** and **SE5: Quality management system** but at the time of research are under consideration. Table 5.36, depicts the proposed SE1-6 and findings for the PriHealthOrg case.

SGI	Proposed Technology	Findings
1	Service Registry	Utilised as part of the BI system
2	Repository	Under consideration
3	Policy & contract management systems	The policies are placed, the system is under consideration
4	Quality management system	Requirements identified, system under consideration
5	SOA management system	Utilised as part of the BI system

Table 5.36: Testing the SOA Governance Infrastructure Element in PriHealthOrg – Findings for Attributes

When asked about the Additional Guideline **AGU1: The sub - elements are determined by the specific governance requirements**, the interviewees replied positively in the correlation

of such guideline and the General Quality-Manager gave an example regarding the Quality Management System (QMS) utilisation:

'Under the Quality Improvement it is required to gather and monitor appropriate indicators highlighting the functionality of different processes [containing services]. We acknowledge that systems as QMS and statistical tools can provide the solution they [council] require. We haven't implemented that because we haven't resolved another problem, that of data entry. The limited staff, time and process automation prevent us from utilising such systems.'

The aforementioned view comes in accordance with the proposed QMS, as seen in Section 3.2.5 (Table 3.6). Both the proposed system (based on Bernhard & Seese (2009) proposition) and the revealed requirement (by the Quality General-Manager) aim at addressing the issue of quality impact of composite services. This reveals that in this case the OS understands the value of the SGI element, has plans to implement such element, yet has not reached a point that these plans are realised due to specific challenges (e.g. limited staff, etc.) that need to be dealt first. This example shows that the proposed additional guideline is in accordance with the empirical data.

So far, the SOA Governance Infrastructure element and its attributes, sub-elements and guidelines proposed by the researcher were investigated and tested by gathering data from the PubHealthOrg case. In the next section the Policies element is examined and analysed.

5.4.6.6 Testing Policies (PO) Element

To test the Policies element, the researcher first asked the interviewees to present any type of policies used as part of governance in PriHealthOrg. During this process the interviewees replied mentioning several types (the explicit types will be analysed in the following paragraphs) of policies for developing, deploying and managing SOA. This finding is in line with the **AT1: Comprise rules for developing, deploying and managing a SOA** proposition. Thus, empirical evidence concurs with the proposed attribute.

The researcher also investigated the proposed Sub-elements (SE1-3) of the PO element. For the **SE1: Enforcement**, all interviewees replied positive of the existence of such element in the policies conceptualisation. Additionally, when asked to address the **SE2: Aspects** and

SE3: Areas that policies hold, the interviewees provide details of such aspects and areas that will be discussed in the following paragraphs. Moreover, the Quality-Manager reported that:

'The governance leaders and senior management, are responsible for knowing what international and Greek laws, regulations, and other requirements apply to the hospital...the knowledge and responsibility starts from there and is disseminated to all the personnel capable to ensure the adherence to these laws.'

The aforementioned view comes in accordance with the literature findings in Section 2.4.1 where it was identified that the laws, regulations, mandates and other legal obligations imposed by government bodies are a critical parameter for healthcare, that can be addressed by the adoption and implementation of SOA (Ruth, 2009). This finding also highlights the **compliance policies** that need to be implemented, as part of the healthcare regulatory compliance to standards set by national and international laws.

Elaborating further on the issue of policies the Quality General-Manager pointed on the archives. The researcher investigated the archives, where it is declared that:

'In all cases, there is a leadership accountability for contracts or other arrangements to ensure that the services [healthcare] meet patient needs and are included as part of the hospital's quality standards.'

This finding points out that except compliance with laws, the hospital also ensures, through contracts that internally structured policies are set as part of the hospital business (e.g. healthcare services). The aim of these **business policies** is to ensure that healthcare services meet quality standards and patients' needs. This set of policies acts as an alignment mechanism between the laws, government and patient requirements from the one side and business (processes, IT and SOA) from the other.

Additionally, the IT-Manager, reported on the standardised, documented practice followed, when a request for a new service (like an update, alteration of existing or new service) is received by the IT department:

'The users describe the request and email it, or by email they send a general description and then a meeting is arranged. Every request is recorded like an issue in the "open issues" list, in which the requester, date, description,

attachments (emails, minutes of meetings, etc.), type of change, actions are also recorded. Depending on the category of change (as recorded) one of the following is followed:

- Customisation of level data: direct implementation in test environment testing by users –acceptance – transfer to the implementation environment.
- Customisation that affects subsystems: In collaboration with employees of the Department that requested the change the need for change and the priorities is specified.
 - If necessary (depending on the type of request) the requirement are discussed in a meeting with users and the appropriate specifications portfolio is produced. Also potential changes / impact on system interfaces and other modules are identified.
 - In a meeting the changes are presented for approval to the managers of the hospital
 - Implementing at development environment, testing by the support team.
 - Transfer at testing environment and test by the users - Acceptance
 - Transfer to implementation environment.'

This practise as it was described by the IT-Manager, shows a clear documented set of **process policies**, similar to those described in the literature, by Marks (2008), regarding the creation, publication, and testing of services.

Furthermore, as presented in Section 5.4.3, the IT-Manager mentioned the technology standards required for the web-Services (e.g. HL7, medilab/SAP protocols) and the need to apply them, when developing applications and services. This statement reveals the **technology standards compliance** requirements enforced in PriHealthOrg. Moreover, discussing the policy requirements the IT-General Manager raised the issue of security and confidentiality of patients' medical data:

'...we have the ability to integrate our systems with the new hospital [neighbouring country], but due to legal conditions we can't. The restrictions, especially on security and safety [patients' confidentiality] were always an issue.'

The differences between the laws applying to PriHealthOrg and the non-European laws applying to the affiliated hospital (neighbouring country) opposed the integration approach

between the two hospitals. However, this also shows that PriHealthOrg applied a strict policy management to secure patients' confidentiality. The same restriction, about health care laws and patient data, were also identified in the literature both as a challenge (explained in Section 2.2.2), but also proposed under the policy enforcement proposition (Section 3.2.6). To further test the issue, the researcher investigated the PriHealthOrg's archival records, in which it is stated that the organisation maintains the privacy and confidentiality of data and information and is especially careful (e.g. installing security processes) about preserving the confidentiality of sensitive data and information. In the same records the researcher identified the process used to maintain the data confidentiality policy in PriHealthOrg and presents it:

- There is a written policy for addressing the privacy and confidentiality of information that is based on and consistent with laws and regulations,
- The policy defines the extent to which patients/professional staff has access to their health information and the process to gain access when permitted,
- The policy is implemented,
- Compliance with the policy is monitored

The above findings reveal that in this case **security policies** are produced, documented, applied and monitored. This set of policies acts as a risk-minimisation mechanism as it handles the privacy and confidentiality maintained in different categories of information.

In addition, the researcher observed as part of the archival records and as part of the guidelines given by the accreditation program, that organisation wide documented policies (e.g. enterprise policies) that affect all business units, processes and roles are in use in this case organisation. Thus, interpreting the empirical evidence, it is shown that five types of policies are in use in PriHealthOrg, namely: (a) Business, Process, (c) Compliance, (d) Technology Standards Compliance (e) Security policies and (f) Enterprise policies.

In Table 5.37 the researcher summarises the aforementioned findings and the proposed guidelines (GU1-3).

GU	Proposed Guidelines	Findings
1	Aspects (e.g. architecture, technology, organization, and information)	The policies identified cover various aspects such as: architecture, organization, and information
2	Areas (e.g. security, cross-company cooperation, design-time, run-time)	The policies identified cover various areas such as: business, process and security policies
3	Enforcement (e.g. manually or automatically)	Enforcement both in a manual and automated approaches

Table 5.37: Testing the Policies Element in PriHealthOrg – Findings for Guidelines

Also, the researcher investigated the way that these policies were enforced in PriHealthOrg. To the issue of policy enforcement the Quality-Manager reported that:

'The leaders describe, in writing, the nature and scope of services provided through contractual agreements. These contracts form the basis of the policies.'

The IT-Manager, stated:

'The leaders are responsible for the contracts, we are [IT department] responsible for translating and complying with these contracts, when we automate the business processes.'

This statement reveals that the policies are set by the leaders in a manual way. This finding is in accordance with the previously reported view of the IT-Manager (Section 5.4.6.5) that a policy and contract management system is not utilised, but is under consideration. However, the researcher observed in a demonstration given by a healthcare professional, that the access to patient information in electronic format was restricted (role based restriction). This observation reveals that at least for security and compliance policies there was technology assisted enforcement.

Furthermore, the policy enforcement is observed in PriHealthOrg both for design-time and run-time. As mentioned, by the interviewees most of the policies are contractual, based on laws, directives, accreditation guidelines and internal quality standards. These are enforced at the design-time. However, the technology compliance and security policies were detected in run-time, as well. These are part of the specifications provided to the researcher for the SAP BI and SAP IS-H. In more detail, the specification manual mentions a mechanism that runs on security policies for the first and technology standards policies (e.g. data/communications) for the latter (SAP, 2012a; 2012b). The lack of other policies on the run-time, even though the technology (SAP platform) supports them, can be attributed to the level of governance identified in PriHealthOrg (e.g. Managed Level of SOA Governance) that can be satisfied with the manual and design-time policy enforcement, at the time of research. The researcher presents the proposed types of policies and the findings in Table 5.38.

	Proposed Types	Findings
Type of enforcement	Manual	Written documentation of policies (e.g. contracts)
	Technology assisted	Observed by the researcher as part of the access control of sensitive patients' data
	Automated	Not Observed
Design & Run-time Policies	Enterprise	Accreditation program guidelines
	Business	Quality and patient's needs
	Process	Documented policy for development, execution and testing
	Compliance	Laws and directives
	Technology Standards Compliance	HL7, medilab, SAP protocols
	Security	Strict management, Safety and confidentiality of data

Table 5.38: Testing the Policies Element in PriHealthOrg – Findings for Policies Types

Furthermore, the researcher tested the Healthcare Aspects (HA1-2) proposed as part of the SOA PO element (described in Table 3.17). In regard to **HA1: Alignment policies**, the empirical data presented in this section (e.g. business policies) reveal that such policies were placed to aid the alignment. Thus, the findings concur with the proposition. Also, for the **HA2: Policies based on risk minimisation**, findings (e.g. security policies) were also identified. Therefore HA2 is also in line with the findings. The proposed HA1-2 and the findings are illustrated in Table 5.39.

HA	Proposed Healthcare Aspects	Findings
1	Alignment policies	Business policies identified that support alignment
2	Policies based on risk minimization	Security policies identified that support risk minimization

Table 5.39: Testing the Policies Element in PriHealthOrg – Findings for Healthcare Aspects

To this end, the Policies element and its attributes, sub-elements, guidelines, additions and healthcare aspects proposed by the researcher were investigated and tested by gathering data from the PriHealthOrg case. In the next section the Metrics element is investigated and analysed.

5.4.6.7 Testing Metrics (ME) Element

Regarding the utilisation of Metrics in PriHealthOrg, the researcher discussed the issue with the interviewees, and received an affirmative response that PriHealthOrg develops and employs several metrics to gain feedback for evaluation and control of their business processes. More precisely and regarding the first proposed attribute **AT1: Improve transparency**, the researcher identified in the archival records that:

'Measuring clinical and management processes in the hospital results in the accumulation of data and information. Understanding how well the hospital is doing depends on the analysis of the data and information over time and

in comparison with other organisations. This tracking and comparison may require technology and/or staff members with data management experience...thus: (a) The leaders understand the measurement and improvement priorities in terms of this necessary support and (b) The leaders understand the technology and other support requirements for tracking and comparing measurement results.'

This report indicates that PriHealthOrg uses metrics (raw data or technology supported measurement) to obtain feedback for clinical and managerial processes, thus improve transparency. Thus the empirical data agree with the proposition (e.g. AT1).

In addition, when the IT Manager was asked to comment on the **AT2: Provide visibility of essential states and parameters of the SOA initiative**, he replied:

'We use measurements to have a clear view of how the automated processes, or integration or WS or SOA etc. work. We actually have to know how they work, so as to improve the current state. As stated by my colleague [this was a group interview and the IT Manager mentioned the Quality Manager] we are always in a quality improvement mode...'

In interpreting the empirical data, it appears that the IT Manager talks about the characteristics that metrics hold, like: (a) improve transparency and (b) provide visibility of the SOA initiative (e.g. 'the way it works'). Evidently the empirical evidence support the Attributes (AT1-2) proposed by the researcher (Table 3.17) for the ME element. To this end, the proposed attributes and findings are summarised in Table 5.40.

AT	Proposed Attributes	Findings
1	Improve transparency	Utilized to provide transparency of IT,SOA
2	Provide visibility of essential states and parameters of the SOA initiative	Provide clear view of how SOA works

Table 5.40: Testing the Metrics Element in PriHealthOrg – Findings for Attributes

In addition, the researcher investigated the proposed Sub-Element **SE1: Metrics categories** that proposes that metrics are divided in several categories, examples of which are given like: Services, Service operation, Projects and Governance processes. The interviewees when asked to comment on the proposed SE1 replied positive on the use of the proposed categories and described that these examples reflect on most of the metrics categories employed in PriHealthOrg. Thus, in this case the aforementioned proposition and examples coincide with the empirical evidence.

Regarding the proposed Guideline, **GUI: Design metrics for categories, such as: Services, Service operation, Projects, Governance processes**, from the empirical evidence presented it appears that PriHealthOrg designed metrics for categories as Services, Service Operation, Clinical Process and Projects. Thus, empirical evidences are in line with the proposition. The researcher presents the proposed guideline and the findings in Table 5.41.

SE	Metrics Categories	Findings
1	Services	<ul style="list-style-type: none"> • Composite services
2	Service Operation	<ul style="list-style-type: none"> • Quality • Functionality • Performance
3	Clinical Processes	<ul style="list-style-type: none"> • Patient assessments • Laboratory services • Radiology /diagnostic imaging services • Surgical procedures • Antibiotic and other medication use • Medication errors and near misses • Anesthesia and sedation use • Use of blood and blood products • Availability, content, and use of patient records • Infection prevention and control, surveillance, and reporting • Clinical research
4	Governance Processes	<ul style="list-style-type: none"> • The procurement of routinely required supplies and medication essential to meet patient needs • Reporting of activities as required by laws and regulations • Risk management • Utilization management • Patient and family expectations and satisfaction • Staff expectations and satisfaction • Patient demographics and clinical diagnoses • Financial management • Prevention and control of events that jeopardise the safety of patients, families, & staff

Table 5.41: Testing the Metrics Element in PriHealthOrg – Findings for Metrics Categories

The fieldwork data show that the OS in PriHealthOrg chooses to focus metrics not in the low level of SOA service decomposition (e.g. single services) but at a higher level where services are grouped and form composite ones. The researcher does not claim that further metrics for SOA Services are not produced in PriHealthOrg as such claim would require more evidence and data from multiple sources. Such detailed research on the metrics is out of the scope of this dissertation. Yet the empirical data reveal that the OS focuses on metrics for business processes, as in the Clinical Process category. This way to monitor SOA services, is described in literature as reactionary, as the organisation can only measure the operation of the service (if it is up and running) and react if the process stops working (Biske, 2008). Opposite to this, Aier *et al.*, (2009) endorses a more proactive view, with the governance of services directed in the behaviour of services (the way they perform) and thus each level (even the low level

decomposition) has separate goals and metrics. The absence of a more thorough SOA measurement (single services) as proposed in literature was discussed in an interview with the Quality Manager, who reported:

“In healthcare most organisations have limited resources, they cannot collect data to measure everything they want. Thus, each organisation must choose which processes and outcomes are most important to measure based on its mission, patient needs, and healthcare services. Measurement often focuses on those [e.g. processes, healthcare services etc.] that are of high risk to patients, provided in high volume, or are problem prone. Leaders are responsible for making the final selection of key measures to be included in the organisation’s quality activities.”

The manager’s view reveals that a balance between metrics and resources needed to develop and analyse metrics was kept in this case. To keep this balance and also measure the most important aspects (as explained in the aforementioned view) PriHealthOrg focused in processes with high risk to patients, provided in high volume, or are problem prone. This finding reveals a characteristic distinctive to healthcare that as explained it may raise concern due to its reactionary nature. Therefore, the researcher highlights the issue of “Distinctive Metrics” for further research.

Regarding the Additional Guideline, AGU1: **Goal/Question/Metric (GQM) method** proposed in Section 3.2.7, it can be stated that a similar process was applied in this case. GQM follows a top-down approach by first defining goals, then deriving questions and finally deriving metrics (Aier *et al.*, 2009). The same method was utilised in PriHealthOrg for a process they refer to as “Timeline of laboratory results”. The goal of this process is to keep a defined time period for reporting the test results. Thus, as reported to the researcher, by the Quality Manager, they observe different timelines (e.g. availability of data), based on patient needs, services offered, and clinical staff needs. Also, special attention is given to urgent tests, such as those from the emergency department, operating theatres and intensive care units. Therefore, upon those they measure the timeliness of the reporting (e.g. test results). A graphical representation of the aforementioned example and the resemblance with the GQM method can be seen in Figure 5.12.

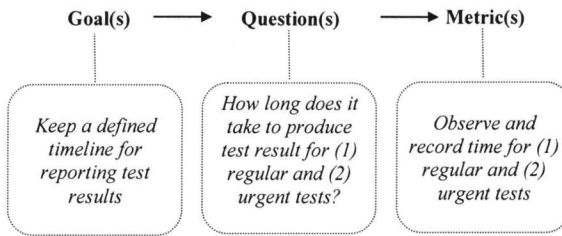


Figure 5.12: Example of the Goal/Question/Metric (QGM) Method in PriHealthOrg

Thus, the QGM method can be considered as a useful guideline for the ME element.

Also, the researcher tested the proposed Healthcare Aspects (HA1-2) as these were presented in Chapter 3 (Table 3.17). Empirical evidence gathered in this case reveal that metrics were set to measure the business processes and assisted the OS to measure alignment (between business and IT) and thus **HA1: Metrics to measure alignment level** proposition agrees with the findings. On the contrary, the second aspect **HA2: Metrics measuring complexity** was not supported by the research findings. Yet it was revealed from the interviewees that in PriHealthOrg the SOA maturity has not reached such levels that SOA complexity can be an issue and thus metrics addressing complexity were not designed and implemented (also addressed as part of the OS HA5). The researcher presents the proposed aspects and findings in Table 5.42.

HA	Proposed Healthcare Aspects	Findings
1	Metrics to measure alignment level	The metrics measure indirectly the alignment as they are set to measure the business policies
2	Metrics to measure complexity	Not Observed

Table 5.42: Testing the Metrics Element in PriHealthOrg – Findings for Healthcare Aspects

Thus far, the Metrics element and its attributes, sub-elements, guideline and healthcare aspects proposed by the researcher were investigated and tested by gathering data from the PriHealthOrg case. In the next section the Best Practices element is examined and analysed.

5.4.6.8 Testing Best Practices (BP) Element

The interviewees were initially asked to provide their view on the issue of Best Practices and if such practices were utilised in PriHealthOrg. With the Quality Manager reporting:

'Of course we utilise best practises, some set by us [e.g. OS], others by other individuals in charge of the departments' operation, experts etc. My door is always open for a good idea.'

This finding relates to the proposed Guideline, **GUI: Maintained by the organisational entity**, as it depicts the OS to maintain best practices, and apply them accordingly. In addition, on the issue of the best practices the Project-Manager, added:

'The accreditation program that was used to provide the know-how for our restructuring towards patient centred processes, is a best practice by its self. We examined a lot of accreditations and standards, this was the toughest and most famous, and it's full of best practises for many quality improvements and standardisation processes.'

The researcher, reflecting on the manager's view, investigated the accreditation program and identified that the accreditation foundation developing the program supports not only individual organisations, but international communities, as 375 hospitals in 47 countries (till June 2012) utilised it. The program's professional workforce works directly with healthcare organisations to achieve their quality goals, as well as helping ministries, government agencies and health professional groups develop national accreditation programs. These kinds of collaborations includes partnerships with international agencies such as the World Health Organization (WHO), and with national accreditation programs, thus in many respects the accreditation program can be considered as an Industry Best Practise. In more detail, the development of the program includes:

- A governing body inclusive of international experts from around the world,
- Accreditation decisions by an international committee of health care experts,
- Standards revisions guided by an international panel,
- Advisory Councils made up of health care leaders and experts in Europe, the Middle East and Asia Pacific,
- Collaborative research on quality and safety with international agencies.

The aforementioned evidences are in line with the proposed Attributes (AT1-2), **AT1: Collects experience**, and **AT2: Support the creation of new policies**. In PriHealthOrg the best practices used (part of the accreditation program) are: (a) a collection of experiences from various experts (e.g. AT1), (b) used to create new policies (e.g. AT2) and (c) supporting the creation of new policies (e.g. AT2). For example, this was evident for the security policies

(analysed in the PO element). On the contrary, there is no evidence that directly support the view that the best practices employed in the PriHealthOrg case provided a cost-effective operation. Thus, **AT3: Cost-effective operations** was not observed in this case. Even though the empirical evidence do not support this attribute, when the IT-Manager was asked to comment he replied that to measure the direct cost (or cost reduction) of SOA in healthcare is a good practice but a complex process that needs detailed and focused research, that at the time was not set as a priority. Thus, the researcher refrains from discarding this proposition and considers it as not observed in this case organisation. The propositions and the findings for each attribute are presented in Table 5.43.

AT	Proposed Attributes	Findings
1	Collects experience	Best practices (part of the accreditation program) are a collection of experiences from various experts
2	Support the creation of new policies	Evidence indicates that best practices were used to create new policies (e.g. security policies)
3	Cost-effective operation	Not Observed

Table 5.43: Testing the Best Practices Element in PriHealthOrg – Findings for Attributes

Moreover, the researcher tested the proposed Sub-Element **SE1: Best practices' categories** as this was presented in Table 3.15 and as it is included in the BP element in Table 3.17. Empirical data identified in the archival records show several best practices (divided in categories) presented in the form of guidelines and recommendations (issue also explored in OS AT3). The categories were based on the business process identified by the accreditation program. The interviewees mentioned that the OS followed these guidelines to great extent. Thus, the empirical evidence coincides with the findings.

The researcher investigated Additional Guideline, **AGU1: Best practices categorisation**, as this was included in the BP element proposal (Table 3.17). For this proposition the researcher employing the O'Dell & Grayson (1998) justification and illustrated four categories, like: Good Idea, Good Practice, Local Best Practice and Industry Best Practice. When the researcher asked the interviewees to comment on the issue, the Quality Manager reported:

'This makes sense to have such categories and then be able to put weight [e.g. meaning value] on the practice. I can see this as a useful method and certainly consider it.'

In interpreting the aforementioned views the proposed additional guideline can be considered as a valuable guideline in this case. Thus, the proposition is in accordance with the empirical evidence.

The interviewees when asked to comment the **HA1: Best practices based on standards**, they mentioned that the practices utilised in PriHealthOrg are practices based on international healthcare, management and IT standards. Also, they pointed out that the accreditation program might be considered as a best practice itself. Thus, the findings concur with the proposition.

Regarding the proposed **HA2: Practices focusing on testing and error minimization** the empirical evidences (e.g. HA2: Policies based on risk minimisation) show that such practices were used in PriHealthOrg case. Therefore this aspect is in line with the findings. The researcher presents the proposed aspects and findings in Table 5.44.

HA	Proposed Healthcare Aspects	Findings
1	Best practices based on standards	Standards and BP were provided by the accreditation program
2	Practices focusing on testing and error minimization	Evidence of risk minimisation

Table 5.44: Testing the Best Practices Element in PriHealthOrg – Findings for Healthcare Aspects

Thus far, the Best Practices element and its attributes, sub-elements, guideline and healthcare aspects proposed by the researcher were investigated and tested by gathering data from the PriHealthOrg case. In the next section, the empirical data regarding the Governance Processes element are presented.

5.4.6.9 Testing SOA Governance Processes (GP) Element

In Chapter 3, Section 3.2.9 the researcher presented SOA Governance Processes element as one of the main elements of any SOA Governance framework. This was based on the notion that the GP element includes all the relevant to governance activities that an OS undertakes in order to govern SOA. Additionally, the researcher distinguished and highlighted specific Attributes (AT1-5) for the GP element that the interviewees were asked to comment upon. The findings of these interviews alongside the data retrieved from the archival records are presented in this section.

When the Project-Manager was asked to comment on **AT1: Deal with the management of the service life-cycle**, it was reported that:

'The leaders frequently have the opportunity to create new governance processes or need to modify existing ones. Mainly, the processes use design elements from authoritative sources, such as: laws/regulations, clinical

practice guidelines, national standards, norms and other. They [e.g. governance processes] may also be structured by the experiences of others, especially if considered to be best practices. Of course, such practices are evaluated by the organisation and tested before hand.'

The manager's view that the governance processes are created and/or modified in a repeatable fashion (also reported in RL AGU1), shows that this is a recurring process, similar to the proposed lifecycle (Section 3.3.6). Additionally, this finding agrees with the plan phase, as this was proposed in Section 3.2.9, yet this issue (and the rest of the phases) will be explored later on in this section.

Regarding the **AT2: Manage service portfolio**, the IT Manager reported:

'We have a dedicated team with 19 members that are in charge of the service lifecycle from design to testing, implementation, monitoring, updates, retirement...all these are documented and allocated to staff as part of the contractual agreements we have with the hospital.'

Interpreting from the empirical evidence it is clear that governance processes were linked with the management of the service portfolio, as described by the manager. Thus, AT2 coincides with the findings.

Furthermore, for the **AT3: Ensure that services are designed properly** and **AT4: Ensure SOA will deliver the features required by an organization**, the IT Manager replied that since most of the services and projects they create are directly linked with patients' wellbeing they insure they are designed properly, based on standards. He also mentioned that the IT team tests them to secure their effectiveness and the safety of their approach. Thus, the empirical evidence concurs with the attributes.

In the subject of **AT5: Create and enforce policies**, it was presented in Section 5.4.6.6 that the OS adopted, created and enforced policies and implemented processes to do so. Therefore, fieldwork data are in agreement with the proposition in this case. In order to summarise the aforementioned proposed attributes and findings the researcher presents them in Table 5.45.

AT	Proposed Attributes	Findings
1	Deal with the management of the service life-cycle	Dedicated team to manage service lifecycle
2	Manage service portfolio	Dedicated team to manage service portfolio
3	Ensure that services are designed properly	Design of services identified as a process
4	Ensure SOA will deliver the features required by an organization	Identified as a process

5	Create and enforce policies	Creation and enforcement of policies was identified as a process
---	-----------------------------	--

Table 5.45: Testing the Governance Processes Element in PriHealthOrg – Findings for Attributes

In Chapter 3 the researcher proposed as Sub-element **SE1: Governance lifecycle** as part of the GP element (Table 3.17). The empirical data for AT1-5 (e.g. processes for design, plan, maintain, retire services etc.) reveal that such lifecycle exist in PriHealthOrg. Thus, the findings concur with the proposition. Yet, a detailed account of the governance lifecycle (e.g. phases) will be presented in the following paragraphs.

The researcher asked the interviewees to comment on the proposed Guideline, **GU1: Governance lifecycle may include phases such as: plan, define, implement and measure**, to which they replied positively that such phases existed. As described in AT1 the **plan** phase is identified in PriHealthOrg including the use of best practices. For the **design** phase, the researcher examined the archival records where it is stated that PriHealthOrg during the design of the processes proceeds to design: methods to monitor data from various aspects (like facility management program, introduction of new technology, employees' skill and knowledge) and staff education program based on the processes that will be introduced. This finding describes that in PriHealthOrg the design phase was part of the governance processes, as the hospital designs methods, programs for various aspects.

Regarding the **implement** phase of the GP element, as analysed in Section 5.4.6.6, the empirical evidence supports this proposition. Thus, the empirical evidence supports that such phase exists in this case.

Regarding the **measure** phase of the proposed element, as analysed in Section 5.4.6.7, the empirical evidence supports the proposition of governance processes measurement. Additionally, the researcher identified more data for this proposition in the archives. There two processes were addressed namely: (a) data validation and (b) data analysis:

'Data validation is an important tool for understanding the quality of the quality data and for establishing the level of confidence decision makers can have in the data. Data validation becomes one of the steps in the process of setting priorities for measurement, selecting what is to be measured, selecting and testing the measure, collecting the data, validating the data, and using the data for improvement. The essential elements of a credible data validation process include the following: (a) Re-collecting the data by a second person not involved in the original data collection, (b) Using a

statistically valid sample of records, cases, and other data, (d) Comparing the original data with the re-collected data, (c) When data elements are found not to be the same, noting the reasons (for example, unclear data definitions) and taking corrective actions.'

Additionally, in the archives it was reported that the analysis process includes comparisons internally, with other organizations when available, and with scientific standards, and desirable practices. As stated in the records, the goal of data analysis is to be able to compare an organisation in four ways:

- With itself over time, such as month to month, or one year to the next,
- With other similar organizations, such as through reference databases,
- With standards, such as those set by accrediting and professional bodies or those set by laws or regulations
- With recognized desirable practices identified in the literature as best practices

These findings describe, the way that data are validated and analysed in this case, and thus provide valuable insights. On the issue of data validation and processes analysis, the Quality General Manager, reported:

'We want the quality of the services provided to patients, anytime, anywhere, by all the staff members to be the same high quality standards set by us and the accreditation program. Thus creating, measuring, validating, analysing, changing, recreating processes is a continuous flow of activities.'

As this issue was emphasised in the archival records and by the interviewees, the researcher highlights the '**Data validation**' and '**Data analysis**' issues to be further explored in Chapter 6.

Moreover, the researcher investigated the proposed Additional Guideline, **AGUI: SOA Governance phases and their attributes**, as this was presented in Figure 3.2. For this proposition the researcher summarised the views of all the interviewees in Table 5.46. In this table the positive identifications marked with (✓), the negative with (x) and the no answer with (-). In more detail, the first column includes the proposed phases followed by the attributes and the responses of the interviewees are depicted in the third to sixth column respectively.

Phases	Attributes	Q-M	QG-M	P-M	IT-M	ITG-M
Plan	SOA Strategy	✓	✓	✓	✓	✓
	SOA requirements/Specifications	✓	✓	✓	✓	✓
	Initial governance framework	✓	✓	✓	-	✓
	Financial and SOA Investment	✓	✓	✓	✓	✓
	Communication and Direction	✓	✓	✓	✓	✓
	Responsibilities, roles and skills	✓	✓	✓	✓	✓
	Organizational structures	✓	✓	✓	✓	✓
	Services ownership	✓	✓	✓	✓	✓
Design	Transition Plans	-	-	✓	✓	✓
	SOA Reference Architecture	✓	✓	✓	✓	✓
	SOA Processes	✓	✓	✓	✓	✓
	Organization and Relationships	✓	✓	✓	✓	✓
	SOA policies	✓	✓	✓	✓	✓
	Metrics	✓	✓	✓	✓	✓
	Maturity model	✓	✓	-	-	✓
Implement	Governance processes	✓	✓	✓	✓	✓
	Transition plans	✓	✓	✓	✓	✓
	Enable operation and use	✓	✓	✓	✓	✓
	Activate processes	-	-	✓	✓	✓
	Enforce policies	✓	✓	✓	✓	✓
Measure	Monitor metrics	✓	✓	✓	✓	✓
	Evaluate performance	✓	✓	✓	✓	✓
	Manage policy ccompliance	✓	✓	✓	✓	✓

Table 5.46: Testing the Governance Processes Element in PriHealthOrg – Findings for Governance Phases

The uniformity of responses is understandable as the interviewees were part of OS and thus aware and able to identify the attributes and phases in a similar manner. Some minor differences exist (no answer in some of the questions) as the interviewees had different roles and got involved in different phases of governance and therefore they were able to understand and identify the attributes with some minor differences. Yet, all the attributes and phases seem to be in line with the empirical data gathered in this case.

Additionally, the researcher examined the proposed Healthcare Aspects (HA1-4) as these are presented in Table 5.47. Thus, in regard to the **HA1: Alignment governance process**, the data presented so far (PO HA1) show that the OS created alignment processes. For example, in ME HA1 it was revealed that OS created goals and metrics to identify if the goals were met. Thus, the field data concur with the proposition.

Regarding the **HA2: Promotional processes that endorse SOA and its beneficial parameters (e.g. educational and communication planning)**, as explained in OS AT6 several endorsement processes were implemented. One such process in the form of an educational program was designed and performed during the restructuring. On the issue the Quality General-Manager reported:

'We formed and delivered an education program over a period of 3 months, in which each employee had the chance to sit in a class for 2 hours and hear about the vision, general information and specialised information for his/her profession. They were delivered information on issues, such as: what is the accreditation program, what is a process, why should I follow that process, where can I find information about it, the whole story so they can understand what was required by them. From there on, each individual learned what was required of him/her, and what was required in the everyday business he/she was part of. We didn't want to make them crazy, overloading them with information and statistics, but to get our message across.'

In interpreting the empirical evidence, it appears that this educational program: (a) endorsed SOA vision, (b) was vast and well designed and (c) promoted the change to patient centred approach, under which the SOA infrastructure will be (and partially is) implemented. Clearly, the scale of the aforementioned educational endeavour was vast and unique for this case but required for such a restructuring. Another, interesting finding is that PriHealthOrg included everyone in this educational program, as to be and/or feel part of and comprehend the effort put into transforming the business processes.

Another important finding, identified from the empirical evidence, is the importance of the communication parameter, as complementary to the educational program. The Quality General-Manager's statement reported previously, explains that employees were informed on how and where to retrieve information regarding the restructuring, the business processes and details that concern them. Also, the researcher observed that this communication channel was extended to emails, memos, notifications and other means. Furthermore, as seen in Figure 5.9, a dedicated council of 'Management of communication and information' exists. This council, based on the accreditation program guidelines is responsible for issues, such as: (a) identifying information needs, (b) designing an information management system, (c) defining and capturing data and information, (d) analysing data and transforming it into information, (e) transmitting and reporting data and information, and (f) integrating and using information. The notion of communication was proposed as part of the educate phase, however the empirical findings reveal that PriHealthOrg identifies this as a critical aspect and pays great attention to address it. This is also evident in the findings presented for OS HA6. Thus, the researcher highlights the role of 'Communication' in this case. Yet this issue will be addressed in Chapter 6.

Also, concerning **HA3: Standardisation process**, as shown in OS HA8 the OS dedicated structures (e.g. teams in this case) that proposed and evaluated various standards (e.g. medical, managerial, IT). Thus, empirical evidence concur with the proposition for this case. The proposed aspects and findings are presented in Table 5.47.

HA	Proposed Healthcare Aspects	Findings
1	Alignment governance process	Created several processes aiding alignment
2	Promotional processes that endorse SOA and its beneficial parameters (e.g. educational and communication planning)	Identified several endorsement processes
3	Standardisation process	Dedicated committees with relevant processes
4	Testing processes	Testing processes were identified (e.g. for policies)

Table 5.47: Testing the Governance Processes Element in PriHealthOrg – Findings for healthcare Aspects

To this end, the GP element and its attributes, sub-elements, guideline and healthcare aspects proposed by the researcher were examined and tested for the PriHealthOrg case. In the next section, the SOA Governance framework and the relation of each element are investigated.

5.4.6.10 Testing the SOA Governance Framework and Elements' Relations

Concluding the investigation of the proposed elements of the SOA Governance framework, the researcher proceeded to investigate the framework itself and the proposed relations between the elements (as seen in Table 3.17).

Thus, the interviewees were asked to comment if (a) the proposed SOA Governance framework can be applied as a decision-making tool for SOA Governance by healthcare organisations and (b) if this framework can provide an easy to follow reference blueprint that can diagrammatically express the elements. The interviewees responded positively in the configuration and clarity, of the framework and the IT-Manager stated:

'From our discussions so far and the framework you present I can reflect positively that such framework can be a tool for decision making and highlight important aspect in management, governance and IS/SOA related issues.'

Taking into account this view but also all the interviews and archival records, the researcher concluded in a positive result as all the evidence support the notion that each and every element played a part in SOA Governance for this case. Yet, this case and the data gathered offered several findings (e.g. GP HA2: Communications), new attributes (e.g. GP GU1: Data

Validation) and highlighted practices (e.g. RD element) of a successful SOA implementation. All these will be analytically presented in the next section.

Additionally, the researcher examined if the SOA Governance framework can be an easy to follow reference blueprint. To test this proposition, the researcher invited the interviewees to create SOA Governance scenarios and use the framework (seen in Figure 3.4) to work-out if their requirements on SOA Governance are being satisfied. The Quality-Manager implemented such a simulation scenario in which a new Quality Improvement project on a high-risk process is created:

'Let us assume that a high-risk process, prescription related for example requires to be automated. This can be labelled Quality improvement. Thus, first the Quality Improvement & Patient Safety committee will identify the need. This committee is part of the OS element and needs to proceed to a number of management processes. First check the current status of the process, which can be achieved by the MM element. Gather data regarding the current process, which can be achieved by the ME element and maybe the SGI element if digital data exist, these two need to be connected as they are [pointing at the arrow of the SGI-ME]. Then several governance processes will be created in the OS relating with the GP Element [pointing at the arrow of the OS-GP] as: design the solution, set policies, define roles etc. For these the GP, PO and OS elements are needed. Yet, after the testing and implementation new data and measurement is needed on how well the solution/processes work, so the ME element is used and the SGI to gather the data. Then the Quality Improvement & Patient Safety committee will analyse the data and certify the final version of the process. I see your proposition working, yet I believe it requires the detail of each element to be known to have a clear view of what each element includes.'

In regard to the last remark made by the manager, the researcher agrees that the proposed SOA Governance framework requires to be accompanied with the theoretical analysis of each element (as presented in Table 3.17) to be fully understood. Yet, based on the interviewee's response and several other scenarios that the researcher discussed with other interviewees it is clear that this framework can be used as a SOA Governance blueprint for healthcare organisations.

5.4.6.11 Summarising Findings Obtained from PriHealthOrg

The empirical investigation indicates that the proposed SOA Governance framework can be applied as a decision-making tool for SOA Governance by healthcare organisations. The case data indicated that few additional findings and propositions for further research arose. These findings are summarised below and presented in Table 5.48. In more detail, Table 5.48 horizontally illustrates the attributes, sub-elements, guidelines, additional guidelines, and healthcare aspects, whereas vertically each of the elements, such as Organisational Structure (OS), Roles (RL), Maturity Model (MM), Roadmap, (RD) SOA Governance Infrastructure (SGI), Policies (PO), Metrics (ME), Best Practices (BP) and Governance Processes (GP) are placed. Additionally, next to each element (Attribute, Sub-Element etc.) the researcher placed a column in order to illustrate the Finding (F) for each. The symbols of that column state: (✓) in line with empirical data, (T) Tested, (NO) Not Observed and (UC) Under Consideration.

		SOA Governance Elements																	
		OS	F	RL	F	MM	F	RD	F	SGI	F	PO	F	ME	F	BP	F	GP	F
Attributes	AT1	✓		AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓
	AT2	✓		AT2	✓	AT2	✓	AT2	✓	AT2	✓			AT2	✓	AT2	✓	AT2	✓
	AT3	✓		AT3	✓	AT3	✓			AT3	✓					AT3	NO	AT3	✓
	AT4	✓		AT4	✓					AT4	✓							AT4	✓
	AT5	✓		AT5	✓													AT5	✓
	AT6	✓																	
	AT7	✓																	
	AT8	✓																	
	AT9	✓																	
Sub-elements	SE1	✓		SE1	✓	SE1	T✓	SE1	✓	SE1	✓	SE1	✓	SE1	✓	SE1	✓	SE1	✓
	SE2	✓				SE2	T✓			SE2	UC	SE2	T✓						
	SE3	NO								SE3	UC	SE3	T✓						
	SE4	✓								SE4	UC								
										SE5	UC								
										SE6	✓								
Guidelines	GU1	✓		GU1	✓	GU1	✓	GU1	✓	GU1		GU1	✓	GU1	✓	GU1	✓	GU1	✓
	GU2	✓		GU2	✓	GU2	✓	GU2	✓			GU2	✓						
	GU3	✓		GU3	NO	GU3	✓	GU3	✓			GU3	✓						
					GU4	NO													
Additional Guidelines	AGU1	✓		AGU1	T✓			AGU1	✓					AGU1	✓	AGU1	✓	AGU1	✓
	AGU2	✓																	
	AGU3	✓																	
Healthcare Aspects	HA1	✓				HA1	✓					HA1	✓	HA1	✓	HA1	✓	HA1	✓
	HA2	✓										HA2	✓	HA2	NO	HA2	✓	HA2	✓
	HA3	✓																HA3	✓
	HA4	✓																HA4	✓
	HA5	NO																	
	HA6	✓																	
	HA7	✓																	
	HA8	✓																	
	HA9	✓																	

Table 5.48: Proposed SOA Governance Elements & Findings for PriHealthOrg Case [(✓) In Line With Empirical Data, (T) Tested, (NO) Not Observed and (UC) Under Consideration]

Moreover, the case data uncovered additional aspects regarding Organisational Structure, Maturity Model (MM) and Governance Processes (GP) elements. In Organisational Structure (e.g. OS AT6 and HA9) and Governance Processes (e.g. GP HA2) the data gathered from interviewees and empirical evidence point towards highlighting the role of ‘Communication’ for this project. The researcher acknowledges that even though this aspect is addressed (as part of the elements themselves) it requires to be highlighted in a more substantial way. Alongside, for the Maturity Model AT1 it was identified that the assessment was based on the ‘Quality Improvement’ method utilised by PriHealthOrg. This finding can be considered as a valuable detailed approach due to its sophistication to address aspects in a healthcare (e.g. high risk, problematic etc.) perspective. Furthermore, regarding the Governance Processes GU1 it was revealed through this fieldwork that attributes like ‘Data validation’ and ‘Data analysis’ are useful in the measurement phase. Details for both were identified and presented. These findings will be further explored in Chapter 6.

The case data also revealed the way the Roadmap element was constructed in the PriHealthOrg. In more detail, (regarding the GU2), a graphical representation of the Roadmap element, presented in Figure 5.11, that illustrates the steps the Organisational Structure took to create the SOA Roadmap was shown. This is an important finding as it provides an insight look of the steps followed to build the roadmap of a successful SOA project.

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

- Regarding Organisational Structure GU3, the researcher proposes the issue of ‘Federated Decentralisation’ to be further examined in relevance to the governance balance between the departmentalisation and OS, as this proved to be of high importance and thus, should be investigated in depth.
- Regarding Maturity Model AT1, researcher proposes the issue of ‘Quality Improvements’ to be further investigated to facilitate a deeper level of analysis, as this is identified as a sophisticated method of addressing maturity.
- Regarding Metrics GU1, the researcher proposes the issue of ‘Distinctive Metrics’ to be further researched, as the focus to be placed on processes (e.g. clinical) rather on individual project was an interesting finding that is valued in PriHealthOrg.

5.5 Conclusions

Chapter 5 presented and analysed the SOA Governance practices by two healthcare organisations, namely PubHealthOrg and PriHealthOrg. Based on the empirical data reported in this chapter, the enquiry is now able to draw conclusions. Nonetheless, 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.

The empirical investigation indicates that the proposed SOA Governance framework can be applied as a decision-making tool for SOA Governance by healthcare organisations. From the discussions with the interviewees few additional findings related to SOA Governance and some issues for further research arose. In Section 5.3.6.11 and 5.4.6.11 the researcher summarised the results for each case study individually and highlighted both the important

finding and the issues for further research. In this conclusive section the researcher presents a summary of these for both organisations, as seen in Table 5.49.

In more detail, Table 5.49 horizontally illustrates the attributes, sub-elements, guidelines, additional guidelines, and healthcare aspects, whereas vertically each of the elements, such as Organisational Structure (OS), Roles (RL), Maturity Model (MM), Roadmap, (RD) SOA Governance Infrastructure (SGI), Policies (PO), Metrics (ME), Best Practices (BP) and Governance Processes (GP) are placed. Additionally, next to each element (Attribute, Sub-Element etc.) the researcher placed a column in order to illustrate the PubHealthOrg (C1) and PriHealthOrg (C2) for each. The symbols of that column state: (✓) In Line With Empirical Data, (T) Tested, (NO) Not Observed and (UC) Under Consideration.

		SOA Governance Elements																							
		OS		RL		MM		RD		SGI		PO		ME		BP		GP							
Prop.	C1	C2	Prop.	C1	C2	Prop.	C1	C2	Prop.	C1	C2	Prop.	C1	C2	Prop.	C1	C2	Prop.	C1	C2	Prop.	C1	C2		
Attributes	AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	AT1	✓	
	AT2	✓	AT2	✓	AT2	✓	AT2	✓	AT2	✓	AT2	✓	AT2	✓	AT2	✓	AT2	✓	AT2	✓	AT2	✓	AT2	✓	
	AT3	✓	AT3	✓	AT3	✓	AT3	✓	AT3	✓	AT3	✓	AT3	✓	AT3	✓	AT3	✓	AT3	✓	AT3	✓	AT3	✓	
	AT4	✓	AT4	✓	AT4	✓	AT4	✓	AT4	✓	AT4	✓	AT4	✓	AT4	✓	AT4	✓	AT4	✓	AT4	✓	AT4	✓	
	AT5	✓	AT5	✓	AT5	✓	AT5	✓	AT5	✓	AT5	✓	AT5	✓	AT5	✓	AT5	✓	AT5	✓	AT5	✓	AT5	✓	
	AT6	✓	AT6	✓	AT6	✓	AT6	✓	AT6	✓	AT6	✓	AT6	✓	AT6	✓	AT6	✓	AT6	✓	AT6	✓	AT6	✓	
	AT7	✓	AT7	✓	AT7	✓	AT7	✓	AT7	✓	AT7	✓	AT7	✓	AT7	✓	AT7	✓	AT7	✓	AT7	✓	AT7	✓	
	AT8	✓	AT8	✓	AT8	✓	AT8	✓	AT8	✓	AT8	✓	AT8	✓	AT8	✓	AT8	✓	AT8	✓	AT8	✓	AT8	✓	
	AT9	✓	AT9	✓	AT9	✓	AT9	✓	AT9	✓	AT9	✓	AT9	✓	AT9	✓	AT9	✓	AT9	✓	AT9	✓	AT9	✓	
Sub-elements	SE1	✓	SE1	✓	SE1	NO	TV	✓	SE1	✓	SE1	✓	SE1	✓	SE1	✓	SE1	✓	SE1	✓	SE1	✓	SE1	✓	
	SE2	NO	✓	SE2	TV	TV	✓	SE2	UC	UC	UC	SE2	UC	TV	TV	✓	SE2	UC	UC	UC	SE2	UC	TV	✓	
	SE3	NO	NO	SE3	NO	NO	✓	SE3	UC	UC	UC	SE3	UC	UC	UC	✓	SE3	UC	UC	UC	SE3	UC	UC	✓	
	SE4	✓	✓	SE4	✓	✓	✓	SE4	UC	UC	UC	SE4	UC	UC	UC	✓	SE4	UC	UC	UC	SE4	UC	UC	✓	
	SE5	✓	✓	SE5	✓	✓	✓	SE5	UC	UC	UC	SE5	UC	UC	UC	✓	SE5	UC	UC	UC	SE5	UC	UC	✓	
	SE6	✓	✓	SE6	✓	✓	✓	SE6	UC	UC	UC	SE6	UC	UC	UC	✓	SE6	UC	UC	UC	SE6	UC	UC	✓	
Guidelines	GU1	✓	GU1	✓	GU1	TV	✓	GU1	✓	GU1	TV	✓	GU1	✓	GU1	✓	GU1	✓	GU1	✓	GU1	✓	GU1	✓	
	GU2	✓	GU2	✓	GU2	TV	✓	GU2	✓	GU2	TV	✓	GU2	✓	GU2	✓	GU2	✓	GU2	✓	GU2	✓	GU2	✓	
	GU3	✓	GU3	NO	GU3	TV	✓	GU3	✓	GU3	TV	✓	GU3	✓	GU3	✓	GU3	✓	GU3	✓	GU3	✓	GU3	✓	
	AGU1	✓	AGU1	TV	AGU1	NO	NO	AGU1	✓	AGU1	NO	NO	AGU1	✓	AGU1	TV	AGU1	✓	AGU1	TV	AGU1	TV	AGU1	TV	
Additional Guidelines	AGU2	✓	✓	AGU2	✓	✓	✓	AGU2	✓	AGU2	✓	✓	AGU2	✓	AGU2	✓	AGU2	✓	AGU2	✓	AGU2	✓	AGU2	✓	
	AGU3	✓	✓	AGU3	✓	✓	✓	AGU3	✓	AGU3	✓	✓	AGU3	✓	AGU3	✓	AGU3	✓	AGU3	✓	AGU3	✓	AGU3	✓	
Healthcare Aspects	HA1	✓	✓	HA1	✓	✓	✓	HA1	✓	HA1	✓	✓	HA1	✓	HA1	✓	HA1	✓	HA1	✓	HA1	✓	HA1	✓	
	HA2	✓	✓	HA2	✓	✓	✓	HA2	✓	HA2	✓	✓	HA2	✓	HA2	✓	HA2	✓	HA2	✓	HA2	✓	HA2	✓	
	HA3	✓	✓	HA3	✓	✓	✓	HA3	✓	HA3	✓	✓	HA3	✓	HA3	✓	HA3	✓	HA3	✓	HA3	✓	HA3	✓	
	HA4	✓	✓	HA4	✓	✓	✓	HA4	✓	HA4	✓	✓	HA4	✓	HA4	✓	HA4	✓	HA4	✓	HA4	✓	HA4	✓	
	HA5	NO	NO	HA5	NO	NO	✓	HA5	✓	HA5	NO	NO	HA5	✓	HA5	NO	NO	HA5	✓	HA5	NO	NO	HA5	✓	
	HA6	✓	✓	HA6	✓	✓	✓	HA6	✓	HA6	✓	✓	HA6	✓	HA6	✓	HA6	✓	HA6	✓	HA6	✓	HA6	✓	
	HA7	✓	✓	HA7	✓	✓	✓	HA7	✓	HA7	✓	✓	HA7	✓	HA7	✓	HA7	✓	HA7	✓	HA7	✓	HA7	✓	
	HA8	✓	✓	HA8	✓	✓	✓	HA8	✓	HA8	✓	✓	HA8	✓	HA8	✓	HA8	✓	HA8	✓	HA8	✓	HA8	✓	
	HA9	✓	✓	HA9	✓	✓	✓	HA9	✓	HA9	✓	✓	HA9	✓	HA9	✓	HA9	✓	HA9	✓	HA9	✓	HA9	✓	

Table 3.49: Proposed SOA Governance Elements & Findings for C1 (PubHealthOrg) & C2 (PriHealthOrg) [(✓) In Line With Empirical Data, (T) Tested, (NO) Not Observed and (UC) Under Consideration]

Moreover, the case data uncovered additional aspects regarding Organisational Structure (OS), Roles (RL), Maturity Model (MM), Roadmap (RD) and Governance Processes (GP) elements.

- In Organisational Structure (e.g. OS AT6 and HA9) and Governance Processes (e.g. GP HA2) the data gathered from interviewees and empirical evidence for both cases point towards highlighting the role of ‘Communication’ for this project. The researcher acknowledges that even though this aspect is addressed (as part of the elements themselves) it requires to be highlighted in a more substantial way.
- In PubHealthOrg case, for the Roles element the crucial role of the ‘SOA evangelist’ was identified and his contribution to the project’s success emphasised.
- The case data also revealed the way the Roadmap element was constructed in PubHealthOrg and the PriHealthOrg. In more detail, (regarding the GU2), a graphical representation of the Roadmap element, for both cases was presented (Figure 5.5 and 5.11 respectively), that illustrates the steps the OS took to create the SOA Roadmap was shown. This is an important finding as it provides a close look of the steps followed to build the roadmap of two successful SOA project.
- In PriHealthOrg, for the Maturity Model AT1 it was identified that the assessment was based on the ‘Quality Improvement’ method. This finding can be considered as a valuable detailed approach due to its sophistication to address aspects in a healthcare (e.g. high risk, problematic etc.) perspective.
- In PriHealthOrg, regarding the Governance Processes GU1 it was revealed through this fieldwork that attributes like ‘Data validation’ and ‘Data analysis’ are useful in the measurement phase. Details for both were identified and presented.

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

- Regarding Organisational Structure AT5, the researcher proposes the issue of ‘SOA training’ to be further examined in relevance to whom, by whom and on what (e.g. SOA related principles), as this proved to be of high importance and thus, should be investigated in depth.

- Regarding Organisational Structure HA5 and Metrics HA2, the researcher proposes the issue of 'SOA Complexity' to be further investigated to facilitate a deeper level of analysis, as complexity imposes a CSF for the success of a SOA implementation.
- Regarding Roles AT5 and SOA Governance Infrastructure GU1, the researcher proposes the issue of 'IT outsourcing contractual agreements impact on SOA Governance' to be further researched, as it was identified a trigger of SOA success but also a considered concern for SOA Governance.
- Regarding Organisational Structure GU3, the researcher proposes the issue of 'Federated Decentralisation' to be further examined in relevance to the governance balance between the departmentalisation and OS, as this proved to be of high importance and thus, should be investigated in depth.
- Regarding Maturity Model AT1, researcher proposes the issue of 'Quality Improvements' to be further investigated to facilitate a deeper level of analysis, as this is identified as a sophisticated method of addressing maturity.
- Regarding Metrics GU1, the researcher proposes the issue of 'Distinctive Metrics' to be further researched, as the focus to be placed on processes (e.g. clinical) rather on individual project was an interesting finding that is valued in PriHealthOrg.

Empirical data revealed from these case studies confirm that the SOA Governance framework and the proposed elements are valid and useful for SOA Governance in healthcare organisations. Furthermore, all the new findings that have been reported and analysed in this Chapter will be taken into consideration in Chapter 6 to revise the conceptual framework and enhance its value.

CHAPTER 6

SOA GOVERNANCE FRAMEWORK FOR HEALTHCARE ORGANISATIONS

Summary

In Chapter 5, the proposed SOA Governance Framework (Figure 3.4) 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 framework can be used to support SOA Governance processes. Moreover, the findings support modifications to the proposed framework and the issues under investigation. As a result a new element (Communication), four new guidelines (e.g. Role, Quality Improvements, Roadmap Design, Data Validation and Data Analysis) and a healthcare aspect (e.g. Quality Improvements) were added to the framework. These additions address with a wider investigation lens SOA Governance issues in healthcare organisations as they were identified based on research on healthcare organisations. In doing so, satisfying the aim of this dissertation, which is to develop a framework for SOA Governance in healthcare organisations to support decision makers and researchers.

6.1 Introduction

The growing need for Healthcare Information Systems integration has attracted a lot of research and industrial interest, as it is still an unfulfilled promise. Nowadays, healthcare organisations have turned to the utilisation of Service Oriented Architecture paradigm, to overcome their integration problems. However, limited research has been conducted in the area of SOA in healthcare organisations. As reported in Chapter 1, this dissertation deals with the SOA Governance in healthcare organisations. In Chapter 2 the researcher, reviewed the normative literature and he: (a) determined SOA CSFs in healthcare and (b) identified common concepts of existing SOA Governance models. For the latter a concept map was created, as it is illustrated in Figure 2.6. The SOA Governance concept map not only provided a graphical representation of the main concepts, but also aided in the discussion of the similarities (common elements), differences (scale, detail and analysis) and limitations (confusion, overlapping, and lack of testing and healthcare aspects). Consequently, the researcher suggest to: (a) use the common elements identified in the map (e.g. literature), (b) address the limitations (identified in Chapter 2) by enhancing the analysis with additions beyond the level provided by the normative literature and (c) infuse the framework with the healthcare perspective (CSFs and HIS challenges). Thus, to address these issues, Chapter 3 derived and conceptualised a framework that can be used to explain SOA Governance in healthcare organisations. The proposed framework contributes in the SOA area, as it: (a) highlights the elements of SOA Governance, (b) introduces each element based on attributes, sub-elements, guidelines, relations and (c) infuses the elements with healthcare specific aspects.

Chapter 4 justified the selection of an appropriate research methodology that can be used to test the proposed framework. 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 employed in Chapter 5 to test the conceptual SOA Governance framework. In doing so, Chapter 5 presented and analysed the empirical data collected from two healthcare organisations, namely PubHealthOrg and PriHealthOrg. The preliminary research findings were described and the data retrieved were used to test the conceptual framework and the issues under investigation, as these were summarised in Table 3.17. In doing so, the researcher tested and evaluated the conceptual SOA Governance elements and framework proposed in Chapter 3 (Table 3.17).

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 framework (presented in Figure 3.4) for SOA Governance in healthcare organisations, (Section 6.3). The chapter concludes with the development of a revised framework for SOA Governance in healthcare organisations that can be used as a decision-making tool by the healthcare organisations. The proposed framework can be considered as novel and can be used as a supporting tool for decision-making and a beneficial blueprint for SOA Governance in healthcare organisations.

6.2 Lessons Learnt from Case Studies

Through the empirical evidences presented in Chapter 5, the researcher studied the area of SOA Governance in healthcare by: (a) applying the SOA framework elements and (b) examining the elements relations. 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 section (or this dissertation) to offer prescriptive guidelines for the SOA Governance 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 SOA Governance phenomenon in healthcare organisations, taking into consideration the parameters involved in each case. 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 SOA Governance has an important role during the implementation processes for HIS integration. This crucial role has been reported in the literature and was validated through this research. Within the context of healthcare organisations investigated in this research it appears that SOA Governance is a CSF.

Lesson 2 Each SOA Governance element identified in this research plays an important role during the implementation of SOA Governance in healthcare. Their crucial role has been reported in the literature and was validated through this research.

- Lesson 3** The conceptual framework can be used from organisations as a supporting tool for decision-making and to allow researchers to apprehend and analyse SOA Governance in healthcare organisations.
- Lesson 4** The data gathered from the fieldwork for both cases point towards highlighting the role of Communication. The researcher suggests that the role of Communications needs to be highlighted in a more substantial way and thus includes it as a new element of the SOA Governance framework and proposes a set of attributes, sub-elements, guidelines and healthcare aspects to describe it.
- Lesson 5** For the Roles (RL) element the crucial function of the ‘SOA evangelist’ was identified and his contribution to the project’s success emphasised. The researcher suggests that this role need to be included in the list of proposed SOA roles and so defines this findings and attaches specific responsibilities.
- Lesson 6** The design and methodology used to create the Roadmap (RD) for both case organisations was shown. This is an important finding as it provides a close look of the steps followed to create the roadmap for a successful SOA implementation in these two organisations. The researcher includes this finding as part of the RD element.
- Lesson 7** For the Maturity Model (MM) element it was identified that the assessment was based on the ‘Quality Improvement’ method. This finding can be considered as a valuable detailed approach due to its sophistication to address aspects in a healthcare (e.g. high risk, problematic etc.) perspective and thus is included as a guideline.
- Lesson 8** Regarding the Governance Processes (GP) element, it was revealed through this fieldwork, that attributes like ‘Data validation’ and ‘Data analysis’ are useful in the measurement phase. Therefore, these practical findings alongside details for both are included in the GP element.

6.3 The Revised Conceptual Model for SOA Governance in Healthcare

The findings of the empirical analysis, discussed in Chapter 5, are used in this chapter to extend and modify the conceptual framework that was proposed in Chapter 3 (Table 3.17). Section 6.3 is divided in two parts: (a) Section 6.3.1 that presents the findings that derived from the analysis of the two case studies, regarding the elements of the SOA Governance framework and (b) Section 6.3.2 that presents: the findings that derived from the analysis of the two case studies, regarding the conceptual framework (summarised in Section 5.5) and the revised conceptual SOA Governance Framework.

6.3.1 Findings and Revised Elements for SOA Governance Framework

In this section, the researcher presents SOA Governance findings regarding specific elements (presented in Table 5.49), such as: Roles (RL), Roadmap (RD), Maturity Model (MM) and (d) Governance Processes (GP), 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 elements) are displayed. In more detail, the empirical investigation indicates that the proposed elements can be used to address SOA Governance in healthcare organisation with the few additional findings highlighted by the interviewees. These findings are summarised in the next paragraphs and depicted in Table 6.1.

Element	Findings from PubHealthOrg	Findings from PriHealthOrg
Organisational Structure (OS)	The data gathered from interviewees and the empirical evidence For OS (e.g. OS AT6) highlight the role of ‘Communication’ for this project.	In OS (e.g. OS AT6 and HA9) the data gathered from interviewees and empirical evidence highlight the role of ‘Communication’ for this project.
Roles (RL)	In RL element the crucial role of the General Manager as a ‘SOA evangelist’ was identified and his contribution to the project’s success is emphasised	-
Maturity Model (MM)	-	In MM AT1 it was identified that the assessment was based on the ‘Quality Improvement’ method utilised by PriHealthOrg. This finding can be considered as a valuable detailed approach due to its sophistication to address aspects in a healthcare (e.g. high risk, problematic etc.) perspective.
Roadmap (RD)	In RD GU2, a graphical representation of the RD element, as seen in Figure 5.4, illustrates the steps the OS took to create the SOA RD. This finding provides an insight look of the steps followed to build the roadmap of a successful SOA project.	Regarding the RD GU2, a graphical representation of the RD element, as seen in Figure 5.10, which illustrates the steps the OS took to create the SOA RD was shown. This is an important finding as it provides an insight look of the steps followed to build the roadmap of a successful SOA project.
Governance Processes (GP)	For GP (e.g. GP HA2) the data gathered from interviewees and empirical evidence emphasises on the role of ‘Communication’ for this project.	In GP (e.g. GP HA2) the data gathered from interviewees and the empirical evidence focus on highlighting the role of ‘Communication’ for this project. Regarding the GP GU1 it was revealed through this fieldwork that attributes like ‘Data validation’ and ‘Data analysis’ are useful in the measurement phase. Details for both were identified and presented.

Table 6.1: Main Findings Regarding SOA Governance Elements

From the empirical data, it was revealed that for OS (e.g. OS AT6 and HA9) and GP (e.g. GP HA2) the data gathered from interviewees and empirical evidence for both cases highlight the role of ‘Communication’ for this project. The researcher acknowledges that even though this aspect is addressed (as part of the elements themselves) it requires to be highlighted in a more substantial way. Thus, develops this finding as an element of the SOA Governance framework.

New Element: Communication (CM)

In order to emphasize the importance of 'Communication', the researcher attempts to synthesise the retrieved data (e.g. empirical data, interviews, observations, archival record etc.) and construct this new element with attributes, sub-elements, guidelines, healthcare aspects and relations, as seen in Table 6.2.

In PriHealthOrg it was revealed that the CM element is attributed to be responsible for issues, such as: (a) identifying information needs, (b) designing an information management system, (c) defining and capturing data and information, (d) analysing data and transforming it into information, (e) transmitting and reporting data and information, and (f) integrating and using information. Therefore there are the Attributes (AT1-6) that the CM element includes and therefore are presented as such in Table 6.2. Additionally, relating to data from both cases (e.g. PriHealthOrg and PubHealthOrg) it was revealed that several communication channels existed. These were internal like: emails, memos, seminars or external like: Web-site announcements, press releases and university seminars. These are the Sub-Elements of the CM Element. Alongside it was revealed that the role of top-management (e.g. General Manager) who gave interviews and participated in workshops and conferences to promote the project and its beneficial utilisation, greatly assisted to communicate the vision of the project. Thus, the researcher included the involvement of the top-management as a guideline for this element.

Interpreting the empirical data, revealed that the creation of dedicated councils positively affected the communications in PriHealthOrg case. The councils were dedicated to (a) promote communication between members and (b) promote the SOA project(s) and thus considered as healthcare aspects for this element. Also, from the empirical data, it was evident that the CM managed by the OS, related with specific processes of the GP element and requires SGI element to be automated (e.g. dissemination). Thus, the researcher includes the appropriate relations as seen in the last column in Table 6.2.

Communication (CM) Element				
Attributes	Sub-elements	Guidelines	Healthcare Aspects	Relations
1. Identifying information needs, 2. Designing an information management system, 3. Defining and capturing data/information, 4. Analysing data and transforming it into information, 5. Transmitting and reporting data and information, 6. Integrating and using information	1. Internal-External Communication on channels (Seminars, Web-site, press, email, memo etc.)	1. Involve top-management as a Communication Leader	1. Dedicated Councils to promote communication between members 2. Dedicated Councils to promote the SOA project(s)	1. Organisational Structure 2. SOA Governance Infrastructure 3. Governance Processes

Table 6.2: Communication Element

The need for a Communication element was validated in both case studies, thus the researcher includes a graphical representation of the element in the SOA Governance framework (presented in Section 6.3.2).

New Guideline for RL Element: SOA Evangelist

This is an interesting finding, as was evident that the role of the General Manager as an evangelist of the project, HIS integration and subsequently SOA, played a crucial role in gaining the support and minimising the resistance to change caused by the project. Nonetheless, the researcher identified (as discussed in Section 5.3.6.2) that the General Manager’s role as an evangelist was distinctive to the case organisation and can be credited to the particularities of that project (e.g. iServ was a pioneer project for the Greek healthcare sector, need for cost cuts etc.). Therefore, the researcher acknowledged the importance of the role (e.g. evangelist) yet refrained from directly linking this role with a top-management figure (e.g. General Manager), as there were no further evidence (e.g. literature) to support such association beyond this case. However, indications from literature also highlight the role of the SOA evangelist and describe its function not obligatory set to talk to the business about the technology or even mentioning the term SOA, instead educate stakeholders regarding the key business drivers and "new methods" for helping to deliver these drivers (Kavis, 2008). This was evident in PubHealthOrg case. Therefore empirical evidence highlights the role of SOA evangelist that is responsible to educate the business about the SOA.

To this end, the researcher structured this role’s description and responsibilities as seen in Table 6.3.

Roles Element			
Category	Role	Description	Responsibilities
SOA strategy & Governance	SOA Evangelist	Educate stakeholders regarding the key business drivers and "new methods" for helping to deliver these drivers	<ul style="list-style-type: none"> • Promotional planning and delivery • Communicate process information • Bring interested parties into the discussion

Table 6.3: New Role on Roles Element – SOA Evangelist

The need for a SOA evangelist was justified in PubHealthOrg case and thus the researcher included this role as part of the RL element (e.g. list of SOA roles).

New Guideline/Healthcare Aspect for MM Element: Quality Improvements

In the PriHealthOrg case, for the MM Element it was identified that the assessment was based on the detailed approach, described as: ‘Quality Improvements’. This is a valuable guideline for the MM element due to its sophistication but also an important HA as it addresses healthcare aspects (e.g. high risk, problematic etc).

The Quality Improvements guideline proposes that the core processes (e.g. quality and safety) are the ones that need to be addressed in regard to their maturity level (in the same manner as a maturity model). This approach includes: (a) leading and planning the quality improvement program, (b) designing new clinical and management processes as well, (c) measuring how well processes work through data collection, (d) analysing the data, and (e) implementing and sustaining changes that result in improvement. Additionally, as stated in Section 5.4.6.3, Quality Improvement approach proactively identifies and reduces risk and variation and use data to focus on priority issues. This is a very interesting finding, that comes in accordance with literature, that indicates that as SOA implementation progresses and business processes start to address business needs (as quality and safety in PriHealthOrg case) new ‘intelligent’ models are required, that need to support more than just decomposition, they ought to be able to capture processes with flexible sequences that are result based (as critical, high-risk, problematic, and primary processes in PriHealthOrg case) (Mahadevan *et al.*, 2009). In this case, Quality Improvements seems to be similar to such an intelligent model.

Thus, this approach is included as a MM guideline (e.g. core processes addressed in regard to their maturity level) and as a MM HA (e.g. quality and safety of healthcare processes addressed as part of their maturity level).

New Guideline for RD Element: Roadmap Design

This issue, as seen in Figure 6.1 was generated with data from both case studies. In RD GU2, a graphical representation of the RD element, as seen in Figure 5.4 and 5.10, illustrates the steps the OS took to create the SOA RD for PubHealthOrg and PriHealthOrg respectively. This finding provides an insight look of the steps followed to build the roadmap of a successful SOA project and thus is considered as a valuable guideline.

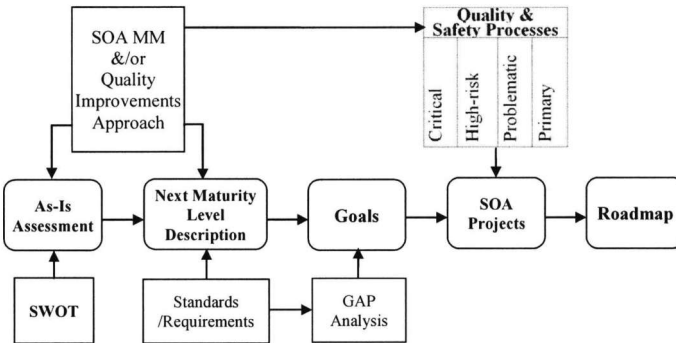


Figure 6.1: SOA Roadmap New Design Guidelines

Figure 6.1 illustrates the steps the OS can take to create the SOA roadmap. First the OS proceeds to an AS-IS assessment with the aid of a SWOT analysis, as explained in Section 5.3.6.4. Based on this analysis and the SOA Maturity Model and/or the Quality Improvements approach, highlights the next maturity level. This (e.g. forthcoming) level's description results from standards and requirements imposed internally (e.g. OS, Quality improvements) or externally (e.g. government amendments). Thereafter, the OS continues with a GAP analysis to identify in detail the requirements and set the goals to complete. The OS uses these goals to identify the candidate SOA projects out of a list based on specific parameters (Quality and Safety Process). Thus, combining the goals and specific candidate projects they created the roadmap to reach the next maturity level.

Therefore, the researcher includes the Roadmap Design guideline as a RD element guideline for the SOA Governance framework.

New Guideline for GP Element: Data Validation and Data Analysis

Investigating the PriHealthOrg case revealed valuable guidelines like 'Data validation' and 'Data analysis'.

In Section 5.4.6.9 Data Validation was described as an important tool for understanding the value of the quality data and for establishing the level of confidence data analysts can have in the data. Thus, it is proposed that a credible data validation process may include the following: (a) Re-collecting the data by a second person not involved in the original data collection, (b) Using a statistically valid sample of records, cases, and other data, (d) Comparing the original data with the re-collected data, (c) When data elements are found not to be the same, noting the reasons (for example, unclear data definitions) and taking corrective actions. This way, Data Validation becomes one of the steps in the process of setting priorities for measurement, selecting what is to be measured, selecting and testing the measure, collecting the data, validating the data, and using the data for improvement.

In Section 5.4.6.9 Data Analysis process, was described as a process that includes comparisons internally, with other organizations when available, and with scientific standards, and desirable practices. The Data Analysis’ goal was identified to be able to compare an organization in four ways: (a) with itself over time, such as month to month, or one year to the next, (b) with other similar organizations, such as through reference databases, (c) with standards, such as those set by accrediting and professional bodies or those set by laws or regulations and (d) With recognized desirable practices identified in the literature as best practices.

These were applied for measurement purposes, so the researcher includes them as part of the measurement phase of the GP element. Recognizing the value and important guidance that the Data Validation and Data Analysis can have on the measurement phase, the researcher includes them as part of the GP element.

Governance Process (GP) Element			
Guideline	Phase	Attribute	Details
SOA Governance phases and their attributes (examples of the latter)	Measurement	Data validation	<ul style="list-style-type: none"> • Re-collecting the data by a second person not involved in the original data collection, • Using a statistically valid sample of records, cases, and other data, • Comparing the original data with the re-collected data, • When data elements are found not to be the same, noting the reasons (for example, unclear data definitions) and taking corrective actions
		Data Analysis	<ul style="list-style-type: none"> • With itself over time, such as month to month, or one year to the next, • With other similar organizations, such as through reference databases, • With standards, such as those set by accrediting and professional bodies or those set by laws or regulations and • With recognized desirable practices identified in the literature as best practices

Table 6.4: Governance Process (GP) Element – New Attributes for the Measurement Phase

6.3.2 Findings and Revised Model

Earlier sections of this dissertation (see Sections 2.4, 2.5, 3.1, 3.2, 5.3 and 5.4) have reported, analysed and investigated the confusion that surrounds SOA Governance in healthcare organisations. In doing so, section 2.5.7 has identified the need for the development of a SOA Governance Framework to aid the decision making and act as a management tool for healthcare organisations. Section 3.5 proposed such a framework (see Table 3.17), which consists of literature findings, additional guidelines and healthcare specific aspects (see Figure 3.4). The proposed framework was examined during the case studies with interviewees emphasising that:

- The proposed framework can be used as a decision-making tool and supports the SOA Governance
- Although the proposed framework supports decision-making, it requires minor modifications derived from the fieldwork findings

As reported in Section 6.3.1, interviewees suggested one new element (Communication), four new guidelines (e.g. Role, Quality Improvements, Roadmap Design, Data Validation and Data Analysis) and a new healthcare aspect (e.g. Quality Improvements).

Much of the discussion reported in Chapter 5 regarding the proposed framework, indicates that the SOA Governance framework should include the analysis of each element to be sufficiently comprehended. In support of this, the researcher reorganises Table 3.17 by integrating: (a) the guidelines of each element with its additional guidelines (b) infuses the elements' description with the findings presented in Section 6.3.1 and (c) adds the new element (Communication). These are highlighted with grey colour.

Such a presentation of the proposed framework's elements allows decision-makers to have a comprehensible view of each element in a clear understandable way. Moreover, decision-makers can more easily emphasize on each elements attributes, sub-elements, guidelines, healthcare aspects and relations.

SOA Governance Elements									
Organisational Structure (OS)	Roles (RL)	Maturity Model (MM)	Roadmap (RD)	SOA Governance Infrastructure (SGI)	Policies (PO)	Metrics (ME)	Best Practices (BP)	Governance Processes (GP)	Communication (CM)
<ol style="list-style-type: none"> 1. Corroborates a number of councils 2. Define and abolish governance policies 3. Obtain and maintain business objectives, standards, best practices 4. Define and obtain feedback from metrics 5. Train employees 6. Communicates SOA purpose 7. Sets roadmap 8. Influence decisions on project 9. prioritisation 	<ol style="list-style-type: none"> 1. Hold SOA responsibilities 2. Responsible for governance processes 3. Gain the support of all the relevant stakeholders 4. Decrease resistance to change 5. Reduce the risk of program failure in a later stage 	<ol style="list-style-type: none"> 1. Assessment mechanism 2. Provides comparison between current and future states of SOA 3. Assist in steering and planning needed for running a SOA 	<ol style="list-style-type: none"> 1. Provides an incremental SOA adoption planning process 2. Detailed process 	<ol style="list-style-type: none"> 1. Manages governance information, 2. Automates governance processes, 3. Enforce governance policies, 4. Collects metrics 	<ol style="list-style-type: none"> 1. Comprise rules for developing and managing a SOA 	<ol style="list-style-type: none"> 1. Improve transparency 2. Provide visibility of essential states and parameters of the SOA initiative 	<ol style="list-style-type: none"> 1. Collects experience 2. Support the creation of new policies 3. Cost-effective operation 	<ol style="list-style-type: none"> 1. Deal with the management of the service life-cycle 2. Manage service portfolio 3. Ensure that services are properly designed 4. Ensure SOA will deliver the features required by an organization 5. Create and enforce policies 	<ol style="list-style-type: none"> 1. Identifying information needs, 2. Designing an information management system, 3. Defining and capturing data/information 4. Analysing data and transforming it into information, 5. Transmitting and reporting data and information, 6. Integrating and using information
Attributes (AT)									
Sub-elements (SE)	<ol style="list-style-type: none"> 1. Centre-of-Excellence 2. Governance Board 3. Program office 4. Councils/Committees 	<ol style="list-style-type: none"> 1. Levels 2. Application Areas 	<ol style="list-style-type: none"> 1. Transition plans 	<ol style="list-style-type: none"> 1. Registry 2. Repository 3. ESB 4. Policy & contract management 5. Quality management system 6. SOA management system 	<ol style="list-style-type: none"> 1. Enforcement 2. Aspects 3. Areas 	<ol style="list-style-type: none"> 1. Metrics categories (Such as: Services, Service operation, Projects and Governance processes) 	<ol style="list-style-type: none"> 1. Best practices' categories 	<ol style="list-style-type: none"> 1. Governance lifecycle 	<ol style="list-style-type: none"> 1. Internal-External Communication channels (Seminars, Web-site, press, email, memo etc.)

Table 6.5a: Proposed SOA Governance Elements

SOA Governance Elements									
Organisational Structure (OS)	Roles (RL)	Maturity Model (MM)	Roadmap (RD)	SOA Governance Infrastructure (SGI)	Policies (PO)	Metrics (ME)	Best Practices (BP)	Governance Processes (GP)	Communication (CM)
<ol style="list-style-type: none"> 1. Main governance body 2. Members from both IT and business 3. Structured in a centralized or decentralized manner 4. Designed to compensate for the weaknesses of the current organisational and IT structure 5. Engagement approach 6. Balanced number of structures 	<ol style="list-style-type: none"> 1. Members from both IT and business 2. Require specific skills/training 3. RACI 4. List of roles and responsibilities 	<ol style="list-style-type: none"> 1. Detailed analysis 2. Levels such as: initial, managed, qualitatively managed and optimised 3. Application areas: organization, process, governance, service/ service management 4. Examples such as CMMI, COBIT 5. Quality Improvements 	<ol style="list-style-type: none"> 1. Based on: current and target SOA 2. Designed for each organisation's particularities 3. Planning for: transformation initiative, deliverables, resources, costs, time scales, project dependencies, and risk 4. Design guidelines 	<ol style="list-style-type: none"> 1. The sub-elements are determined by the specific governance requirements 	<ol style="list-style-type: none"> 1. Aspects may include: Architecture, Technology, Organization, Portfolios, Information execution and Project 2. Areas may include: Security, Cross-company cooperation, Design-time, Run-time and Finance 3. Enforcement either manually, or automatically 	<ol style="list-style-type: none"> 1. Design metrics for categories such as: Services, Service operation, Projects, Governance processes 2. G/QM method 	<ol style="list-style-type: none"> 1. Maintained by the organisational entity 2. Best practices categorisation 	<ol style="list-style-type: none"> 1. Governance lifecycle may include phases such as: plan, design, implement and measure 2. SOA Governance phases and their attributes (examples of the latter). 	<ol style="list-style-type: none"> 1. Involve top-management as a Communication Leader

Table 6.5b: Proposed SOA Governance Elements

Guidelines (GL)

SOA Governance Elements										
Healthcare Aspects (HA)	Organisational Structure (OS)	Roles (RL)	Maturity Model (MM)	Roadmap (RD)	SOA Governance Infrastructure (SGI)	Policies (PO)	Metrics (ME)	Best Practices (BP)	Governance Processes (GP)	Communication (CM)
	<ol style="list-style-type: none"> Dedicated alignment structures (e.g. committees, councils) Business/IT alignment goals Responsible to set clear goals for SOA Governance issues Involve individuals with skills that can set clear goals Dedicated formal (committees, interest groups) or informal (intranets, wikis) to control complexity Committees dedicated to cost control, sponsor identification and funding. Dedicated structures (e.g. committees and interest groups) to minimize risk Dedicated structures (e.g. committees and interest groups) to identify and propose standards Cultivate SOA friendly culture 		<ol style="list-style-type: none"> Funding added as a 'application area' in the maturity model Quality Improvements 			<ol style="list-style-type: none"> Alignment policies based on risk minimization 	<ol style="list-style-type: none"> Metrics to measure alignment level Metrics measuring complexity 	<ol style="list-style-type: none"> Best practices based on standards Practices focusing on testing and error minimisation 	<ol style="list-style-type: none"> Alignment governance process Promotional processes that endorse SOA and its beneficial parameters (e.g. educational and communication planning). Standardisation process Testing processes 	<ol style="list-style-type: none"> Dedicated Councils to promote communication between members Dedicated Councils to promote the SOA project(s)

Table 6.5c: Proposed SOA Governance Elements

SOA Governance Elements									
Organisational Structure (OS)	Roles (RL)	Maturity Model (MIM)	Roadmap (RD)	SOA Governance Infrastructure (SGI)	Policies (PO)	Metrics (ME)	Best Practices (BP)	Governance Processes (GP)	Communication (CM)
<ol style="list-style-type: none"> 1. Roles 2. Roadmap 3. Best practices 4. Policies 5. Governance processes 6. Governance Infrastructure 7. Metrics 8. Maturity model 	<ol style="list-style-type: none"> 1. Organisational structure 	<ol style="list-style-type: none"> 1. Organisational structure 2. Metrics 	<ol style="list-style-type: none"> 1. Organisational structure 2. Maturity model 	<ol style="list-style-type: none"> 1. Organisational structure 2. Metrics 3. SOA Governance processes 4. Policies 	<ol style="list-style-type: none"> 1. Organisational structure 2. SOA Governance processes 3. SOA Governance Infrastructure 	<ol style="list-style-type: none"> 1. Organisational structure 2. SOA Governance processes 3. Maturity model 	<ol style="list-style-type: none"> 1. Organisational structure 	<ol style="list-style-type: none"> 1. Organisational structure 2. Policies 3. Governance Infrastructure 	<ol style="list-style-type: none"> 1. Organisational Structure 2. SOA Governance Infrastructure 3. Governance Processes

Table 6.5d: Proposed SOA Governance Elements

Table 6.5a-6.5d shows the revised SOA Governance framework's elements. The findings as the new element and the additions in the other elements are highlighted in the aforementioned table. The researcher considered the aforementioned issues that emerged from the case data and were explained in this section. In doing so, a revised method for SOA Governance is proposed. The revised framework is illustrated in Figure 6.2. In this figure, the new element (e.g. Communication) that was derived from the fieldwork is represented with dashed lines and the several other findings (e.g. additional guidelines and aspect) with coloured dashed reference boxes. At a practical level, the framework contributes towards a deeper understanding of SOA Governance in healthcare organisations. At a conceptual level, it proposes a blueprint that should be considered during the SOA Governance lifecycle.

The novelty of the proposed framework presented in Table 6.5 lies in the following:

- Based on the literature review reported in Chapter 2 there is an absence of theoretical models that are tested and infused with healthcare aspects. Therefore, this framework is one of the first attempts to explore and understand SOA Governance in healthcare.
- The proposed framework consists of a comprehensive set of elements that were derived from a rigorous literature review of peer-review publications. As a result, the justification and identification of SOA Governance elements is grounded on the normative literature.
- The proposed framework addresses the normative literature's limitations (confusion, overlapping, and lack of testing and healthcare aspects). Especially, provides a detailed account of the common SOA Governance elements identified from the literature.

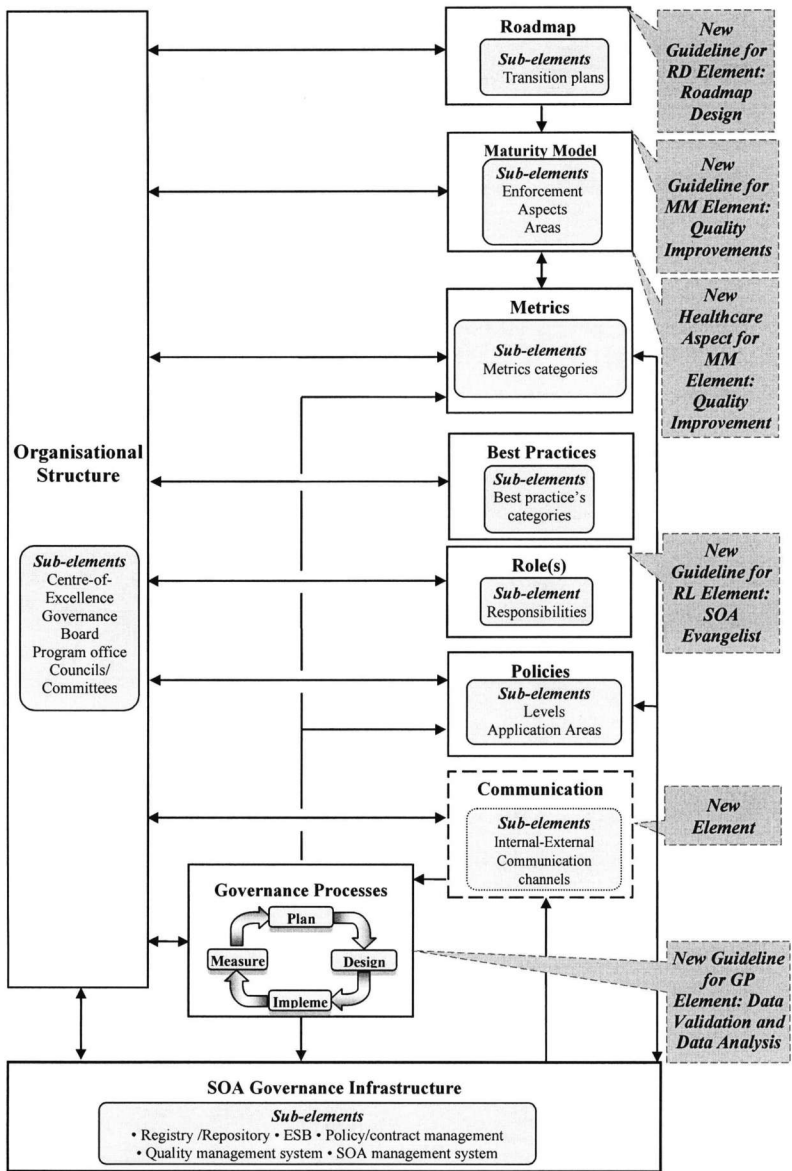


Figure 6.2: Revised SOA Governance Framework

6.4 Conclusions

The researcher proposed, argued, justified and presented a set of elements that can address SOA Governance in healthcare organisations. The empirical investigation indicated that the proposed framework can be used to address SOA Governance in healthcare organisations. The case data revealed that few additional findings and propositions for further research related to SOA Governance arose, which were presented in this chapter.

Therefore, in Chapter 6, the modifications to the conceptual SOA Governance framework were introduced 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 framework (Figure 6.2), the empirical evidence suggests among others that: (a) one new element (e.g. Communication), (b) four new guidelines (e.g. role, quality improvements, roadmap design, data validation and data analysis) and a healthcare aspect (e.g. quality improvements) should be included as part of the framework and its elements description respectively.

The value of the new element was emphasised by the interviewees and observed by the researcher in the archival records. The researcher described this element based on these findings and presented its attributes, sub-elements, guidelines and healthcare aspects (Table 6.4) and its relations (Figure 6.2).

Thus, this enhanced framework contributes to better decision-making and understanding, during the SOA Governance in healthcare organisations. The novelty of the conceptual framework presented in Figure 6.2 lies on the following: (a) it is based on a comprehensive set of tested SOA Governance elements (b) it contributes towards a better understanding of each element, and (c) allows decision-makers to clarify the confusion surrounding SOA Governance. As reported in Section 6.3.2, such a tool can be used as a frame of references to evaluate the extensiveness of existing SOA Governance elements and provides valuable guidance in enhancing them or plan for future extensions.

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 described in this dissertation. The limitations of the research undertaken are identified and presented, and the researcher 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 and contributions that this research makes to the body of the knowledge and research implications, both to academics and practitioners is presented. Finally, this last chapter concludes with the identification and discussion of further research directions, in this challenging and fast-evolving research area of SOA Governance in healthcare organisations.

7.1 Research Overview

This dissertation started with an overview of the research problem in Chapter 1. It has been identified in the literature and empirically confirmed that during the last decades various integration technologies have been used to integrate Healthcare Information Systems (HIS). Yet, in many cases, integration efforts have resulted in heterogeneous and fragmented systems, or systems that still have challenges in terms of interoperability, safety and management. Thus, the need for integrated HIS in a safer, interoperable and more manageable environment motivated organisations to consider the adoption of advanced paradigms such as Service Oriented Architecture. SOA is an architectural paradigm that supports reusability and emphasizes on breaking business processes into smaller blocks of functionality (e.g. services). In doing so, an organization following the SOA paradigm can: (a) reduce costs, (b) provide higher return on investment (c) reuse and integrate services and legacy systems, (d) reduce time to market and (e) better align business with Information technology (IT) (Marks, 2008; Mueller Benjamin, 2010). Despite SOA benefits, many organisations claim they face problems and will not expand SOA use. This reveals that even though SOA is considered a valuable architectural paradigm it still has factors that affect its applicability. In order, to aid in this challenge, research interest has focused beyond the technical parts of the architecture to SOA Governance. SOA Governance can be characterised as a continuous control process that guarantees sufficient adaptability and integrity of an SOA system. Only recently, SOA Governance came to the top of the research agenda and therefore, scientific research and literature around it, remains limited with SOA Governance on healthcare organisations remaining under explored. Chapter 1 then, states the aim of this research, which is to *study SOA Governance in healthcare organisations. In doing so, resulting in the development of a framework that can be used to support decision-making on SOA Governance issues.* Thereafter, Chapter 1 provides a general overview to the dissertation outline.

In Chapter 2, the researcher reviewed the literature and focused on the aforementioned issues (e.g. HIS challenges, SOA and SOA Governance). Despite Healthcare Information Systems benefits (e.g. improve patient safety, work efficiency, resource allocation and quality of care healthcare systems have challenges that can result in failure (Heeks, 2002). In the past, HIS failures have caused the death of patients (e.g. London Ambulance Service Computer-Aided Dispatch) (Avison and Young, 2007). Thus, as HIS were identified to be a crucial parameter for patients care and safety, the researcher investigated and identified the challenges surrounding such implementations (Section 2.2). The potential and current challenges were categorised into four main categories, such as: (a) complexity, (b) globalization, (c) integration and (d) medical errors. 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 paradigm, like SOA, has been highlighted in the normative literature. The increasing adoption of SOA was supported by both the technical and the business community. From a technical perspective, SOA was seen as an approach to develop software placing reusability as a priority, as well as clearly defined interfaces. A service infrastructure enables discovery, composition and invocation of services, thus applications are built using functionality from available services. From a business perspective, SOA was understood as a way of providing availability of legacy functionality to remote clients, implementing new business process models by utilising existing or third-party software assets thus minimising the IT costs, implementation time and increasing innovation through IT investments. To understand SOA benefits the researcher proceeded in a thorough investigation of the literature (seen in Section 2.4.1).

The literature review highlighted that not all SOA projects have delivered the expected outcomes, due to organisations lack of understanding especially in non-technical factors (managerial, human etc.) surrounding SOA implementations (Aier *et al.*, 2011). This is extremely important as investments of hundreds of thousands of Euros do not lead to the expected outcomes and in some cases result in failure (Erickson and Keng, 2008). A failure in a healthcare organisation's IT infrastructure is not an option as the literature is full of cases where healthcare IT failures cost patients' lives (Fitzgerald and Russo, 2005; Johnson, 2011; Kaplan and Harris-Salomone, 2009). So the researcher investigated the SOA Critical Success Factors in healthcare (seen in Table 2.6). From the aforementioned literature research it was depicted that SOA Governance was reported in 50% of the cases studied and it was reported as a critical dimension to SOA that is required from an early stage (Felton, 2010; Gaydos, 2010).

The top priority given to SOA Governance is in accordance with the views of many researchers (Biske, 2008; Josuttis, 2007; Marks, 2008; Niemann *et al.*, 2008). In a nutshell they report that SOA implementations require governance mechanisms to excel, otherwise the architecture will end up complex, uncontrolled, brittle and eventually discarded (Marks, 2008). To this end, the researcher focused the research on the role of SOA Governance in healthcare organisation.

To build an appropriate theoretical foundation the researcher proceeded in a rigorous literature review, since SOA Governance was a relatively new field of study with little known publications especially in healthcare organisations (see Section 2.5.2). More precisely in

Section 2.5, the researcher explained the main concepts of SOA Governance and provided a detailed description of the theoretical approaches surrounding this research area. Although the identified SOA Governance models shared common issues, no single approach seemed to be used or tested adequately. As well, in Section 2.5.6 the researcher focusing on the literature review findings developed a concept map that highlights the main concepts of a SOA Governance framework. The SOA Governance concept map provides not only a graphical representation of the main concepts, but aids in the discussion of the similarities (common elements), differences (scale, detail and analysis) and limitations (confusion, overlapping, lack of testing and healthcare aspects). These open issues were addressed in Chapter 3.

In order to extend the established norms and to overcome the limitations identified in literature in Chapter 3, the researcher proposed a SOA Governance framework integrated with nine elements, such as (a) Organisational Structures (OS), (b) Roles (RL), (c) Maturity Model (MM), (d) Roadmap (RD), (e) SOA Governance Infrastructure (SGI), (f) Policies (PO), (g) Metrics (ME), (h) Best Practices (BP), and (i) Governance Processes (GP). Moreover, the researcher proposes a unique formulation combining the identified common elements of SOA Governance, the SOA CSFs and HIS challenges. This conceptualisation pinpointed attributes and guidelines for each element, required to successfully govern a SOA and tackle longstanding HIS challenges. Thus, for each element a detailed theoretical analysis, including its corresponding attributes, guidelines and relations, examples and healthcare aspects was presented (illustrated in Table 3.17). This conceptualisation was the basis to create the SOA Governance framework (seen in Figure 3.4). This proposition makes a step forward and contributes to the body of knowledge as it: (a) highlights the elements required in SOA Governance, (b) introduces specific additions and guidelines beyond the normative literature, (c) identifies healthcare specific aspects required in a the SOA Governance and interprets them as part of the identified elements and (d) combines the elements and proposes a SOA Governance framework.

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 framework (Figure 3.4). In doing so, Chapter 5 presented and analysed the

empirical data collected from two healthcare organisations, namely PubHealthOrg and PriHealthOrg. In Chapter 5, the preliminary research findings, the data retrieved to explore the conceptual framework and the issues under investigation 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 framework (presented in Figure 3.4) for SOA Governance in healthcare organisations (Section 6.3). The researcher proposed, argued, justified and presented a set of elements that can address SOA Governance in healthcare organisations. The empirical investigation indicated that the proposed framework can be used to address SOA Governance in healthcare organisations. The empirical findings validated the nine elements and revealed that few additional findings and propositions for further research related to SOA Governance arose, which were presented.

Therefore, in Chapter 6, the modifications to the conceptual SOA Governance framework were placed by empirical data presented and analysed in Chapter 5, as well as the further analysis reported in Chapter 6. With regards to the revised conceptual framework (Figure 6.2), the empirical evidence suggested among others that: (a) one new element (e.g. Communication), (b) four new guidelines (e.g. role, quality improvements, roadmap design, data validation and data analysis) and a healthcare aspect (e.g. quality improvements) should be included as part of the framework and its elements description respectively. Thus, the resulting enhanced framework contributes to better decision-making and understanding, for SOA Governance in healthcare organisations. The major outcomes derived from the empirical findings are presented in the next section.

7.2 Main Facts

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

- Fact 1** By reviewing the normative literature, the researcher identified a list of HIS Challenges in Section 2.2, a list of SOA benefits (seen in Section 2.4) and SOA Critical Success Factors (CSFs) (in Section 2.4). This classification revealed SOA Governance as the most important CSF during SOA implementation.
- Fact 2** The literature in the area of SOA, revealed the absence of a complete, tested theoretical model associated with the SOA Governance in healthcare organisations. Additionally, by reviewing the identified propositions (Section 2.5.7) the researcher identified several

similarities (common elements), differences (scale, detail and analysis) and limitations (confusion, overlapping, lack of testing and healthcare aspects).

Fact 3 A conceptual framework has been proposed to address the void in the literature regarding SOA Governance in healthcare organisations (see Figure 3.4) and address the limitations and confusion surrounding the area. This framework has been structured in a rigorous literature review based on peer-review publications and each element proposed with attributes, sub-elements, guidelines, examples and infused with healthcare aspects.

Fact 4 The researcher investigated two healthcare organisations in Greece as multiple case studies, to validate the proposition, the PubHealthOrg and PriHealthOrg. The two organisations provided sufficient information for this research and through the data retrieved and exposed a good understanding of SOA in healthcare (Chapter 5). The case data reveal empirical approaches and insights of SOA Governance practice enhancing the understanding of the under explored healthcare area.

Fact 5 From the empirical data and the theoretical analysis, the issues proposed for further research and the Conceptual Framework (Figure 3.4) were examined and validated.

Fact 6 The SOA Governance framework consists of ten elements namely: (a) Organisational Structures (OS), (b) Roles (RL), (c) Maturity Model (MM), (d) Roadmap (RD), (e) SOA Governance Infrastructure (SGI), (f) Policies (PO), (g) Metrics (ME), (h) Best Practices (BP), (i) Governance Processes (GP) and (j) Communications (CM).

Fact 7 Its elements were described alongside its attributes, sub-elements, guidelines and healthcare aspects (Chapter 6).

Fact 8 The conceptual framework can be used as a tool for decision-making to support organisations, and to allow researchers to apprehend and analyse SOA Governance process in healthcare organisations.

7.3 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 1: *To conduct a literature review in the area of SOA in healthcare with special interest in SOA Governance.*

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

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

Based on the literature review, limited research has been conducted in the area of SOA Governance in healthcare organisations, with the majority of the identified research on SOA Governance model propositions with limited testing and justification. These models were identified through a rigorous literature review, described and critically discussed. As reported in Chapter 2, the identified literature holds several similarities (common elements), differences (scale, detail and analysis) and limitations (confusion, overlapping, lack of testing and healthcare aspects).

Objective 3: *To study relevant models of SOA Governance. Therefore, it will develop a conceptual framework for SOA Governance. The latter might be used as a decision-making tool by healthcare organisations.*

To overcome the literature void and identified limitations, Chapter 3 proposed the use of the identified common element as a foundation of the SOA Governance framework. To this end the researcher justified, described and categorised each element on the basis of its: attributes, sub-elements, guidelines, additional guidelines and healthcare aspects. In doing so, the researcher conceptualised a structured SOA Governance framework to support decisions making in healthcare organisations (Figure 3.4).

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 PubHealthOrg and PriHealthOrg. The preliminary research findings were described and the data retrieved were used to test the conceptual framework (Figure 3.4) and the elements under investigation, as these were summarised in Table 3.17. In doing so, the researcher tested and evaluated the conceptual framework proposed in Chapter 3.

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

In Chapter 6, the research findings obtained from the case organisations were considered and utilised to modify the conceptual framework accordingly. The revised framework supports decision-makers and researchers for SOA Governance 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 reported.

The accomplishment of the above objectives has been made possible through the development of a conceptual SOA Governance framework in healthcare organisations. This was demonstrated by examining the limitations of the established norms in SOA and SOA Governance addressing open issues in the practice of HIS integration 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.

7.4 Statement of Contribution and Research Novelty

The outcome of this research has extended the boundaries of knowledge by making a novel contribution to the area of SOA Governance in healthcare organisations. The researcher proposed the following contributions:

Novel Classification of HIS Challenges

The researcher reviewed the normative literature, identified 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) Complexity, (b) Globalisation, (c) Integration and (d) Medical Errors (as presented in Table 2.1). This categorisation of potential and challenges was applied and proved to be supportive for the analysis of the case studies (Chapter 5).

7.4.1 Novel Method for SOA Governance Elements' Structure

The confusion surrounding the SOA Governance models drove the researcher in the construction of a SOA Governance concept map (seen in Figure 2.6). This novel to SOA Governance approach graphically depicted the confusion and “cluttering” of overlapping concepts, as well as the unstructured propositions identified in peer-review publications. Nevertheless, the concept map presents a novel reference point of the research contacted in the SOA Governance area.

The literature in the area of SOA revealed the absence of a complete, tested theoretical model associated with the SOA Governance in healthcare organisations. Additionally, reviewing the identified propositions (Section 2.5.7) emphasised several similarities (common elements), differences (scale, detail and analysis) and limitations (confusion, overlapping, lack of testing and healthcare aspects). Based on these literature review findings the researcher proceeded in a novel synthesis of the SOA Governance elements. This synthesis and the resulting elements description is novel as it achieves the following:

Novel Definition of SOA Governance Elements

Each element was derived from the literature review (e.g. common elements of the concept map), additional literature sourced to clarify the limitations (e.g. lack of detail, overlapping, etc.) that might exist and healthcare specific aspects (utilising the identified HIS challenges and CSFs). Thus, the proposed elements hold the merit and quality of peer-review articles published in academic journals and conferences (vom Brocke *et al.*, 2009), the detail to overcome identified limitations and the healthcare aspects, the value of which (e.g. healthcare) was emphasised throughout this dissertation.

Novel structure of SOA Governance Elements

For each element the researcher provided a set of characteristics that described the element but also provided a structured identification tool during the fieldwork (Table 3.17). These

characteristics were: (a) attributes, (b) sub-elements, (c) guidelines, (d) additional guidelines and (e) healthcare aspects

7.4.2 Novel SOA Governance Framework in Healthcare Organisations

In order to provide a cohesive conceptualisation of the SOA Governance, the researcher included all the nine elements in a reference blueprint depicting only the elements, sub-elements and relations in-between them, as seen in Figure 3.4. This approach provides an easy to follow reference blueprint, which can diagrammatically express the elements without cluttering the demonstration with further details.

The proposed SOA Governance framework in Figure 3.4 makes a novel contribution at two levels. Firstly, at a conceptual level, it identifies and proposes nine elements that should be considered during the SOA Governance process. The identification of the nine elements is based on the theoretical works conducted by others in this area. As a result, the conceptualisation of the elements is grounded in the normative literature. In addition to this, the framework incorporates additions that are gathered from additional literature resources beyond the ones that composed the elements. This comes as a method to overcome the limitations identified in normative literature and enhance the elements' conceptualisation. Moreover, the researcher proposes a unique formulation combining the identified common elements of SOA Governance, the SOA CSFs and HIS challenges. This proposal aims to pinpoint attributes and guidelines for each element, required to successfully govern a SOA and tackle longstanding HIS challenges. Secondly, at a practical level, the proposed framework contributes towards a better understanding of the research area (SOA Governance in healthcare).

7.5 Research Limitations

The empirical research discussed in Chapter 6 represents the beginning of research on SOA Governance in healthcare organisations. However, the empirical data collected are confined to the limited context of a public and a private healthcare organisation of the Greek sector. Moreover, the organisational structure of the healthcare organisations for provision of healthcare services varies from country to country. Even though, much of the case data for PriHealthOrg were part of the worldwide accreditation program, it still requires further research to other awarded hospitals to be able to draw parallel conclusions.

As described and justified in Chapter 4, to collect and interpret the data, a qualitative, and 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 researcher 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 researcher wanted to partially deal with this concern through developing a conceptual framework that incorporates SOA Governance elements reported in previous studies and combines them with the revised SOA Governance framework. This framework consisted of issues under research identified from the literature regarding SOA Governance 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 SOA Governance 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 have 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 most important difficulty the researcher faced was the restricted access to information such as the hospitals documents. Moreover, the researcher failed to arrange appointments with some healthcare actors and top executives, to verify certain issue, since they had demanding schedules.

7.6 Recommendations for Further Work

Research can usually be further developed and the research presented here is no exception. Thus, in the light of the reflections and the limitations it is recommended that further work could usefully be pursued as follows:

- The SOA Governance framework for healthcare organisations was based on two case organisations in Greece. The organisational structure of Greece is relatively different from the other countries. Therefore, the results of this research cannot be generalised. The researcher thus recommends validating this framework in the context of different countries.
- Another important recommendation is to conduct the same type of research in organisations that failed to achieve an appropriate degree of SOA Governance, concluding to project failure and/or concerns about SOA benefits. This would possible enrich with a set of valuable data as SOA Critical Failure Factors and will provide support to decision makers in understanding these failure triggers.
- A recommendation for the future study may be the detailed analysis of each of the SOA Governance element. In doing so, each element will perceive adequate focus and analysis in order to be examined in depth and provide a richer set of attributes, sub-elements, guidelines and healthcare aspects.
- This research has found that SOA Governance is an important issue. Therefore, it is recommended to transform the proposed SOA Governance elements' structure and the framework itself into a large-scale survey questionnaire, instant of using interpretive epistemology. Clearly, this approach would not have been possible previously, since the framework did not exist. Miles and Huberman (1994) discuss such a research design starting with a qualitative approach that provides an initial exploratory phase, whose outcomes may be used to create quantitative instruments (e.g. surveys) to collect new data. It is the researcher's understanding that such large-scale survey may offer the opportunity to establish generic significance to the issues related to the proposed SOA Governance

Framework (e.g. attributes, relations etc.). In surveying a representative sample of organisations the elements' characteristics related to the proposed framework can be better verified and understood.

REFERENCES

- Abelein, U., Habryn, F. and Becker, A.** 2009. *'Towards a holistic framework for describing and evaluating business benefits of a service oriented architecture'*, Proceedings of Enterprise Distributed Object Computing Conference Workshops, 13th, 1-4 Sept. 2009
- Ackermann, T., Miede, A., Buxmann, P. and Steinmetz, R.** 2011. *'Taxonomy of technological IT outsourcing risks: support for risk identification and quantification'*, Proceedings of 19th European Conference on Information Systems, Helsinki, AIS, June 9-11
- Adamczyk, P., Smith, P., Johnson, R. and Hafiz, M.** 2011. *'REST: From Research to Practice'* In REST: From Research to Practice, Vol. 1, (Eds, Wilde, E. and Pautasso, C.) Springer New York, pp. 526.
- Aier, S., Ahrens, M., Stutz, M. and Bub, U.** 2009. *'Deriving SOA Evaluation Metrics in an Enterprise Architecture Context Service-Oriented Computing - ICSOC 2007 Workshops'*, Vol. 4907 (Eds, Di Nitto, E. and Ripeanu, M.) Springer Berlin / Heidelberg, pp. 224-233.
- Aier, S., Bucher, T. and Winter, R.** 2011. *'Critical Success Factors of Service Orientation in Information Systems Engineering'*, Business & Information Systems Engineering, 3(2): 77-88.
- Aletras, V., Kontodimopoulos, N., Zagouldoudis, A. and Niakas, D.** 2007. *'The short-term effect on technical and scale efficiency of establishing regional health systems and general management in Greek NHS hospitals'*, Health Policy, 83(2-3): 236-245.
- Anderson, J. and Aydin, C.** 2005. *'Evaluating the Organizational Impact of Health Care Information Systems'*, Springer; 2nd edition (October 7, 2005),
- Angelidis, P., Giest, S., Dumortier, J., Artmann, J. and Heywood, J.** 2010. *'eHealth Strategies'*, DG Information Society and Media, ICT for Health Unit, Bonn Germany.
- Antikainen, J. and Pekkola, S.** 2009. *'Factors influencing the alignment of SOA development with business objectives'*, Proceedings of 17th ECIS, Verona Italy, June 8-10
- Aron, R., Dutta, S., Janakiraman, R. and Pathak, P.** 2011. *'The Impact of Automation of Systems on Medical Errors: Evidence from Field Research'*, Info. Sys. Research, 22(3): 429-446.
- Asanin, S., Rosengren, P., Brodén, T., Martins, I., Barca, C., Pérez, M., Montandon, L., Stratakis, M. and Louloudakis, S.** 2013. *'Adopting Rule-Based Executions in SOA-Oriented Remote Patient Monitoring Platform with an Alarm and Alert Subsystem'* In Wireless Mobile Communication and Healthcare, Vol. 61, (Eds, Godara, B. and Nikita, K.) Springer Berlin Heidelberg, pp. 437-444.
- Ausubel, D.** 2000. *'The Acquisition and Retention of Knowledge: A Cognitive View'*, Kluwer Academic Publishers, Boston, MA.
- Avison, D. and Young, T.** 2007. *'Time to rethink health care and ICT?'*, Communications ACM, 50(6): 69-74.

- Bakker, H.** and **Iacob, M.** 2009. *'Web-services in the dutch healthcare insurance sector: expected versus achieved benefits'*, Proceedings of Proceedings of the 2009 ACM symposium on Applied Computing, Honolulu, Hawaii, ACM, 1617-1618.
- Basili, V.,** Lindvall, M., Regardie, M., Seaman, C., Heidrich, J., Münch, J., Rombach, D. and Trendowicz, A. 2010. *'Linking Software Development and Business Strategy Through Measurement'*, Computer, 43(4): 57-65.
- Basit, C.,** Wang, J., Wu, S., Maglione, M., Mojica, W., Rot, h. E., Morton, S. and Shekelle, P. 2006. *'Systematic Review: Impact of Health Information Technology on Quality, Efficiency, and Costs of Medical Care'*, Annals of Internal Medicine, 144(10): 742-752.
- Baskerville, R.,** Cavallari, M., Hjort-Madsen, K., Pries-Heje, J., Sorrentino, M. and Virili, F. 2005. *'Extensible architectures: The Strategic Value of Service-oriented Architecture in Banking'*, Proceedings of 13th ECIS, Regensburg, Germany, Association for Information Systems., 61–74.
- Baskerville, R.,** Cavallari, M., Hjort-Madsen, K., Pries-Heje, J., Sorrentino, M. and Virili, F. 2010. *'The strategic value of SOA: a comparative case study in the banking sector'*, International Journal of Information Technology and Management, 9(1): 30-53.
- BCBSA.** 2008 *"Realizing quality-of-care, business value, and delivery on it's promise"*, In SOA in Healthcare April 15-17, 2008 - Chicago, IL USA.
- Bebchuk, L.,** Cohen, A. and Ferrell, A. 2009. *'What Matters in Corporate Governance'*, Review of Financial Studies, 22(2): 783-827.
- Beimborn, D.,** Joachim, N., Schlosser, F. and Streicher, B. 2009. *'The Role of IT/Business Alignment for Achieving SOA Business Value - Proposing a Research Model'*, Proceedings of 15th AMCIS, San Francisco, California, AISel, 10. 6-9 August
- Bell, S.** and Hindmoor, A. 2009. *'Rethinking governance: the centrality of the state in modern society'*, Cambridge University Press, Cambridge
- Bennington, L.** 2010. *'Review of the corporate and healthcare governance literature'*, Journal of Management & Organization, 16(2): 314-333.
- Beratarbide, E.** and Kelsey, T. 2011. *'eHealth Governance, A Key Factor for Better Health Care: Implementation of IT Governance to Ensure Better care through Better eHealth'* In Ethical Issues and Security Monitoring Trends in Global Healthcare: Technological Advancements (Ed. Brown, S. M.) IGI Global, Hersley, NY., pp. 72-92.
- Bernhardt, J.** and Seese, D. 2009. *'A Conceptual Framework for the Governance of Service-Oriented Architectures'* In Service-Oriented Computing – ICSOC 2008 Workshops, Vol. 5472, Springer Berlin / Heidelberg, pp. 327-338.

References

- Bertolino, A.** and Polini, A. 2009. '*SOA Test Governance: Enabling Service Integration Testing across Organization and Technology Borders*', Proceedings of International Conference on Software Testing, Verification and Validation Workshops, 277-286. 1-4 April 2009
- Beyer, M., Kuhn, K., Meiler C., Jablonski S.** and Lenz R. 2004. '*Towards a flexible, process-oriented IT architecture for an integrated healthcare network*', Proceedings of Proceedings of the 2004 ACM symposium on Applied computing, Nicosia, Cyprus, ACM,
- Bhagat, S., Fontaine, D.** and Gibson K. 2010. '*Danish Healthcare Information Technology - An Analytical Study of Consumer Issues*', Worcester Polytechnic Institute, Worcester.
- Bhandari, G.** and Snowdon, A. 2011. '*Design of a patient-centric, service-oriented health care navigation system for a local health integration network*', Behaviour & Information Technology, 1-11.
- Bieberstein, N., Bose, S., Walker, L.** and Lynch, A. 2005. '*Impact of service-oriented architecture on enterprise systems, organizational structures, and individuals*', IBM Syst. J., 44(4): 691-708.
- Biske, T.** 2008. '*SOA Governance*', Packt Publishing Ltd., Birmingham, UK.
- Blanton, J., Leski, J., Nicks, B.** and Tirzaman T. 2009. '*Making SOA work in a healthcare company*', Proceedings of Proceeding of the 24th ACM SIGPLAN conference companion on Object oriented programming systems languages and applications, Orlando, Florida, USA, ACM,
- Blumonta, I. D.** 2009. '*Stimulating the adoption of health information technology*', The new England journal of medicine, 360(15): 1477- 1479.
- Boerner, R.** and Goeken, M. 2009. '*Service identification in SOA Governance literature review and implications for a new method*', Proceedings of 3rd IEEE International Conference on Digital Ecosystems and Technologies, Instabul, Turkey, IEEE, 588-593.
- Boochever, S.** 2004. '*HIS/RIS/PACS integration: getting to the gold standard*', Radiol Manage, 26(3): 16-24.
- Brereton, P., Kitchenham, B., Budgen, D., Turner, M.** and Khalil, M. 2007. '*Lessons from applying the systematic literature review process within the software engineering domain*', Journal of Systems and Software, 80(4): 571-583.
- Brown, C.** 2008. '*Managing Information Technology*', Prentice Hall.
- Brown, W., Moore, G.** and William, T. 2006. '*SOA governance —IBM's approach*', Effective governance through the IBM SOA Governance Management Method approach, RAW-10953-USEN-00): 16.
- Bugrara, K.** 2010. '*The clinical ATLAS*', Proceedings of SOA in Healthcare: Improving Health through Technology, Westin Arlington Gateway Arlington VA USA, June 12-14

- Buntin, M., Burke, M., Hoaglin, M. and Blumenthal, D.** 2011. *'The Benefits of Health Information Technology: A Review of The Recent Literature Shows Predominantly Positive Results '*, Health Affairs 30(3): 464-471.
- Campbell, C.** 2010. *'Using Service Oriented Architecture to Support Meaningful Use'*, Proceedings of SOA in Healthcare: Improving Health through Technology: The role of SOA on the path to meaningful use, Westin Arlington Gateway, in Arlington, VA USA., OMG, July 12-14
- Campbell, J., McDonald, C. and Sethibe, T.** 2010. *'Public and Private Sector IT Governance: Identifying Contextual Differences'*, Australasian Journal of Information Systems, Vol 16, (2).
- Canfora, G., Penta, M. and Penta, M.** 2009. *'Service-Oriented Architectures Testing: A Survey'* In Software Engineering, Vol. 5413(Eds, Lucia, A. and Ferrucci, F.) Springer Berlin Heidelberg, pp. 78-105.
- Chang, H.-L. and Lue, C.-P.** 2009. *'An Exploratory Study of Risk Factors for Implementing Service-Oriented IS Projects Designing E-Business Systems. Markets, Services, and Networks'*, Vol. 22 (Eds, Weinhardt, C., Luckner, S. and Stöber, J.) Springer Berlin Heidelberg, pp. 83-95.
- Chang, M., He, J., Tsai, W., Xiao, B. and Chen, Y.** 2006. *'UCSOA: User-Centric Service-Oriented Architecture'*, Proceedings of IEEE International Conference on e-Business Engineering, Shanghai, China, 248-255. 24-26 October
- Chapell, D.** 2004. *'Enterprise Service Bus: Theory in Practice'*, O'Reilly Media,
- Charmel, P. and Frampton, S.** 2008. *'Building the business case for patient-centered care'*, Healthcare Financial Management, 62(3): 80-85.
- Chatterjee, S., Chakraborty, S., Sarker, S., Sarker, S. and Lau, F. Y.** 2009. *'Examining the success factors for mobile work in healthcare: A deductive study'*, Decision Support Systems, 46(3): 620-633.
- Chiasson, M., Reddy, M., Kaplan, B. and Davidson, E.** 2007. *'Expanding multi-disciplinary approaches to healthcare information technologies: What does information systems offer medical informatics?'*, International Journal of Medical Informatics, 76: S89-S97.
- Choi, J., Nazareth, D. L. and Jain, H. K.** 2012. *'Information Technology Skill Management Strategies for Implementing New Technologies: A Case of Service-Oriented Architecture'*, Systems, Man and Cybernetics, Part A: Systems and Humans, IEEE Transactions on, 42(4): 838-853.
- Clemensen, J., Rasmussen, J., Denning, A. and Craggs, M.** 2011. *'Patient Empowerment and New Citizen Roles through Telehealth Technologies - The Early Stage'*, In IARIA, Proceedings of The Third International Conference on eHealth, Telemedicine, and Social Medicine Gosier France, eTELEMED, 114-119. 23-28 Feb 2011

References

- Clifford, G., Blaya, J., Hall-Clifford, R. and Fraser, H.** 2008. '*Medical information systems: A foundation for healthcare technologies in developing countries*', BioMedical Engineering OnLine 2008, 7:18, 7(18): 8.
- CMMI Institute** 2012. '*Capability Maturity Model Integration*', <http://cmmiinstitute.com/>, [Day of Access, 10.3]
- Connell, J.** 2006. '*Medical tourism: Sea, sun, sand and ... surgery*', Tourism Management, 27(6): 1093-1100.
- Cooper, H.** 1988. '*Organizing knowledge syntheses: A taxonomy of literature reviews*', Knowledge, Technology & Policy, 1(1): 104-126.
- Daskalakis, S. and Mantas, J.** 2009. '*The Impact of SOA for Achieving Healthcare Interoperability*' Methods of Information in Medicine, 2010(3).
- Davaki, K. and Mossialos, E.** 2005. '*Plus ça change: Health sector reforms in Greece*', Journal of Health Politics, Policy and Law 2005 Volume 30, Number 1-2: 143-168
- Davis, J.** 2010. '*Using Service Aware Standards to Secure the Exchange of the Electronic Health Record*', Proceedings of SOA in Healthcare: Improving Health through Technology: The role of SOA on the path to meaningful use, Westin Arlington Gateway, in Arlington, VA USA., OMG, July 12-14
- Davison, R., Vreede, G. and de Briggs, R.** 2005. '*On peer review standards for the information systems literature*', Communications of the AIS, 16(4): 967-980.
- Demirkan, Haluk and Goul, Michael** (2006) "*AMCIS 2006 Panel Summary: Towards the Service Oriented Enterprise Vision: Bridging Industry and Academics*," Communications of the Association for Information Systems: Vol. 18, Article 26.
- Do, N. and Nguyen, H.** 2010. '*Lessons Learned from a Information Exchange (IHE) pilot*', Proceedings of SOA in Healthcare: Improving Health through Technology, Westin Arlington Gateway, VA USA, June 12-14
- Douglas, B. and Dick, D.** 2013. '*Web Services and Service-Oriented Architectures: The Savvy Manager's Guide*', Morgan Kaufmann Publishers, Waltham USA.
- Duffield, C., Kearin, M., Johnston, J. and Leonard, J.** 2007. '*The impact of hospital structure and restructuring on the nursing workforce*', The Australian journal of advanced nursing: a quarterly publication of the Royal Australian Nursing Federation, 24(4): 42-46.
- Economou, C.** 2010. '*Health Systems in Transition*', Health system review, 12(7): 1–180.
- Elammari, M., Alteap, T. and Alteap, M.** 2011. '*Health Architecture Based on SOA and Mobile Agents*' In Software Engineering and Computer Systems, Vol. 181 (Eds, Zain, J., Wan Mohd, W. and El-Qawasmeh, E.) Springer Berlin Heidelberg, pp. 54-65.

- Erickson, J.** and Keng, S. 2008. '*Critical Success Factors in SOA Implementation*', Proceedings of AMCIS, Toronto, ON, Canada August 14th-17th 2008,
- Erl, T.** 2005. '*Service-Oriented Architecture (SOA): Concepts, Technology, and Design*', Prentice Hall Upper Saddle River, NJ.
- European Communities.** 2009. '*eHealth in Action: Good Practice in European Countries*', Office for Official Publications of the European Communities, Luxembourg.
- European Observatory on Health Systems Policies.** 2008. '*Health Targets in Europe: Learning from experience*'. ISBN 9789289042840
- Felton, D.** 2010. '*Implementing the DoD/VA Virtual Lifetime Electronic Record*', Proceedings of SOA in Healthcare: Improving Health through Technology, VA USA, July 12-14
- Ferguson, J.** 2010. '*Challenges & Learning In The New Era of Health IT*', Proceedings of SOA in Healthcare: Improving Health through Technology, Westin Arlington Gateway, VA USA., OMG, July 12-14
- Finnegan, D.** and Hamid, K. 2009. '*Information systems (IS) integration approaches in healthcare: a critical review*' In Integrating Healthcare With Information and Communications Technology, Vol. 1 (Eds, Currie, W. and Finnegan, D.) Radcliffe Publishing, London, pp. 35-63.
- Firat, K., Moser, L.** and Melliar-Smith, M. 2008. 'Building a Distributed E-Healthcare System Using SOA', IT Professional, 10(2).
- Fitzgerald, G.** and Russo, N. 2005. '*The turnaround of the London ambulance service computer-aided despatch system (LASCAD)*', European Journal of Information Systems, 14(3): 244-257.
- Franklin, B., Kara, O. G., Parastou, D., Jacklin, A.** and Barber, N. 2007. '*The impact of a closed-loop electronic prescribing and administration system on prescribing errors, administration errors and staff time: a before-and-after study*', Qual Saf Health Care 16
- Franzen, J.** 2008. '*Factors to succeed with SOA*' Department of Applied Information Technology, Göteborg, Sweden REPORT NO. 2008:093
- Gall, D., Gall, J.** and Borg, R. 2006. '*Educational research: An introduction*', Longman Publishers USA, White Plains, N.Y.
- Garrido, M., Kristensen, F., Nielsen, C.** and Busse, R. 2008, '*Healthcare technology assessment and Health policy-making in Europe: Current status, challenges and potential*' Vol. 14 (Eds, European Observatory on Health Systems and Policies) WHO, Copenhagen Denmark, pp. 147. ISBN 9789289042932
- Gaunt, N.** 2009. '*Electronic health records for patient-centered healthcare*' In Integrating Healthcare With Information and Communications Technology (Ed, Finnegan, D.) Radcliffe Publishing, pp. 274.

References

- Gaydos, S.** 2010. *'The Plan vs. The Reality: Navigating SOA Challenges in Federal Healthcare'*, Proceedings of SOA in Healthcare: Improving Health through Technology, VA USA, OMG, July 12-14
- George, C., Whitehouse, D. and Duquenoy, P.** 2013. *'eHealth: Legal, Ethical and Governance Challenges'*, Springer Berlin Heidelberg, Berlin, Heidelberg. ISBN 9783642224737
- Gilbertson, D.** 2008. *'The role of SOA in near-term evolution of EHR'*, Proceedings of SOA in Healthcare realizing quality-of-care, , April 15-17, 2008 - Chicago, IL USA,
- Ginter, P., Swayne, L. and Duncan, W.** 2013. *'The Strategic Management of Health Care Organizations'*, Jossey-Bass, San Francisco, CA, USA.
- Giokas, D.** 2008. *'Industry studies: What impact did SOA have on your business-IT alignment and organizational agility?'*, Proceedings of SOA in Healthcare realizing quality-of-care,, Chicago IL USA,
- Gleave, R.** 2009. *'Across the Pond: Lessons from the US on Integrated Healthcare'*, Nuffield Trust, The (January 21, 2009),
- Goene, O., Poletti, P., Vallejo, P., Cucic, C., Klazinga, N. and Suñol, R.** 2009. *'Quality requirements for cross-border care in Europe: a qualitative study of patients', professionals' and healthcare financiers' views'*, Qual Saf Health Care, 18(Supplement): 15-21.
- Greek Chapter of European Observatory.** 2008. *'Μελέτη για τη χρήση τεχνολογιών πληροφορικής και επικοινωνιών στον τομέα υγείας και πρόνοιας'*. <http://www.observatory.gr/>
- Guimares, C. and de Carvalho, J.** 2011. *'Outsourcing in the Healthcare Sector-A State-of-the-Art Review'*, Supply Chain Forum: an International Journal, 12(2): 140-148.
- Haresh, L. and Fethi, R.** 2009. *'Service Oriented Computing in Practice - An Agenda for Research into the Factors Influencing the Organizational Adoption of Service Oriented Architectures'*, Journal of theoretical and applied electronic commerce research, 4 (1).
- Haux, R.** 2006. *'Health information systems - past, present, future'*, International Journal of Medical Informatics, 75(3-4): 268-281.
- Heeks, R.** 2002. *'Information Systems and Developing Countries: Failure, Success, and Local Improvisations'*, The Information Society: An International Journal, 18(2): 101 - 112.
- Heffner, R.** 2009. *'Forrester Report: Survey Results Show SOA Governance Improves SOA Benefit Realization'*. Forrester Research Inc.
- Hensley, J.** 2008. *'Lessons learned: how to drive business value from a service oriented approach'* Proceedings of SOA in Healthcare realizing quality-of-care, business value, and delivery on it's promise, April 15-17, 2008 - Chicago, IL USA,

- Hirzalla, M., Cleland-Huang, J. and Arsanjani, A.** 2009. '*A Metrics Suite for Evaluating Flexibility and Complexity in Service Oriented Architectures*' In *Service-Oriented Computing – ICSOC 2008 Workshops*, Vol. 5472 (Eds, Feuerlicht, G. and Lamersdorf, W.) Springer Berlin Heidelberg, pp. 41-52.
- HL7/OMG** 2010. '*The Practical Guide for SOA in Health Care*', Healthcare Services Specification Project (HSSP), <http://hssp.wikispaces.com/file/view/2008-12-29+SOA%2BHealthcare%2BPractical%2BGuide%2Bv1.0.pdf>, [Day of Access, 01.10.10]
- HM Government** 2013. '*Information Technology Infrastructure Library*', <http://www.itil-officialsite.com/home/home.aspx>, [Day of Access, 07.03]
- Hojaji, F. and Shirazi, M.** 2010. '*AUT SOA Governance: A new SOA Governance framework based on COBIT*', Proceedings of 3rd IEEE International Conference on Computer Science and Information Technology (ICCSIT)
- Hojaji, F. and Shirazi, M. R. A.** 2010a. '*Developing a more comprehensive and expressive SOA governance framework*', Proceedings of 2nd IEEE International Conference on Information Management and Engineering (ICIME), 563-567. 16-18 April 2010
- Hojaji, F. and Shirazi, M. R. A.** 2010b. '*A Comprehensive SOA Governance Framework Based on COBIT*', Proceedings of 6th World Congress on Services (SERVICES-1), Miami, FL 407 - 414 5-10 July 2010
- Horowitz, M., Rosensweig, J. and Jones, C.** 2007. '*Medical tourism: globalization of the healthcare marketplace*' *MedGenMed*, 9(4): 33.
- Hsieh, S., Hsieh, S., Cheng, P. and Lai F.** 2012. '*E-health and healthcare enterprise information system leveraging service-oriented architecture*', *Telemedicine and e-Health*, 18(3).
- Hsin, C.** 2006. '*Adopting Emerging Integration Technologies in Organisations*', School of Information Systems, Computing and Mathematics, Brunel University, Uxbridge, West London.
- HSSP** 2013. '*Healthcare Services Specification Program* ', <http://hssp.wikispaces.com/>, [Day of Access, 19.01.2013]
- Huff, S.** 2008. '*Impact of SOA initiatives on business*', Proceedings of SOA in Healthcare realizing quality-of-care, Chicago IL USA, April 15-17
- Huhns, M. and Singh, M.** 2005. '*Service-Oriented Computing: Key Concepts and Principles*', IEEE Internet Computing, 9(1).
- IHE** 2012. '*Integrating the Healthcare Enterprise*', <http://www.ihe.net/>, [Day of Access, 01.03.2011]
- ISACA** 2013. '*COBIT 5: A Business Framework for the Governance and Management of Enterprise IT*', <http://www.isaca.org/cobit/pages/default.aspx>, [Day of Access, 20.01]

References

- ITGI 2011. *'Global status report on the governance of enterprise IT'*, IT Governance Institute, Rolling Meadows, IL 60008 USA
- ITRC 2010. *'Identity Theft Resource Center'*, <http://www.idtheftcenter.org/>, [Day of Access, 01.12]
- Janiesch, C. and Korthaus, A. 2010. *'Validation of a generic Service Governance Meta Model on the comparison of major Governance frameworks'*, Proceedings of 21st Australasian Conference on Information Systems, Brisbane, Australia,
- Janiesch, C., Korthaus, A. and Rosemann, M. 2009. *'Conceptualisation and facilitation of SOA Governance'*, Proceedings of 20th Australian Conference on IS, Melbourne, Australia, 10. 2-4 Dec 2009
- Janiesch, C., Niemann, M. and Repp, N. 2009a. *'Towards a Service Governance Framework for the Internet of Services'*, Proceedings of 17th European Conference on Information Systems 2009, Verona Italy, June 8-10
- Janssen, M. 2008. *'Exploring the Service-Oriented Enterprise: Drawing Lessons from a Case Study'*, Proceedings of 41st Annual International Conference on System Sciences, Hawaii, 10.
- JCI 2012. *'Joint Commission Resources: International Catalogue'*, Practical Solutions-Oriented Health Care Information, 2012(1): 28.
- Jeng, J. and Lianjun, A. 2007. *'System Dynamics Modeling for SOA Project Management'*, Proceedings of Proceedings of the IEEE International Conference on Service-Oriented Computing and Applications, IEEE Computer Society, 286-294.
- Joachim, N., Beimborn, D. and Weitzel, T. 2011. *'What are important governance and management mechanisms to achieve IT flexibility in SOA?: An empirical exploration'*, Proceedings of 44th Hawaii International Conference on Systems Science, Poipu, Kauai,
- John Hopkins 2010. *'Johns Hopkins Medicine International (JHI) facilitates the global development to set the standard of excellence in medical education, research and patient care.'* http://www.hopkinsmedicine.org/international/international_partnerships/, [Day of Access, 01-01-2010]
- Johnson, C. W. 2011. *'Identifying common problems in the acquisition and deployment of large-scale, safety-critical, software projects in the US and UK healthcare systems'*, Safety Science, 49(5): 735-745.
- Johnson, M. 2009. *'Data Hemorrhages in the Health-Care Sector'* In Financial Cryptography and Data Security, Vol. 5628 (Eds, Dingledine, R. and Golle, P.) Springer Berlin / Heidelberg, pp. 71-89.
- Josuttis, N. 2007. *'SOA in Practice: The Art of Distributed System Design'*, O'Reilly Media,
- Juneja, G., Dournae, B., Natoli, J. and Birkel, S. 2007. *'Oriented Architecture Demystified: A pragmatic approach to SOA for the IT executive'*, Intel Press,

- Kadambi, G.** 2010. '*SOA in Healthcare A Results Oriented Approach*', Proceedings of SOA in Healthcare: Improving Health through Technology: The role of SOA on the path to meaningful use, Westin Arlington Gateway, in Arlington, VA USA, OMG, July 12-14
- Kajko-Mattsson, M., Lewis, G. and Smith, D.** 2007. '*A Framework for Roles for Development, Evolution and Maintenance of SOA-Based Systems*', Proceedings of Proceedings of the 29th International Conference on Software Engineering Workshops, IEEE Computer Society
- Kamal, M., Themistocleous, M. and Morabito, V.** 2008. '*Evaluating e-Government infrastructure through enterprise application integration (EAI)*' In Evaluating Information Systems (Ed, Butterworth-Heinemann, Oxford, pp. 302-321.
- Kannampallil, T., Schauer, G., Cohen, T. and Patel, V.** 2011. '*Considering complexity in healthcare systems*', Journal of Biomedical Informatics, 44(6): 943-947.
- Kaplan, B. and Harris-Salamone, K. D.** 2009. '*Health IT success and failure: recommendations from literature and an AMLA workshop*', Journal of the American Medical Informatics Association : JAMIA, 16(3): 291-299.
- Kavis, M.** 2008. '*8 characteristics of successful SOA implementations*', Network World, Inc <http://www.networkworld.com/news/2008/100208-8-characteristics-of-successful-soa.html>, [Day of Access, 06.06]
- Khoubati, K., Shah, S., Dwivedi, Y. and Shah, M.** 2007. '*Evaluation of investment for enterprise application integration technology in healthcare organisations: a cost-benefit approach.*', Int J Electron Healthc, 3(4): 453-467.
- Khoubati, K., Themistocleous M. and Irani, Z.** 2006b. '*Evaluating Integration Approaches Adopted By Healthcare Organisations*', Journal of Management Information Systems 22, Number 4 (4): 69 - 108
- Khoubati, K., Themistocleous, M. and Irani, Z.** 2006a. '*Investigating enterprise application integration benefits and barriers in healthcare organisations: an exploratory case study*', Int J Electron Healthc, 2(1): 66-78.
- Kilbridge, P. and Classen, D.** 2008. '*The Informatics Opportunities at the Intersection of Patient Safety and Clinical Informatics*', Journal of the American Medical Informatics Association, 15(4): 397-407.
- Kitsiou, S., Manthou, V. and Vlachopoulou, M.** 2006. '*A Framework for the Evaluation of Integration Technology Approaches in Healthcare*', Proceedings of IEEE International Special Topic Conference on Information Technology in Biomedicine, Ioannina, Greece,
- Kohlborn, T., Korthaus, A. and Rosemann, M.** 2009. '*Business and Software Service Lifecycle Management*', Proceedings of Enterprise Distributed Object Computing Conference, 2009. EDOC '09. IEEE International, 87-96. 1-4 Sept. 2009

References

- Kohn**, L. T. and Corrigan, J. 2000. *'The err is Human: Building a Safer Health System'*, Washington, D.C. USA.
- Kohnke**, O., Scheffler, T. and Hock, C. 2008. *'SOA-Governance – Ein Ansatz zum Management serviceorientierter Architekturen'*, WIRTSCHAFTSINFORMATIK, 50(5): 408-412.
- Kokko**, T., Antikainen, J. and Syst, T. 2009. *'Adopting SOA - Experiences from Nine Finnish Organizations'*, Proceedings of Proceedings of the 2009 European Conference on Software Maintenance and Reengineering, IEEE Computer Society, 129-138.
- Koufi**, V., Malamateniou, F., Papakonstantinou, D. and Vassilacopoulos, G. 2010. *'Using ESB and BPEL for Evolving Healthcare Systems Towards Pervasive, Grid-Enabled SOA Information Systems Development'* (Eds, Papadopoulos, G. A., Wojtkowski, W., Wojtkowski, G., Wrycza, S. and Zupancic, J.) Springer US, pp. 167-175.
- Koumaditis**, K. and Themistocleous, M. 2011. *'The importance of SOA Governance in HIS integration: A literature review'*, Proceedings of Proceedings of European, Mediterranean and Middle Eastern Conference on Information Systems, Athens, Greece, 260-275. 30-31 May
- Koutsouris**, D., Aggelidis, P., Berler, A. and Tagaris, A. 2005. *'Integration of Healthcare Information Systems'*, ebusiness-forum, Z3 research team, Athens.
- Krey**, M. 2010. *'Information Technology Governance, Risk and Compliance in Health Care - A Management Approach'*, Proceedings of Developments in E-systems Engineering (DESE), 2010, 7-11. 6-8 Sept. 2010
- Krey**, M., Furnell, S., Harriehausen, B. and Knoll, M. 2012. *'Approach to the Evaluation of a Method for the Adoption of Information Technology Governance, Risk Management and Compliance in the Swiss Hospital Environment'*, Proceedings of Hawaii International Conference on System Sciences, Maui, Hawaii USA, 2810-2819. January 04-07
- Kweku-Muata**, O. and Ojelanki, N. 2006. *'Managing risks in information systems outsourcing: An approach to analyzing outsourcing risks and structuring incentive contracts'*, European Journal of Operational Research, 174(1): 245-264.
- Lacity**, M., Khan, S. and Willcocks, L. 2009. *'A review of the IT outsourcing literature: Insights for practice'*, The Journal of Strategic Information Systems, 18(3): 130-146.
- Lam**, W. 2005. *'Investigating Success Factors in Enterprise Application Integration: A Case-driven Analysis'*, European Journal of Information Systems, 14(2): 175-187.
- Lapão**, L. 2011. *'Organizational Challenges and Barriers to Implementing "IT Governance" in a Hospital'*, Electronic Journal of Information Systems Evaluation, 1(14).

- Leader, E.** 2010. *'A New Approach Expanding SOA in Healthcare'*, Proceedings of SOA in Healthcare: Improving Health through Technology: The role of SOA on the path to meaningful use, Arlington, USA., OMG, July 12-14
- Lee, J., Shima, H. and Kim, K.** 2010. *'Critical Success Factors in SOA Implementation: An Exploratory Study'*, Information Systems Management, 27(2): 123 - 145.
- Legner, C. and Heutschi, R.** 2007. *'SOA Adoption in Practice - Findings from Early SOA Implementations'*, Proceedings of European Conference on Information Systems, St Gallen, Switzerland, 12. 7-9 June
- Leonard, K.** 2004. *'Critical Success Factors Relating Healthcare's Adoption of New technology'*, Electronic Healthcare, 2(4): 10.
- Leventhal, T., Taliaferro, P., Wong, K., Hughes, C. and Mun, S.** 2012. *'The Patient-Centered Medical Home and Health Information Technology'*, Telemed J E Health.
- Levy, Y. and Ellis, T. J.** 2006. *'A Systems Approach to Conduct an Effective Literature Review in Support of Information Systems Research'*, Informing Science Journal, 9(9): 181-212.
- Lizcano, D., Soriano, J., Reyes, M. and Hierro, J.** 2009. *'A user-centric approach for developing and deploying service front-ends in the future internet of services'*, Int. J. Web Grid Serv., 5(2): 155-191.
- Lohe, J. and Legner, C.** 2010. *'SOA Adoption in Business Networks: Does SOA live up to High Expectations?'*, Proceedings of 18th European Conference on Information Systems, Pretoria South Africa, 13. Jun 4-6, 2010
- Ludwick, D. A. and Doucette, J.** 2009. *'Adopting electronic medical records in primary care: Lessons learned from health information systems implementation experience in seven countries'*, International Journal of Medical Informatics, 78(1): 22-31.
- Lunn, K.** 2008. *'Integrating standards to achieve semantic interoperability'*, Proceedings of SOA in Healthcare realizing quality-of-care, business value, and delivery on its promise,, April 15-17, 2008 - Chicago, IL USA,
- Lunt, N., Smith, R., Exworthy, M., Green, S., Horsfal, D. and Mannion, R.** 2011. *'Medical Tourism: Treatments, markets and health system implications: A scoping review'*, Directorate for Employment, Labour and Social Affairs, Paris, France.
- Luo, M., Goldshlager, B. and Zhang, L.** 2005. *'Designing and Implementing Enterprise Service Bus (ESB) and SOA Solutions'*, Proceedings of IEEE International Conference on Services Computing (SCC'05), Orlando, Florida, USA.
- Maenpaa, T., Suominena, T., Asikainenb, P., Maassb, M. and Rostilac. I.** 2009. *'The outcomes of regional healthcare information systems in health care: A review of the research literature'*, international journal of medical informatics, 7 8 (78): 757-771.

References

- Mahadevan, L.,** Kettinger, W. and Paul, R. 2009. '*A Three Level Model of SOA Maturity: Toward Achieving Sense and Respond*', Proceedings of Americas Conference on Information Systems (AMCIS), San Francisco, California August 6th-9th 2009,
- Malinverno, P. and Plummer, D.** 2011. '*Magic Quadrant for SOA Governance Technologies*', Gartner Inc., Stamford, CT 06902-7700 U.S.A.
- Manes, A.** 2011. '*Market Profile: SOA Governance Infrastructure 2011*', Gartner Inc., Stamford, CT 06902 USA.
- Mantzana, V.** 2006. '*Investigating the Adoption of Enterprise Application Integration in Healthcare Organisations Using an Actor-Oriented Approach*', School of Information Systems, Computing and Mathematics Brunel University, Uxbridge UK.
- Mantzana, V., Koumaditis, K. and Themistocleous, M.** 2010. '*Is SOA a Solution to Healthcare Information Systems Interoperability?*', Proceedings of 10th IEEE International Conference on Information Technology and Applications in Biomedicine, Corfu, Greece, November 2-5, 2010, 5.
- Mantzana, V., Koumaditis, K. and Themistocleous, M.** 2011. '*Healthcare IS Interoperability: Challenges and Solutions*', Proceedings of HEALTHINF 2011: International Conference on Health Informatics, Rome, Italy, 26 - 29 January 2011
- Mantzana, V., Themistocleous M., Morabito, V. and Soulioutis, K.** 2008. '*Evaluating actors and factors associated with healthcare information systems*', In Evaluating Information Systems (Ed, Butterworth-Heinemann), Oxford, pp. 179-198.
- 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).
- Marks, E.** 2008. '*Service-Oriented Architecture (SOA) Governance for the Services Driven Enterprise*', Wiley
- Marks, E. and Bell, M.** 2006. '*Service-Oriented Architecture (SOA): A Planning and Implementation Guide for Business and Technology*', John Wiley; Sons, Inc.,
- Mass, M. and Suomi, R.** 2004. '*Adoption-related Aspects of an Information System in Healthcare Setting*', Proceedings of Thirty-Seventh Annual Hawaii International Conference on System Sciences, Big Island, Hawaii, January 5-8
- Menachemi, N., Brooks, R., Schwalenstocker, E. and Simpson, L.** 2009. '*Use of health information technology by children's hospitals in the United States*', Pediatrics, 123(2): 80-84.
- Menge, F.** 2006. '*Enterprise Service Bus and an Open Source Implementation*', Proceedings of International Conference on Management Science and Engineering, Lille, France, 926-930.
- Middleton, B.** 2010. '*Toward Data and Knowledge Interoperability: The Clinical Decision Support Consortium*', Proceedings of SOA in Healthcare: Improving Health through Technology: The role of

- SOA on the path to meaningful use,, Westin Arlington Gateway, Arlington, VA USA., OMG, July 12-14,
- Miles, A.** 2009. *'Complexity in medicine and healthcare: people and systems, theory and practice'*, Journal of Evaluation in Clinical Practice, 15(3): 409–410.
- Miles, M.** and Huberman, A. 1994. *'Qualitative Data Analysis: An Expanded Sourcebook'*, Sage thousand Oaks, California, USA.
- Miller, C.,** Cromwell, T. and Steffensen, S. 2009. *'CONNECTing to the NHIN'*, Proceedings of SOA in Healthcare Conference, Hyatt Regency O'Hare, Chicago, IL USA OMG, June 2-4
- Ministry of Health** 2012. *'The Greek Healthcare Sector'*, <http://www.yyka.gov.gr/>, [Day of Access, 08.08.2012]
- Mirhaji, P.,** Srinivasan, A., Kunapareddy, N., Cascells, W. and Arafat, R. 2008. *'SOA and Rapid Deployment of Ad-Hoc Health Surveillance Systems: Lessons from Katrina Relief Efforts'*, Proceedings of SOA in Healthcare realizing quality-of-care,, Chicago, IL USA, April 15-17
- Mossialos, E.,** Allin, S. and Davaki, K. 2005. *'Analysing the Greek health system: a tale of fragmentation and inertia'*, Health Economics, 14(S1): S151-S168.
- Mueller, B.,** Viering., G., Legner., C. and Riempp., G. 2010. *'Understanding the Economic Potential of Service-Oriented Architecture'*, Journal of Management Information Systems, 26(4): 145 - 180
- Mulrooney, G.** 2009. *'Information Modelling SOA'*, Proceedings of SOA in Healthcare Conference Hyatt Regency O'Hare, Chicago, IL USA
- Mulrooney, G.** 2010. *'Information Modelling SOA'*, Proceedings of SOA in Healthcare: Improving Health through Technology, Westin Arlington Gateway Arlington VA USA, June 12-14
- Nasr, K.,** Gross, H. and van Deursen, A. 2011. *'Realizing service migration in industry—lessons learned'*, Journal of Software Maintenance and Evolution: Research and Practice.
- Niemann, M.,** Appel, M., Repp, N. and Steinmetz, R. 2009. *'Towards a Consistent Lifecycle Model in Service Governance'*, Proceedings of 15th Americas Conference on Information Systems, San Francisco, USA, August 2009.
- Niemann, M.,** Eckert, J., Repp, N. and Steinmetz, R. 2008. *'Towards a generic Governance Model for Service-Oriented Architectures'*, Proceedings of 14th AMCIS, Toronto, Canada, AIS, August 14th-17th
- Niemann, M.,** Janiesch, C., Repp, N. and Steinmetz, R. 2009. *'Challenges of governance approaches for service-oriented architectures'*, Proceedings of 3rd IEEE International Conference on Digital Ecosystems and Technologies DEST '09, 600-605.
- Niemann, M.,** Miede, A., Wolfgang, J., Repp, N. and Steinmetz R. 2010. *'Structuring SOA Governance'*, International Journal on IT/Business Alignment and Governance, 1(1): 58-75.

References

- O'Dell, C. and Grayson, C. J. 1998. *'If only we knew what we know: identification and transfer of internal best practices'*, California Management Review, 40(3): 154–174.
- Oikonomou, N. and Tountas, Y. 2011. *'The Greek economic crisis: a primary health-care perspective'*, The Lancet, 377(9759): 28-29.
- Ott, C., Korthaus, A., Böhmman, T., Rosemann, M. and Krcmar, H. 2011. *'Lecture Notes in Business Information Processing: Foundations of a Reference Model for SOA Governance Information Systems Evolution'*, Springer
- Pandit-Pant, R. 2010. *'Creating an effective response to the reform maelstrom'*, Proceedings of SOA in Healthcare: Improving Health through Technology, Westin Arlington Gateway Arlington VA USA, June 12-14
- Papakonstantinou, D., Malamateniou, F. and Vassilacopoulos, G. 2010. *'A SOA approach to the implementation of an electronic medical record'*, International Journal of Applied Systemic Studies, 3(3): 343-352.
- Papazoglou, M. 2008. *'Web Services: Principles and Technology'*, Prentice Hall,
- Papazoglou, M. and Van den Heuvel, W. 2007. *'Service-Oriented Architectures: Approaches, Technologies and Research Issues'*, VLDB J., 16(3).
- Papazoglou, M. P., Traverso, P., Dustdar, S. and Leymann, F. 2007. *'Service-Oriented Computing: State of the Art and Research Challenges'*, Computer, 40(11): 38-45.
- Papazoglou, M., Traverso, P., Dustdar, S. and Leymann, F. 2008. *'Service-Oriented Computing: A Research Roadmap'*, International Journal of Cooperative Information Systems (IJCIS), 17(2): 223-255
- Pautasso, C., Zimmermann, O. and Leymann, F. 2008. *'Restful web services vs. "big" web services: making the right architectural decision'*, Proceedings of Proceedings of the 17th international conference on World Wide Web, Beijing, China, ACM, 805-814.
- Percivil, C. and Bridges, J. 2006. *'Globalization and healthcare: understanding health and medical tourism'*, Expert Review of Pharmacoeconomics and Outcomes Research, 6(4): 447-454.
- Petter, S., DeLone, W. and McLean, E. 2008. *'Measuring information systems success: models, dimensions, measures, and interrelationships'*, European Journal of Information Systems, 17(3): 236–263.
- Phillips, E. and Pugh, D. 2010. *'How to Get a PhD: A Handbook for Students and Their Supervisors'*, Open University Press, Berkshire, UK.
- Piva, E., Sciacovelli, L., Zaninotto, M., Laposata, M. and Plebani, M. 2009. *'Evaluation of effectiveness of a computerized notification system for reporting critical values.'*, American Journal of Clinical Pathology, 131(3).

- Poon, E., Cina, J., Churchill, W., Patel N., Featherstone E., Rothschild J., Keohane C., Whittemore A., Bate, D. and Gandhi T.** 2006. '*Medication Dispensing Errors and Potential Adverse Drug Events before and after Implementing Bar Code Technology in the Pharmacy*', *Annals of Internal Medicine*, 145(6): 426-434.
- Poulymenopoulou, M., Malamateniou, F. and Vassilacopoulos, G.** 2012. '*Emergency Healthcare Process Automation Using Mobile Computing and Cloud Services*', *Journal of Medical Systems*, 36(5): 3233-3241.
- Qi, Y., Xumin, L., Athman, B. and Brahim, M.** 2008. '*Deploying and managing Web services: issues, solutions, and directions*', *The VLDB Journal*, 17(3): 537-572.
- Rada, R.** 2008. '*Information Systems and Healthcare Enterprises*', IGI Publishing, Hershey PA.
- Ravi, A., Dutta, S., Janakiraman, R. and Praveen, P.** 2011. '*The Impact of Automation of Systems on Medical Errors: Evidence from Field Research*', *Info. Sys. Research*, 22(3): 429-446.
- Rhoads, J., Cooper, T., Fuchs, K., Schluter, P. and Zambuto, R. P.** 2010. '*Medical device interoperability and the Integrating the Healthcare Enterprise (IHE) initiative*', *Biomedical instrumentation & technology / Association for the Advancement of Medical Instrumentation*, Suppl.(2010): 21-27.
- Riben, M.** 2009 '*Terminology Services for the enterprise application environment utilizing the SOA Paradigm*', *Proceedings of SOA in Healthcare Conference*, Hyatt Regency O'Hare, Chicago, IL USA OMG, June 2-4
- Romero, D., Giraldo, J., Galeano, N. and Molina, A.** 2007. '*Towards Governance Rules And Bylaws For Virtual Breeding Environments*' In *Establishing The Foundation Of Collaborative Networks* (Ed. pp. 93-102.
- Rosen, M.** 2010. '*Service Oriented Architecture and Design Strategies*', *Proceedings of SOA in Healthcare: Improving Health through Technology: The role of SOA on the path to meaningful use*, Westin Arlington Gateway, Arlington, VA USA., OMG, 26.
- Rosen, M., Lubrinsky, B., Smith, K. and Balcer, M.** 2008. '*Applied SOA: Service-Oriented Architecture and Design Strategies*', Wiley Publishing Inc., Indianapolis.
- Ruotsalainen, P., Iivari, A. and Doupi, P.** 2008. '*Finland's strategy and implementation of citizens' access to health information.*', *Stud Health Technol Inform.* , 137(379-385).
- Russell, D. J., Looker, N. and Xu, J.** 2006. '*SOA, dependability, and measures and metrics for network enabled capability*', *IET Seminar Digests*, 2006(11589): 131-135.
- Ruth, P.** 2009. '*Services Thinking For Health Plans*', *Proceedings of SOA In Healthcare Conference*, Chicago, IL USA OMG, June 2-4.

References

- Sangroya, A., Garg, K. and Varma, V.** 2010. '*SAGE: An Approach to Evaluate the Impact of SOA Governance Policies*', Proceedings of IEEE 24th International Conference on Advanced Information Networking and Applications Workshops, 539-544. 20-23 April 2010
- Sankaran, V.** 2008. '*The role of SOA in improving health quality*', Proceedings of SOA in Healthcare realizing quality-of-care, business value, and delivery on its promise, April 15-17, 2008 - Chicago, IL USA,
- SAP** 2012a. '*Business Intelligence Platform Administrator Guide*', http://help.sap.com/businessobject/product_guides/boexir4/en/xi4sp5_bip_admin_en.pdf, [Day of Access, 12.12]
- SAP** 2012b. '*SAP IS-H (Communication)*', http://help.sap.com/saphelp_ish472/helpdata/EN/38/0ebc3959d39c39e10000000a114084/frameset.htm, [Day of Access, 20.1]
- Sarasohn-Kahn, J.** 2010. '*How smartphones are changing health care for consumers and providers*', California HealthCare Foundation <http://www.chcf.org/>, 1438 Webster Street Suite 400, Oakland, CA 94612.
- Schelp, J. and Aier, S.** 2009. '*SOA and EA - Sustainable Contributions for Increasing Corporate Agility*', Proceedings of Proceedings of the 42nd Hawaii International Conference on System Sciences, IEEE Computer Society, 1-8.
- Schepers, T., Iacob, M. and Van Eck, P.** 2008. '*A lifecycle approach to SOA Governance*', Proceedings of ACM symposium on Applied computing, Fortaleza, Ceara, Brazil, ACM, March 16 - 20
- Schmidt, M., Hutchison B., Lambros, P. and Phippen, R.** 2005. '*The Enterprise Service Bus: Making service-oriented architecture real*', IEEE Xplore Digital Library (IBM SYSTEMS JOURNAL), 44(4).
- Shang, S. and Seddon, P.** 2000. '*A Comprehensive Framework for Classifying the Benefits of ERP Systems*', Proceedings of 2000 Americas Conference on Information Systems, AMCIS 2000, Long Beach, California, USA, pp.1005-1114.
- Singer, S., Burgers, J., Friedberg, M., Rosenthal, M., Leape, L. and Schneider, E.** 2011. '*Defining and measuring integrated patient care: promoting the next frontier in health care delivery*', Med Care Res Rev, 68(1): 112-127.
- Smith, M., Buchanan, W., Thuemmler, C. and Hazelhoff Roelfzema, N.** 2010. '*Information Governance and Patient Data Protection within Primary Health Care*', International Journal for Quality in Health Care, 7.
- Söderström, E. and Meier, F.** 2007. '*Combined SOA Maturity Model (CSOAMM): Towards a Guide for SOA Adoption*' In Enterprise Interoperability II (Eds, Gonçalves, R., Müller, J., Mertins, K. and Zelm, M.) Springer London, pp. 389-400.

- Stefanou, C.** and Revanoglou, A. 2006. *'ERP integration in a healthcare environment: a case study'*, Journal of Enterprise Information Management, 19(1): 115-130.
- Stefanovic, M.,** Arsovski, S., Arsovski, Z., Aleksic, A., Nestic, S., Rajkovic, D. and Punosevac, Z. 2012. *'Integration of Virtual and Networked Organization Using Server Oriented Architecture'* In Virtual and Networked Organizations, Emergent Technologies and Tools, Vol. 248 (Eds, Putnik, G. and Cruz-Cunha, M.) Springer Berlin Heidelberg, pp. 165-175.
- Stephens, E.** 2008. *'Managing IT investment - The role of EA and SOA with governance'*, Proceedings of SOA in Healthcare realizing quality-of-care., Chicago, IL USA, April 15-17.
- Strandberg-Larsen, M.** and Krasnik, A. 2009. *'Measurement of integrated healthcare delivery: a systematic review of methods and future research directions'*, International Journal of Integrated Care, 9(5)
- Strauss, A.** and Corbin, J. 1998. *'Basics of qualitative research: techniques and procedures for developing'*, Sage Publications, Inc., London UK.
- Strnadl, C.** 2007. *'Bridging Architectural Boundaries Design and Implementation of a Semantic BPM and SOA Governance Tool'* In Service-Oriented Computing – ICSSOC 2007, Vol. 4749 (Ed, Springer Berlin / Heidelberg, pp. 518-529.
- Sun, J.,** Liu, Y., Dong, J., Pu, G. and Tan, T. 2010. *'Model-Based Methods for Linking Web Service Choreography and Orchestration'*, Proceedings of Software Engineering Conference (APSEC), 2010 17th Asia Pacific, 166-175. Nov. 30 2010-Dec. 3 2010
- Themistocleous, M.** and Mantzana, V. 2010. *'Web Services and SOA'*, Athens. ISBN:9789609323819
- Themistocleous, M.,** Azab, N., Kamal, M., Ali, M. and Morabito, V. 2012. *'Location-Based Services for Public Policy Making: The Direct and Indirect Way to e-Participation'*, Information Systems Management, 29(4): 269-283.
- Themistocleous, M.,** Irani, Z., Psannis, K. and Vrehopoulos, A. 2001. *'Application Integration of Information Technology: Classification of Benefits and Barriers'*, Proceedings of International Workshop on New Models of Business: Managerial Aspects and Enabling Technology, St. Petersburg, Russia, School of Management, St. Petersburg, State University, 153-161, June 128-129, 2001.
- Tilley, S.** and Smith, D. 2010. *'Migrating to SOA: approaches, challenges, and lessons learned'*, Proceedings of Proceedings of the 2010 Conference of the Center for Advanced Studies on Collaborative Research, Toronto, Ontario, Canada, IBM Corp., 371-373.
- Tsavalias, K.,** Siskou, O. and Liaropoulos, L. 2012. *'Hospital mergers in Europe: The experience of Greece and future prospects'*, Archives of Hellenic medicine 29(2): 233-239.
- US Department of Health & Human Services.** 2010. *'Reports on Health Reform'*, <http://www.healthreform.gov/reports/index.html#online>, [Day of Access, 10.10.]

References

- US Government.** 2009. *'Health Reform Web site'*, <http://www.healthreform.gov/reports/index.html>, [Day of Access, 01/04/2010]
- Van Rosse, F., Maat, B., Rademaker, C., van Vught, A., Egberts, A. and Bollen, C.** 2009. *'The effect of computerized physician order entry on medication prescription errors and clinical outcome in pediatric and intensive care: a systematic review'*, *Pediatrics*, 123(4).
- Velez, L., Rebuge, A., Silva, M. and Gomes, R.** 2009. *'ITIL assessment in a healthcare environment: The role of IT governance at hospital São Sebastião'*, *International Congress of the European Federation for Medical Informatics*, 150(2009): 73-80.
- Vengco, J.** 2008. *'Thinking SOA: How to get your organization ready'*, *Proceedings of SOA in Healthcare realizing quality-of-care Chicago IL USA*, April 15-17
- Vest, J. R. and Gamm, L. D.** 2010. *'Health information exchange: persistent challenges and new strategies'*, *Journal of the American Medical Informatics Association: JAMIA*, 17(3): 288-294.
- Viering, G., Legner, C. and Ahlemann, F.** 2009. *'The (lacking) Business Perspective on SOA-Critical Themes in SOA Research'*, *Proceedings of 9th International Conference on Business Informatics*, Wien, 45-54.
- Vom Brocke, J., Simons, A., Niehaves, B., Riemer, K., Plattfaut, R. and Cleven, A.** 2009. *'Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process'*, *Proceedings of Proceedings of the 17th European Conference on Information Systems*, Verona, 2206–2217.
- Wachter, R.** 2008. *'Understanding Patient Safety'*, McGraw-Hill Professional, New York.
- Watson, R.** 2010. *'European cross border healthcare moves a step closer'*, *British Medical Journal*, 341(6196).
- Weiler, J.** 2010. *'Service Orient Acquisition Roadmap'*, *Proceedings of SOA in Healthcare: Improving Health through Technology*, West Arlington Gateway, Arlington, VA USA, June 12-14
- Weiner, B.** 2009. *'A theory of organizational readiness for change'*, *Implementation Science*, 4(1): 1-9.
- Welker, B.** 2009. *'Lessons learned on implementing SOA at veterans affairs'*, *Proceedings of SOA in Healthcare Conference*, Hyatt Regency O'Hare, Chicago, IL USA OMG, June 2-4
- Wendell, O.** 2009. *'Integrated Requirements Design: A practical methodology for SOA'*, *Proceedings of SOA in Healthcare Conference Hyatt Regency O'Hare, Chicago, IL USA*, June 2-4, 2009
- WHO** 2008, Vol. 2 (Eds, Health Metrics Network) WHO Press, Avenue Appia 20, CH-1211 Geneva 27, Switzerland, pp. 72. ISBN 9789241595940
- Willcocks, L., Whitley, E. and Avgerou, C.** 2008. *'The ranking of top IS journals: a perspective from the London School of Economics'*, *European Journal of Information Systems*, 2008(17): 163–168.

- William, A. R., William, J. B. and Francis, X. M.** 2001. *'Enterprise Application Integration: A Wiley Tech Brief'*, John Wiley Sons, Inc.,
- Wolf, S.** 2008. *'The Proposed Patient Mobility Directive and the Reform of Cross-Border Healthcare in the EU'*, TILEC, 2008(034): 57.
- Wong-Bushby, I., Egan, R. and Isaacson, C.** 2006. *'A Case Study in SOA and Re-architecture at Company ABC'*, Proceedings of Proceedings of the 39th Annual Hawaii International Conference on System Sciences - Volume 08, IEEE Computer Society, 179.172.
- World Health Organisation** 2006, Global Observatory for eHealth, Switzerland, pp. 339.
- Wrightson, A.** 2008. *'Information aspects of SOA in healthcare'*, Proceedings of SOA in Healthcare realizing quality-of-care, April 15-17, 2008 - Chicago, IL USA.
- Yoon, T. and Carter, P.** 2007. *'Investigating the Antecedents and Benefits of SOA Implementation: A Multi-Case Study Approach'*, Proceedings of Americas Conference on Information Systems Keystone Colorado, August 9-12
- Yusof, M., Kuljis, J., Papazafeiropoulou, A. and Stergioulas, L.** 2008. *'An evaluation framework for Health Information Systems: human, organization and technology-fit factors (HOT-fit)'*, International Journal of Medical Informatics, 77(6): 386-398.
- Zhang, J., Xu, W. and Ewins, D.** 2007. *'System Interoperability Study for Healthcare Information System with Web Services'* Journal of Computer Science, 3(7).
- Żmuda, D., Psiuk, M. and Zieliński, K.** 2010. *'Dynamic monitoring framework for the SOA execution environment'*, Procedia Computer Science, 1(1): 125-133.

Annex I HIS Integration Standards and Approaches

Many healthcare organisations have adopted integrated approaches. These approaches can be divided in three main categories: (a) integration standards, (b) integration projects and (c) integrated systems, as seen in Table 2.2. The table summarizes Integration standards as (a) EDI, (b) DICOM, (c) HL7, (d) CENT/TC 251, (e) ISO TC 251 and ICD as seen in Table 2.2a. Integration projects as (a) SynEx, (b) Synapses, (c) Hansa/DHE, (d) open HER, (e) FMA, (f) OBO, (g) HSSP and (h) CORBA/CORBAMED and Integration systems as ERP, and Cloud as seen in Table 1 and 2 presented them with a brief description.

Integration Approach	Description	Reference	
Integration Standards	CEN/TC 251	Established by the European Standardisation Committee, Technical Committee 251 for Medical Informatics. Standardization in the field of Health Information and Communications Technology (ICT) is aimed at achieving compatibility and interoperability between independent systems. This includes requirements on the structure of health information to support clinical and administrative procedures, technical methods to support interoperable systems as well as requirements regarding safety, security and quality.	Klein (2002) Rodrigues (2008)
	DICOM	The Digital Imaging and Communications in Medicine (DICOM) Standard specifies a non-proprietary data interchange protocol, digital image format, and file structure for biomedical images and image-related information. Based on middleware technology.	Saverio (2008)
	EDI	Used in healthcare internally for admissions, clinical and financial purpose. Used in healthcare externally with other stakeholder such as suppliers and insurance providers. Evolved as an electronically data carrier replacing paper documents.	Khoubati (2006b)
	HL7	The term HL7 is used both: i) as a name for the organization and ii) as a set of messaging standards (Version 2.x and Version 3.x). HL7 standards are the most successful messaging standards in the healthcare industry. It is a protocol that consists of standardized grammar and vocabulary.	Gocalves (2007)
	ICD	The ICD is the global standard to report and categorize diseases, health-related conditions and external causes of disease and injury in order to compile useful health information related to deaths, illness and injury (mortality and morbidity). The design of the ICD has a direct impact on health care. It influences public health programmes, prevention, reimbursement and treatment. Countries use it to compile basic health statistics and to monitor health spending. To compare findings between countries, a common standard is needed. Emerging diseases and scientific developments, advances in service delivery, and changes in health information systems require a revision of ICD. One major need is to improve the relevance of the ICD in primary care settings. Another key driver is the development of computerized health information systems.	World Health Organisation (2010)
	ISO TC 215	In the software branch, ISO TC 215 constitutes the international standard of Health Information and Communications Technology (ICT), to allow for compatibility and interoperability between independent systems.	Rodrigues (2008)

Table 1: Integration Standards Adopted by Healthcare Sector

Integration Approach	Description	Reference	
Integrated Projects	CORBA/ CORBAmed	CORBA (Common Object Request Broker Architecture) is a middleware technology which allows the development of scalable and re-usable software components to evolve independently from operating systems and hardware platforms. CORBAmed (the Healthcare Domain Taskforce or HDTF) was formed, in order to define standardized object oriented interfaces between healthcare specific middleware services and components to provide a high degree of interoperability between a variety of platforms, languages and applications.	Kitsiou (2006)
	FMA	The Foundational Model of Anatomy Ontology (FMA) is an evolving computer-based knowledge source for biomedical informatics; it is concerned with the representation of classes or types and relationships necessary for the symbolic representation of the phenotypic structure of the human body in a form that is understandable to humans and is also navigable, pursuable and interpretable by machine-based systems.	Burger (2008)
	Hansa /DHE	The HANSA project was launched under the EU Health Telematics Fourth Framework programme. The DHE middleware allows information to be entered, stored, modified, and retrieved through a set of common services, which are accessible to the applications by means of public Application Programming Interfaces (APIs).	Kitsiou (2006)
	HSSP	This project development a framework for generating interoperable service specifications that builds on existing and ongoing standardization efforts. In this framework, known as the HSSP Service Specification Framework, HL7 identifies candidates for service standardization and defines normative Service Functional Models that specify the capabilities and conformance criteria for these services.	Kawamoto (2009)
	OBO	The OBO Foundry is a collaborative experiment involving developers of science-based ontologies who are establishing a set of principles for ontology development with the goal of creating a suite of orthogonal interoperable reference ontologies in the biomedical domain. The groups developing ontologies who have expressed an interest in this goal are listed below, followed by other relevant efforts in this domain.	OBO (2008)
	open EHR	The <i>openEHR</i> Foundation is an independent, not-for-profit organization and community. Its aim is to facilitate the creation and sharing of health records by consumers and clinicians via open source, standards-based implementations. <i>openEHR</i> aims to promote and publish the formal specification of requirements for representing and communicating electronic health record information, based on implementation experience, and evolving over time as health care and medical knowledge develop. Also, promote and publish EHR information architectures, models and data dictionaries, tested in implementations, which meet these requirements	Kalra (2006)
	SynEx	The SynEx (<i>synergy on the extranet</i>) project addresses the problem of system integration and the use of a range of components supporting the delivery of healthcare. Enables authorised persons to share and present medical records from any system in any place. Assists authorised persons in understanding their clinical significance.	Grimson (2002)
	Synapses	Funded by the 4th EU framework for health telemetric. Enables healthcare professionals to share electronic patient records and related medical data wherever and in whatever system they are held. The aim is to permit client applications to request parts of or complete electronic healthcare record from different IS.	Khoumbati (2006b)
Integrated Systems	ERP	Enterprise Resource Planning systems are known among others to allow a company to produce and access information in a real-time environment, provides an integrated database, Reduces administrative costs, deployed to manage the data and processes of the hospital. Using ERPs workloads can be better estimated and understood and also allow a company to share common data and practices across the enterprise.	Stefanou <i>et al.</i> , (2006)
	Cloud Infrastructures	Cloud Computing infrastructures can provide solutions and deliver an integrated telemedicine service that automate the process of data collecting to information deliver as a computing utility. With advantages, such as: (a) it provides always-on, real-time data collecting, (b) it eliminates manual collecting work and possibility of typing errors, and (c) enhances the integration of existing HIS.	Rolim <i>et al.</i> , (2010)

Table 2: Integration Approaches Adopted by Healthcare Sector

Annex II SOA Maturity Model

The five stages of maturity: (a) initial, (b) managed, (c) defined, (d) quantitatively managed and (e) optimised proposed by Berbner *et al.*, (2006) with the SOA governance characteristic proposed by Schepers *et al.*, (2008b) and analysed by Rathfelder and Groenda (2008), seen in Figure 1.

- **Initial:** Early SOA projects are mainly initiated by IT departments, which are responsible for the integration of diverse applications. In this early stage SOA is regarded as an IT project, which only marginally affects other business units. No formal SOA governance concept is in place. This is usually accompanied by a lack of support of SOA projects by the top management of the enterprise.
- **Managed** - A consistent change management and versioning becomes necessary since provided services can be consumed by several applications or services. Regular SOA Governance practices take place, identified problems are tackled by project teams that are formed when necessary. Especially in the initial stage of a SOA of maturity level two, enterprise-wide guidelines have to be defined, that standardise the handling of change requests and the rollout of altered services.
- **Defined:** An enterprise-wide policy has to be established that the service orientation paradigm has to be applied throughout the IT landscape. However, reasonable exceptions can still be allowed by the SOA team. An organisational and process framework is defined as a basis for SOA Governance, specific procedures for SOA management in place. Part of the governance of this level is also the establishment of enterprise-wide rules, guidelines, and policies which regulate security concerns.
- **Quantitatively Managed:** At least from this maturity level on, all new IT systems have to be implemented in a service-oriented manner. Furthermore, it is mandatory that all legacy applications are extended with service interfaces and integrated into the SOA. SLAs replace older techniques (e.g. billing and quality control). Nevertheless, enterprise wide rules and a regulating instance exercising fair competition control are necessary in order to prevent unfair enrichment through monopoly positions on crucial services. Key process indicators and metrics have to be defined, which enable monitoring of the enterprise-wide SOA adoption and the business processes. Especially the business process monitoring can use the already present monitoring infrastructure.
- **Optimised:** The business process monitoring evolves into Business Process Management, which allows the control and optimisation of business processes. SOA Governance is a sophisticated approach using

effective and efficient techniques. Also, due to the dynamic conclusion of SLAs, the monitoring of the compliance with the rules, which have been introduced with maturity level four, has to be automated.

Maturity Level	Technology	Processes	Organisation	Governance
Optimised	SOA (performance, alignment, risk, compliance) integrated into continuously improvement process	Systematic approach established for identifying new requirements and detecting gaps	Responsibilities and accountability measures assigned and defined	The business process monitoring evolves in Business Process Management, which allows the control and optimisation of business processes
Quantitatively Managed	Monitoring and performance measurement	SOA framework and service components are systematically and proactively managed across individual service life cycles	Performance metrics defined. Business processes and service components monitored	All new IT systems have to be implemented in a SOA manner and all legacy applications are extended with service interfaces and integrated into the SOA
Defined	SOA implemented	Modelling, documentation, and implementation of business processes based on SOA components across business areas and organisational units	The responsibilities assigned to: governance, operations / maintenance, planning / development, purchasing /sourcing and monitoring of service supply/delivery	Enterprise-wide policy has to be established (SOA paradigm has to be applied throughout the IT landscape). However, reasonable exceptions can still be allowed
Managed	SOA is checked against conformance requirements and planning (plans already created)	Modelling of business processes with service components implemented. First reusable processes implemented on a project basis	Strategic implications of a SOA implementation are analysed. Responsibilities for planning/integration are assigned. Alignment (requirements, prioritization) with business areas is established	A consistent change management - versioning becomes necessary since provided services can be consumed by several applications/services. Enterprise-wide guidelines have to be defined
Initial	SOA knowledge build-up is in progress	SOA knowledge available via individual competence and engagement of experts	No SOA specific organisational occurrence	Early SOA projects by IT departments, (integration of diverse applications)

Table 1: SOA Maturity Levels & Application Area

Annex III 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: Service Oriented Architecture (SOA) Information

Section E: Service Oriented Architecture (SOA) Governance Information

Section F: Service Oriented Architecture (SOA) Governance Framework 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 organisation has?

.....
.....

A.4 As an organisation what healthcare services do you provide?

.....
.....

A.5 Do you co-operate with other organisations to provide these services?

.....
.....

Section B: General Interviewee Information

B.1 Interviewee's Name and Contact Details

Full Name:

Telephone Number:

Fax Number:

E-mail address:

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 in the organisation and in relevance to SOA

.....

.....

Section C: Integration of Healthcare Information Systems Information

C.1 The healthcare services that your organisation provides are integrated? Why? What's your view on that?

.....

.....

.....

.....

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 HIS?

.....

.....

.....

.....

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 Did you run an integration project recently? Can you provide a description of the project?

.....

.....

.....

.....

C.5 Was it a successful project? How do you justify the success (or failure) of the project?

.....

.....

.....

.....

C.6 Can I get more details about this project (reports, technical data, manuals, etc)?

.....

.....

.....

.....

Section D: Service Oriented Architecture Information

D.1 Could you please analyse the integration process from a technical point of view?

.....

.....

.....

.....

D.2 Did you utilise Service-Oriented-Architecture and Web-Services during your integration efforts?

.....

.....

.....

.....

D.3 It has been reported that in the healthcare sector, integration of IS has been a slow and not always successful process. While implementing Service-Oriented-Architecture (SOA), did you face any kind of problems? Which factors do you believe affect the project's process?

.....

.....

.....

.....

D.4 We have developed a list of Critical Success Factors influencing SOA in healthcare. Could you comment on the list and describe if these factors played a role in your project?

Dimension	CSF	Identified	Comment
Operational	Maturity model		.....
	Roadmap		.....
	Complexity		.....
Managerial	Roles		.....
	Team		.....
	Governance		.....
	Existing resources		.....
	Measurement		.....
	Risk		.....
Strategic	Long-term planning		.....
	Clear goals		.....
	Project identification		.....
IT Infrastructure	Resources		.....
	Standards		.....
	Testing		.....
Organisational	Alignment		.....
	Culture		.....
	Experience/training		.....
	Enforce Decisions		.....

D.5 Can you think of any other factors that can affect the project's implementation?

.....

.....

.....

.....

D.6 Can you give examples of the problems faced and the way they were addressed?

.....

.....

.....

.....

*D.7 Do you have any IT/Enterprise/SOA governance framework that you utilise as an organisation?
If so please provide details.*

.....

.....

.....

.....

Section E: Service Oriented Architecture Governance

E.1 The researcher has identified and proposed a list of common elements found in a SOA endeavour. Can you please relate to the issues according to the experience gained from your project and comment on this list?

Issue	Identified		Comment
	Yes	No	
Organisational Structure	<input type="checkbox"/>	<input type="checkbox"/>
Roles	<input type="checkbox"/>	<input type="checkbox"/>
Maturity Model	<input type="checkbox"/>	<input type="checkbox"/>
Roadmap	<input type="checkbox"/>	<input type="checkbox"/>
SOAGovernance Infrastructure	<input type="checkbox"/>	<input type="checkbox"/>
Policies	<input type="checkbox"/>	<input type="checkbox"/>
Matrics	<input type="checkbox"/>	<input type="checkbox"/>
Best Practices	<input type="checkbox"/>	<input type="checkbox"/>
Governance Processes	<input type="checkbox"/>	<input type="checkbox"/>

Key: absent (x), low (○), medium (◐), high (●)

.....

.....

.....

.....

E.2 Could you please define each one of the issues and explain how (if applicable) they were addressed by your organisation?

Issue	Definition	The way it was addressed
Organisational Structure
Roles
Maturity Model
Roadmap
SOAGovernanc e Infrastructure
Policies
Matrics
Best Practices
Governance Processes

.....

Annex III

E.3 I will like you to comment on the following attributes, sub-elements, guidelines and healthcare aspects please (I will explain each one separately):

		SOA Governance Elements																	
		OS	F	RL	F	MM	F	RD	F	SGI	F	PO	F	ME	F	BP	F	GP	F
Attributes	AT1			AT1		AT1		AT1		AT1		AT1		AT1		AT1		AT1	
	AT2			AT2		AT2		AT2		AT2		AT2		AT2		AT2		AT2	
	AT3			AT3		AT3		AT3		AT3		AT3		AT3		AT3		AT3	
	AT4			AT4		AT4		AT4		AT4		AT4		AT4		AT4		AT4	
	AT5			AT5		AT5		AT5		AT5		AT5		AT5		AT5		AT5	
	AT6			AT6		AT6		AT6		AT6		AT6		AT6		AT6		AT6	
	AT7			AT7		AT7		AT7		AT7		AT7		AT7		AT7		AT7	
	AT8			AT8		AT8		AT8		AT8		AT8		AT8		AT8		AT8	
	AT9			AT9		AT9		AT9		AT9		AT9		AT9		AT9		AT9	
Sub-elements	SE1			SE1		SE1		SE1		SE1		SE1		SE1		SE1		SE1	
	SE2			SE2		SE2		SE2		SE2		SE2		SE2		SE2		SE2	
	SE3			SE3		SE3		SE3		SE3		SE3		SE3		SE3		SE3	
	SE4			SE4		SE4		SE4		SE4		SE4		SE4		SE4		SE4	
Guidelines	GU1			GU1		GU1		GU1		GU1		GU1		GU1		GU1		GU1	
	GU2			GU2		GU2		GU2		GU2		GU2		GU2		GU2		GU2	
	GU3			GU3		GU3		GU3		GU3		GU3		GU3		GU3		GU3	
Additional Guidelines	AGU1			AGU1		AGU1		AGU1		AGU1		AGU1		AGU1		AGU1		AGU1	
	AGU2			AGU2		AGU2		AGU2		AGU2		AGU2		AGU2		AGU2		AGU2	
	AGU3			AGU3		AGU3		AGU3		AGU3		AGU3		AGU3		AGU3		AGU3	
Healthcare Aspects	HA1			HA1		HA1		HA1		HA1		HA1		HA1		HA1		HA1	
	HA2			HA2		HA2		HA2		HA2		HA2		HA2		HA2		HA2	
	HA3			HA3		HA3		HA3		HA3		HA3		HA3		HA3		HA3	
	HA4			HA4		HA4		HA4		HA4		HA4		HA4		HA4		HA4	
	HA5			HA5		HA5		HA5		HA5		HA5		HA5		HA5		HA5	
	HA6			HA6		HA6		HA6		HA6		HA6		HA6		HA6		HA6	
	HA7			HA7		HA7		HA7		HA7		HA7		HA7		HA7		HA7	
	HA8			HA8		HA8		HA8		HA8		HA8		HA8		HA8		HA8	
	HA9			HA9		HA9		HA9		HA9		HA9		HA9		HA9		HA9	

E.4 Were there any other issues that played a crucial role in the management and progression of your project?

.....

.....

.....

.....

.....

.....

.....

E.5 Could you please relate the use and associations between the issues?

Issue	Used for	Associated with
Organisational Structure
Roles
Maturity Model
Roadmap
SOAGovernanc e Infrastructure
Policies
Matrics
Best Practices
Governance Processes
New Issue
New Issue
New Issue
New Issue
New Issue

.....

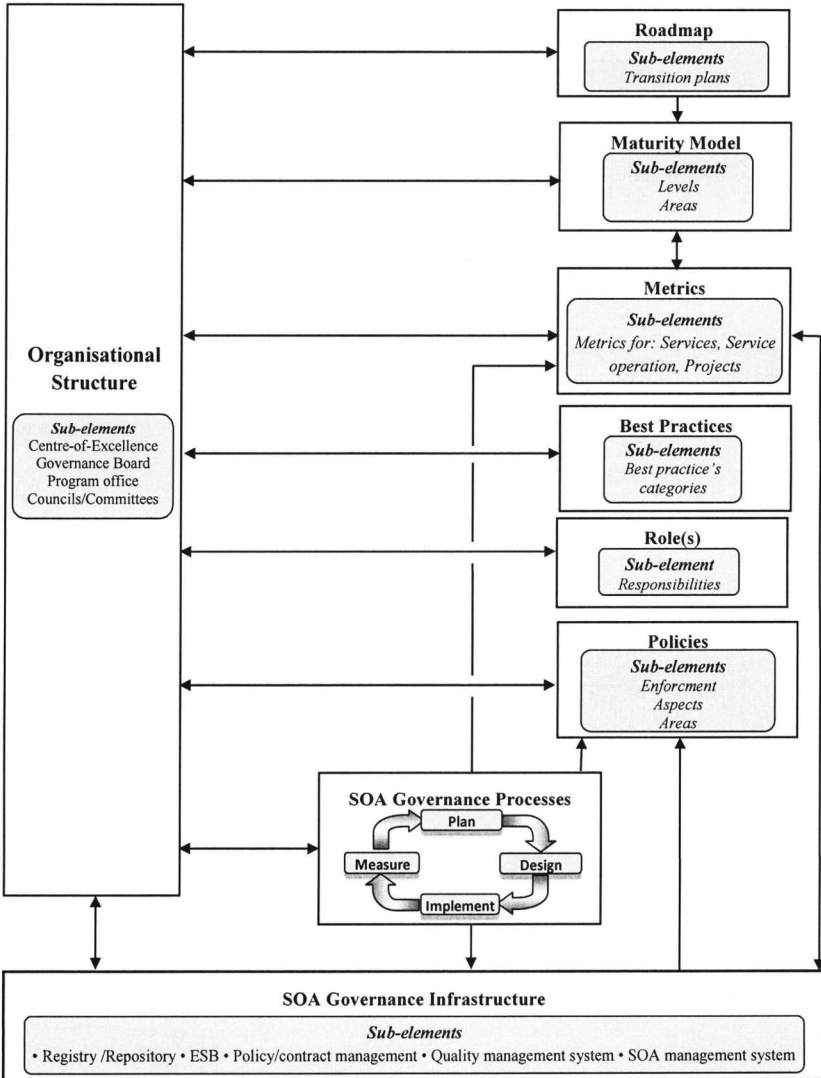
.....

.....

.....

Section F: SOA Governance Framework

F.1 The figure below represents a SOA Governance framework. Could you please comment on the proposition (elements and associations) in regard to your experience? Could you please create a SOA Governance scenario and identify the applicability of the framework based on your scenario?



Section G: Comments

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

.....

.....

.....

.....

.....

.....

.....

Annex IV Types of Involvement

Bieberstein *et al.*, (2005b) reports on the type of involvement into SOA that an organisation can have, such as:

- **Initial:** Organisations in order to reduce risks initially go through a technology validation and a readiness assessment that analyse the technical and business impact on a defined scope. Eventually, the business and technical value realised from this scope is projected to actual propositions for the organisation. This usually involves early pilot projects consisting of creating and exposing services from business operations contained in new or existing applications. The early pilots are used for an early validation of several decision points, such as: (a) the capability to transform existing legacy systems, (b) the non-functional requirements (e.g. performance, security, manageability and availability of tooling), and (c) the organisational structure required supporting an evolution of the organisation (e.g. address skill gaps and establish governance process).
- **Line-of-business:** At this type, the organisation identifies a line of business and prioritises processes where the agility and flexibility that SOA offers increases business value. In case that the organisation has a critical business issue to resolve, the SOA applicability is examined to solve the important issue. This involves a broader initial assessment phase and the identification of key metrics and Critical Success Factors (CSF).
- **Organisation:** This type involves the construction of a business view of a SOA organisation, with a complete prioritisation of projects based on business value followed by the architecture and implementation phases. The organisational activities are separated into business domains and components that constitute the organisation. Furthermore, a SOA governance structure with the required empowerment to monitor, define, and authorise changes to services within the organisation is formed.
- **Organisation-and-partner-network:** This type focuses on a broad transformation of existing business models or the deployment of new business models involving not only the organisation, but also its business partners, suppliers, or customers. The organisation can then select the roles that are appropriate for delivering its value, becoming a service provider, consumer, broker, aggregator, matchmaker, or any combination of those roles.

Annex V Abbreviations

AGU	Additional Guidelines
AT	Attribute
BP	Best Practices
CDSSs	Clinical Decision Support Systems
DICOM	Digital Imaging Communications in Medicine and Common Object Broker Architecture in Medicine
EAI	Enterprise Application Integration
EDI	Electronic Data Interchange
EHCR	Electronic Health Care Records
EKAB	Greek National Centre of Emergency Care
ERP	Enterprise Resource Planning
ESY	Greek National Health System
EU	European Union
GP	Governance Processes
GU	Guidelines
Hansa-	Healthcare Advanced Networked System Architecture Project
HIS	Healthcare Information Systems
HL7	Health Level 7
IKA	Greek Social Security Institution
IS	Information Systems
IT	Information Technology
LIS	Laboratory Information Systems
ME	Metrics
MM	Maturity Model
NHS	National Health System
PACS	Picture Archiving and Communication Systems
PAS	Patient Administration Systems
PO	Policies
RD	Roadmap
RE	Relations
REST	Representational State Transfer
RO	Roles
SE	Sub-Elements
SGI	SOA Governance Infrastructure
SOAP	Simple Object Access Protocol
SOA	Service Oriented Architecture
SynEx	Synergy Extranet
UDDI	Universal Description, Discovery and Integration
UK	United Kingdom
WSDL	Web Services Description Language
WS	Web Services

Annex V

Εκτενής Περίληψη στην Ελληνική Γλώσσα

1.Εισαγωγή

Η ανάγκη για υιοθέτηση Πληροφοριακών Συστημάτων Υγείας (ΠΣΥ) εντείνεται, καθώς αυξάνονται οι απαιτήσεις για έγκυρη ιατρική πληροφορία και ποιοτική, ασφαλή παροχή υπηρεσιών υγείας. Ωστόσο, τα ΠΣΥ εξακολουθούν να παρουσιάζουν αρκετούς περιορισμούς, όπως: (α) πολυπλοκότητα, (β) ολοκλήρωση και (γ) ιατρικά λάθη, που επηρεάζουν το επίπεδο της ποιότητας των παρεχομένων υπηρεσιών υγείας. Οι οργανισμοί υγείας για την αντιμετώπιση των προκλήσεων αυτών, χρησιμοποιούν διάφορες προσεγγίσεις ολοκλήρωσης. Ωστόσο, οι τεχνολογίες που χρησιμοποιήθηκαν για το σκοπό αυτό στο παρελθόν από τους οργανισμούς υγείας δεν έχουν παρουσιάσει μεγάλα επίπεδα υιοθέτησης λόγω των περιορισμών τους. Μεταξύ άλλων οι περιορισμοί αυτοί σχετίζονται με το: (α) υψηλό κόστος, (β) αντίδραση στην αλλαγή, (γ) οργανωτικά θέματα, (δ) υψηλή πολυπλοκότητα, (ε) εύρος αλλαγής, (στ) χρονοβόρες προσεγγίσεις και (ζ) ενδο-οργανωσιακών πολιτικών ζητημάτων και προσωπικών επιδιώξεων. Για να περιοριστούν αυτά τα προβλήματα ολοκλήρωσης, η βιβλιογραφία υποστηρίζει την Υπηρεσιοστρεφής Αρχιτεκτονική (ΥΑ) ως μια υποσχόμενη λύση.

Για τον λόγο αυτό, ο ερευνητής βασισμένος σε ακαδημαϊκά πρότυπα ανασκόπησης και κριτικής ανάλυσης περιέγραψε την ΥΑ, επισήμανε τα οφέλη της και αποκάλυψε τους Κρίσιμους Παράγοντες Επιτυχίας (ΚΠΕ) της με έμφαση στο χώρο της υγείας (Koumaditis *et al.*, 2012). Αυτή η προσέγγιση αποκάλυψε την διακυβέρνηση της ΥΑ ως τον πιο κρίσιμο παράγοντα, και ως εκ τούτου η έρευνα επικεντρώνεται και εμβαθύνει στη μελέτη της διακυβέρνησης της ΥΑ. Η διακυβέρνηση ΥΑ είναι ένα νέο ερευνητικό πεδίο με αδιερεύνητες πτυχές (π.χ. το πεδίο εφαρμογής, τα μοντέλα, τους αλληλοσχετισμούς κλπ). Για τον λόγο αυτό, ο ερευνητής εξήγησε τις βασικές έννοιες της διακυβέρνησης ΥΑ και παρείχε μια λεπτομερή περιγραφή των θεωρητικών προσεγγίσεων γύρω από αυτό το ερευνητικό πεδίο. Παρά το γεγονός ότι τα μοντέλα διακυβέρνησης ΥΑ εμπεριέχουν κοινά θέματα, δεν συγκλίνουν σε μια αποδεκτή ολοκληρωμένη προσέγγιση και παρουσιάζουν ελλείψεις (δεν έχουν εμπλουτιστεί με εμπειρικά δεδομένα). Παράλληλα, κανένα από τα υπάρχοντα μοντέλα δεν αναφέρεται σε οργανισμούς υγείας και τη διαφορετικότητα της προσέγγισης που πηγάζει από αυτή την αναφορά.

Με αυτό τον σκοπό προτάθηκε και αναπτύχθηκε πρότυπο θεωρητικό πλαίσιο διακυβέρνησης ΥΑ που μπορεί να χρησιμοποιηθεί για την υποστήριξη λήψης αποφάσεων. Το προτεινόμενο πλαίσιο δημιουργήθηκε μετά από κριτική ανασκόπηση της βιβλιογραφίας στον χώρο της ΥΑ και διερευνήθηκε και ελέγχθηκε σε οργανισμούς υγείας από όπου συλλέχτηκαν εμπειρικά δεδομένα. Ο τρόπος διεξαγωγής

της πρακτικής έρευνας βασίστηκε σε αρχές ποιοτικής έρευνας χρησιμοποιώντας πολλαπλές μελέτες περίπτωσης. Η ανάλυση των δεδομένων επέφερε προεκτάσεις και επισημάνσεις στο προτεινόμενο πλαίσιο διακυβέρνησης ΥΑ και κατέδειξε τη χρησιμότητα της πρότασης στους οργανισμούς υγείας

2. Ορισμός Προβλήματος – Στόχοι

Κατά τη διάρκεια των τελευταίων δεκαετιών, η ανάγκη για την ολοκλήρωση των ΠΣΥ έχει ενισχυθεί για διάφορους λόγους. Η παρούσα έρευνα εστιάζει σε δύο καιρία ζητήματα ολοκλήρωσης ΠΣΥ: (α) τη μείωση των ιατρικών λαθών που κοστίζουν ανθρώπινες ζωές και (β) την υποστήριξη για παροχή υπηρεσιών υγειονομικής περίθαλψης σε ευρύτερη και παγκόσμια κλίμακα.

Το πρώτο ζήτημα εξετάζει την αναγκαιότητα υποστήριξης της σύγχρονης ιατρικής για συνεπή και ασφαλή ανταλλαγή ιατρικών πληροφοριών και μια διαδικασία που συνδέεται άμεσα με τη διάγνωση και θεραπεία των ασθενών (π.χ. αλλεργίες, ιστορικό ασθενών, ιατρικές εξετάσεις). Παρά την πρόοδο που γίνεται για τη βελτίωση της ποιότητας και της ανταλλαγής ιατρικών πληροφοριών, έχει υπολογιστεί ότι το 5% των εισαγωγών σε νοσοκομείο προκαλούν ιατρικά λάθη και 30% εξ αυτών προκαλούν ζημιά (Wachter, 2008). Τα ιατρικά λάθη, όπως αναφέρεται και στο σχέδιο μεταρρύθμισης του συστήματος υγείας των Ηνωμένων Πολιτειών της Αμερικής (ΗΠΑ), ευθύνονται για το θάνατο 98.000 ανθρώπων κάθε χρόνο (US Department of Health & Human Services., 2010). Επιπλέον, τα ιατρικά λάθη που εμφανίζονται μέσω των μη-ολοκληρωμένων πληροφοριακών συστημάτων υπολογίζεται να οδηγούν στην απώλεια 64 ατόμων ανά ημέρα στο Ηνωμένο Βασίλειο (HB) (Khoumbati *et al.*, 2006a). Τα περισσότερα από αυτά τα λάθη μπορούν να αποφευχθούν. Πολλοί οργανισμοί εντείνουν τις προσπάθειές τους για επίλυση του ζητήματος και προτείνουν λύσεις για την ελαχιστοποίηση των ιατρικών λαθών. Μεταξύ άλλων, η Ευρωπαϊκή Ένωση καταναλωτών πρότεινε ένα σχέδιο ελαχιστοποίησης ιατρικών λαθών, με τη χρήση προηγμένων τεχνολογιών ολοκλήρωσης (Blument, 2009). Παράλληλα, και η ολοκλήρωση των ΠΣ μπορεί να διαδραματίσει ζωτικής σημασίας ρόλο στην αύξηση της ποιότητας των ιατρικών πληροφοριών και τη μείωση των ιατρικών λαθών και μπορεί να θεωρηθεί ως στρατηγική ανάγκη που θα βελτιώσει σημαντικά τις υπηρεσίες υγειονομικής περίθαλψης (Mantzana *et al.*, 2008).

Το δεύτερο ζήτημα αναφέρεται στην ανάγκη των οργανισμών υγείας να παρέχουν υπηρεσίες υψηλής ποιότητας και ασφάλειας μέσω των ΠΣΥ πέρα από τα στενά όρια μιας κλινικής ή ενός νοσοκομείου (Haux, 2006). Τα τελευταία χρόνια, οι ιατρικές πληροφορίες και υπηρεσίες παρέχονται σε εθνικό, περιφερικό και διεθνές επίπεδο (Watson, 2010). Πολλοί ασθενείς τείνουν να χρησιμοποιήσουν υπηρεσίες υγείας εκτός από τη χώρα κατοικίας τους λόγω: (α) μεγάλης λίστας αναμονής, (β) υψηλό κόστος των υπηρεσιών υγειονομικής περίθαλψης, (γ) ειδικευμένης περίθαλψης και (δ) λιγότερων εμποδίων μετακίνησης (Horowitz *et al.*, 2007). Προκειμένου να υποστηριχθεί αυτή η αυξανόμενη ζήτηση

απαιτείται ολοκλήρωση σε πολλά επίπεδα μεταξύ των χωρών, των κυβερνητικών σωμάτων και των οργανισμών υγείας. Από τεχνική πλευρά, οι περισσότερες από αυτές τις υπηρεσίες παρέχονται από αυτόνομα, απομονωμένα και σε πολλές περιπτώσεις μη ολοκληρωμένα ΠΣ. Κατά συνέπεια, γίνεται δύσκολη η παροχή υπηρεσιών που να διαμοιράζονται κοινά χαρακτηριστικά (όπως ποιότητα, ιατρικά δεδομένα ασθενούς κ.α.). Επομένως, απαιτείται η ολοκλήρωση των ΠΣ και υπηρεσιών ώστε να συνδεθούν μεταξύ τους τα σημεία παροχής ιατρικών υπηρεσιών. Αναλυτικότερα, τα ΠΣΥ χρειάζεται να αυτοματοποιούν τις κοινές διαδικασίες, να παρέχουν παρόμοιες υπηρεσίες και να ανταλλάσσουν συμβατές και σχετικές πληροφορίες με ασφάλεια και αξιοπιστία.

Τα ζητήματα που αναφέρονται στις προηγούμενες παραγράφους επηρεάζουν τους οργανισμούς τόσο σε επίπεδο στρατηγικής, όσο και σε επίπεδο πληροφοριακής υποδομής (Rada, 2008) και οδηγούν σε: (α) αλλαγές της στρατηγικής των οργανισμών προς την ολοκλήρωση και (β) επηρεάζουν την ανάπτυξη ολοκληρωμένων αρχιτεκτονικών πληροφοριακής υποδομής. Όμως, η ολοκλήρωση ΠΣΥ δεν είναι μια απλή υπόθεση, λόγω της πολυπλοκότητας και ιδιαιτερότητας του χώρου της υγείας. Οι προσπάθειες να αντιμετωπιστούν τα ζητήματα ολοκλήρωσης στην υγεία έχουν εξετασθεί και κατά το παρελθόν και προσεγγίσεις όπως η Ολοκλήρωση Επιχειρησιακών Εφαρμογών (Enterprise Application Integration - EAI) έχουν χρησιμοποιηθεί και προσδώσει ωφέλιμα μαθήματα στην ανάπτυξη μηχανισμών ολοκλήρωσης. Εντούτοις, η EAI παρουσίασε και περιορισμούς όπως: (α) υψηλό κόστος, (β) αντίσταση στην αλλαγή, (γ) οργανωτικά ζητήματα, (δ) υψηλή πολυπλοκότητα, (ε) μεγάλες αλλαγές, (ζ) μεγάλη διάρκεια υλοποίησης και (η) ζητήματα πολιτικής (Marks and Bell, 2006; Themistocleous and Mantzana, 2010). Όλα αυτά τα ζητήματα είναι σχετικά με τη διακυβέρνηση ΠΣ. Η έλλειψη διακυβέρνησης κατά την εφαρμογή της EAI οδήγησε σε χαμηλά ποσοστά υιοθέτησης της. Αυτό συνέβη διότι, η EAI εστίασε κυρίως στην επίλυση των ζητημάτων ολοκλήρωσης από μια τεχνική προοπτική, δίνοντας έτσι περιορισμένη βαρύτητα στα διαχειριστικά ζητήματα όπως η διακυβέρνηση.

Με βάση την εμπειρία που αποκτήθηκε από τη χρήση της EAI η εστίαση έχει μετατοπιστεί προς την Υπηρεσιοστρεφής Αρχιτεκτονική.

2.1 Υπηρεσιοστρεφής Αρχιτεκτονική

Τα τελευταία χρόνια έμφαση δόθηκε στη διάσπαση των επιχειρησιακών διαδικασιών σε μικρότερα τμήματα λειτουργικότητας (υπηρεσίες). Τα μικρότερα αυτά κομμάτια αυτοματοποιούνται μέσω της χρήσης υπηρεσιών παγκόσμιου ιστού (web-services) που συντίθενται μεταξύ τους και δομούν μια επιχειρησιακή διαδικασία. Σε μια ΥΑ, οι υπηρεσίες είναι καλά καθορισμένες, ανεξάρτητες ενότητες που παρέχουν τυποποιημένη επιχειρησιακή λειτουργία και είναι ανεξάρτητες από την κατάσταση ή το

πλαίσιο άλλων υπηρεσιών (Parazoglou *et al.*, 2008). Αυτό το νέο αρχιτεκτονικό πρότυπο ονομάζεται Υπηρεσιοστρεφής Αρχιτεκτονική.

Η ΥΑ, αποτελεί ήδη ένα σημαντικό υπόδειγμα ολοκλήρωσης σε πολλούς τομείς, μεταξύ των οποίων και στην υγεία. Η βιβλιογραφία όμως δείχνει ότι υπάρχουν ακόμη ζητήματα που καθορίζουν την επιτυχή έκβαση μιας προσπάθειας ολοκλήρωσης με χρήση ΥΑ (Koumaditis and Themistocleous, 2011). Έτσι, σ' αυτή τη διατριβή μελετούνται οι Κρίσιμοι Παράγοντες Επιτυχίας (ΚΠΕ) που σχετίζονται με την ΥΑ και τις εφαρμογές ΥΑ στον τομέα της υγείας (Koumaditis and Themistocleous, 2012). Η κατανόηση των ΚΠΕ μπορεί να βοηθήσει τους οργανισμούς να αυξήσουν τα οφέλη που παίρνουν από την υλοποίηση της ΥΑ και να αυξήσουν τα ποσοστά ολοκλήρωσης. Ως αποτέλεσμα, η ανασκόπηση της βιβλιογραφίας για τον εντοπισμό κρίσιμων παραγόντων επιτυχίας της ΥΑ στον τομέα της υγείας ανέδειξε τον σημαντικό ρόλο που διαδραματίζει κάθε ΚΠΕ κατά την υλοποίηση μιας εφαρμογής ΥΑ στον χώρο της υγείας. Επίσης παρατηρήθηκε ότι η διακυβέρνηση ΥΑ είναι στην κορυφή της λίστας των ΚΠΕ, γεγονός στο οποίο συνηγορούν και αρκετοί ερευνητές του χώρου (Biske, 2008; Josuttis, 2007; Marks, 2008; Niemann *et al.*, 2008).

Ο πρωταρχικός ρόλος της διακυβέρνησης ΥΑ είναι η εναρμόνιση της ΥΑ, δηλαδή εναρμόνιση με νομικούς, τεχνικούς και ενδο-επιχειρησιακούς κανονισμούς. Ειδικά, η διακυβέρνηση πιστοποιεί την ασφαλή και μακρόχρονη λειτουργία μιας ΥΑ (Niemann *et al.*, 2008). Η πλειοψηφία των οργανισμών δεν έχει κατανοήσει την σημασία της διακυβέρνησης ΥΑ, παρά την υλοποίηση αρκετών έργων ΥΑ. Αυτό οφείλεται σε διάφορους λόγους όπως: (α) ταχύτητα αλλαγής, (β) πίεση χρόνου (γ) μέγεθος έργου ΥΑ και (δ) συχνότητα έργου ΥΑ (Koumaditis and Themistocleous, 2011).

Ειδικότερα, οι οργανισμοί αντιμετωπίζουν πιέσεις από τους εμπλεκόμενους (ανταγωνιστές, μετόχους και πελάτες) να βελτιώσουν την πληροφοριακή τους υποδομή και να υιοθετήσουν το υπόδειγμα της ΥΑ με ένα ταχύ ρυθμό. Καθώς, συνήθως, τα χρονικά όρια ολοκλήρωσης του έργου είναι περιορισμένα, δεν υπάρχει χρόνος να εισαχθούν οι αλλαγές που απαιτούνται και να προσαρμόσουν τον οργανισμό στο υπηρεσιοστρεφές υπόδειγμα. Συνήθως, οι οργανισμοί επικεντρώνονται στην τεχνική πλευρά της ΥΑ σε μια προσπάθεια να χρησιμοποιήσουν και να επεκτείνουν τη χρήση της ΥΑ ταχύτερα από τους ανταγωνιστές τους. Έτσι, οι αλλαγές που προκαλούνται από την υιοθέτηση ΥΑ αναπτύσσονται με ταχύ ρυθμό και σε πολλές περιπτώσεις σε συνδυασμό με έλλειψη: (α) γνώσης, (β) κουλτούρας και (γ) εμπειρίας σε τεχνολογία πληροφοριών, παράμετροι οι οποίοι μπορούν να εξετασθούν από την διακυβέρνηση ΥΑ (Baskerville *et al.*, 2005). Επιπρόσθετα, οι οργανισμοί τείνουν να αρχίζουν τα έργα ΥΑ από μικρά πιλοτικά προγράμματα και να τα επεκτείνουν. Σε μικρά πιλοτικά προγράμματα το μέγεθος της αλλαγής και της τεχνολογικής λύσης είναι μικρό, έτσι αναλογικά και οι απαιτήσεις για διακυβέρνηση

περιορισμένες, δίνοντας την εσφαλμένη εικόνα για την αναγκαιότητά της (Schepers *et al.*, 2008a). Όταν όμως το μέγεθος και η συχνότητα των έργων ΥΑ αυξηθεί, επιφέρει και αύξηση της πολυπλοκότητας. Τα μεγάλου εύρους έργα ΥΑ συμβάλλουν καθοριστικά στην πολυπλοκότητα των συστημάτων (Niemann *et al.*, 2008). Η πολυπλοκότητα συνεπάγεται επιπρόσθετες απαιτήσεις π.χ. περισσότερες εγκαταστάσεις αλληλεπιδρώσεων διαδικασιών, νέους ρόλους και ευθύνες (Jeng and Lianjun, 2007). Έτσι, οι οργανισμοί που επιχειρούν να επενδύσουν στην ΥΑ, συνήθως διαπιστώνουν την αναγκαιότητα της ύπαρξης μηχανισμών διακυβέρνησης σε προχωρημένο στάδιο κατά τη διάρκεια του έργου, όταν προσπαθούν να επιλύσουν ζητήματα πολυπλοκότητας.

Επομένως, είτε οι οργανισμοί είναι ενήμεροι για τη διακυβέρνηση της ΥΑ και επιλέγουν να μην δώσουν έμφαση, είτε λόγω χρονικών περιορισμών δεν την αναπτύσσουν. Το αποτέλεσμα και στις δυο περιπτώσεις είναι δημιουργία συστημάτων με χαμηλά ποσοστά διακυβέρνησης, τα οποία είναι δύσκολο να υιοθετηθούν, επεκταθούν και συντηρηθούν. Στο παρελθόν, η αποτυχία υιοθέτησης ΠΣ στην υγεία έχει κοστίσει ανθρώπινες ζωές (Fitzgerald and Russo, 2005). Συμπερασματικά, η ανάπτυξη και χρήση ΠΣΥ χρήζει αυξημένης προσοχής από ερευνητές και επαγγελματίες του χώρου (Biske, 2008; Josuttis, 2007; Marks, 2008; Niemann *et al.*, 2008). Παρόλα αυτά ο μικρός αριθμός εφαρμογών ΥΑ στην υγεία έχει συμβάλει στην περιορισμένη έρευνα στο χώρο της υγείας, ειδικά των θεμάτων διακυβέρνησης.

2.2 Διακυβέρνηση Υπηρεσιοστρεφών Αρχιτεκτονικών

Ως διακυβέρνηση χαρακτηρίζεται η πράξη ελέγχου (μέσω της πολιτικής) της μακροπρόθεσμης στρατηγικής και της κατεύθυνσης μιας οργάνωσης, εκ της διοίκησης. Γενικά, η διακυβέρνηση περιλαμβάνει τις παραδόσεις, τα όργανα και τις διαδικασίες που καθορίζουν πώς η δύναμη ασκείται, πώς στους συμμετόχους δίνεται η δυνατότητα έκφρασης και πώς λαμβάνονται οι αποφάσεις σε σχετικά ζητήματα. Συνήθως, στους περισσότερους οργανισμούς, υπάρχουν δύο τύποι διακυβέρνησης: (α) εταιρική διακυβέρνηση, (β) διακυβέρνηση Τεχνολογίας της Πληροφορικής (ΤΠ).

Η εταιρική διακυβέρνηση είναι σύνολο σχέσεων μεταξύ της εταιρικής διοίκησης, του συμβουλίου, των μετόχων και άλλων συμμετεχόντων που παρέχουν τη δομή μέσω της οποίας οι στόχοι της επιχείρησης τίθενται και προσδιορίζονται τα μέσα που επιτυγχάνονται αυτοί οι στόχοι όπως και η απαιτούμενη απόδοση.

Η διακυβέρνηση ΤΠ είναι η δομή των σχέσεων, των διαδικασιών και των μηχανισμών που χρησιμοποιούνται για να αναπτύξουν, να κατευθύνουν και να ελέγξουν τη στρατηγική και τους πόρους ΤΠ ώστε να επιτευχθούν καλύτερα οι σκοποί και οι στόχοι της εταιρίας. Η διακυβέρνηση αυτού του τύπου αναφέρεται σε ένα σύνολο διαδικασιών που στοχεύουν στην προσθήκη αξίας σε μια επιχείρηση

ισορροπώντας τις πτυχές κινδύνου/ρίσκου και επιστροφής απόδοσης που συνδέονται με τις επενδύσεις ΤΠ. Η διακυβέρνηση ΤΠ είναι η ευθύνη του διοικητικού συμβουλίου και της εκτελεστικής διαχείρισης.

Η διακυβέρνηση ΥΑ διαμορφώνεται σε σχέδιο όταν ο οργανισμός εστιάζει βαθύτερα στην υιοθέτηση και ανάπτυξη ΥΑ, με άλλα λόγια όταν «ωριμάζει» η ΥΑ. Κατά συνέπεια, από ένα χωριστό σχέδιο με διαφορετικούς στόχους για κάθε μια από τις προαναφερθείσες (εταιρική και ΤΠ) δημιουργείται ένα συμπαγές σχέδιο διακυβέρνησης με κοινούς στόχους. Ο σκοπός της διακυβέρνησης της ΥΑ είναι να ευθυγραμμιστεί η διακυβέρνηση λογισμικού με την επιχειρησιακή διακυβέρνηση (Todd Biske, 2008). Αυτή η προσέγγιση συμπεριλαμβάνει το συντονισμό της ανάπτυξης λογισμικού, της απόκτησης και της διάχυσης της επαναχρησιμοποίησης, της επίτευξης μέγιστης ευκινησίας και οικονομιών κλίμακας. Η διακυβέρνηση ΥΑ αναγνωρίζει ότι οι υπηρεσίες είναι εταιρικές αξίες που είναι αναγκαίο να ρυθμιστούν καθ' όλη τη διάρκεια του κύκλου ζωής τους και χτίζει την εφαρμογή της ΥΑ, προς αυτή την κατεύθυνση.

Η ΥΑ καλείται να διαχειριστεί μεγάλες αλλαγές πάσης φύσεως επιφέροντας νέες και η ίδια (Niemann *et al.*, 2009). Πολλές εταιρίες λογισμικού όπως η IBM, Oracle, HP και Software AG, εξέλιξαν τεχνολογίες και μεθόδους διακυβέρνησης ΤΠ και πρότειναν κατάλληλες λύσεις διακυβέρνησης (Castaldini, 2008; Falki *et al.*, 2009; Hewlett-Packard, 2010; Oracle, 2007; 2008; SAP AG, 2008; SOA Software, 2010). Οι προτεινόμενες λύσεις προσανατολίζονται επί το πλείστον σε θέματα γύρω από την εταιρική αρχιτεκτονική, όπως: (α) χρήση καταχωρητών, (β) κύκλου ζωής υπηρεσιών, (γ) Συμφωνίες Επιπέδου Υπηρεσίας (Service Level Agreements (SLAs)) και (δ) καθορισμό/ανάλυση μετρήσεων, (ε) αποτελεσματικότητα των υπηρεσιών και (ζ) χρήσης των υπηρεσιών. Οι προαναφερθείσες προσπάθειες των εταιριών λογισμικού να καθοριστεί και να εφαρμοστεί η διακυβέρνηση καθοδηγούνται στην πλειοψηφία τους από τις πτυχές διακυβέρνησης που μπορούν να αυτοματοποιηθούν από ιδιότητα τεχνολογικά εργαλεία (π.χ. καταχωρητές) και καθοδηγούνται συχνά από τα ενδιαφέροντα της αγοράς. Επιπλέον, οι περισσότερες αναφορές σε μοντέλα διακυβέρνησης προέρχονται από ανέκδοτα άρθρα των εταιριών χωρίς ακαδημαϊκή επικύρωση και αντιπροσωπεύουν τις απόψεις των εταιριών.

Ενώ ερευνητές του χώρου πρότειναν τρόπους και μοντέλα διακυβέρνησης ΥΑ, μελετώντας αυτά παρατηρείται ότι δεν υπάρχει μια κοινά αποδεκτή προσέγγιση διακυβέρνησης ΥΑ (Beimborn *et al.*, 2009b; Berbner *et al.*, 2006; Bernhardt and Seese, 2009a; Bieberstein *et al.*, 2005a; Biske, 2008; De Leusse *et al.*, 2009; Hojaji and Shirazi, 2010b; Janiesch *et al.*, 2009; Niemann *et al.*, 2008; Ott *et al.*, 2011a; Schepers *et al.*, 2008a). Αναλυτικότερα, τα περισσότερα εξ αυτών παρουσιάζουν βήματα διακυβέρνησης σύμφωνα με τον κύκλο ζωής των υπηρεσιών καθ'όλο τον κύκλο ή μερικών φάσεων (Bernhardt and Seese, 2009a; Niemann *et al.*, 2008; Schepers *et al.*, 2008a). Ενώ άλλα ξεκινούν υιοθετώντας τις αρχές μοντέλων διακυβέρνησης ΤΠ και επεκτείνουν προσθέτοντας παραμέτρους ΥΑ

(Bebner *et al.*, 2006; Hojaji and Shirazi, 2010b; Ott *et al.*, 2011a). Μερικοί ερευνητές, επικεντρώνονται σε ανθρώπινους παράγοντες δίνοντας ρόλους για τους μετόχους της διακυβέρνησης (Bieberstein *et al.*, 2005a; Biske, 2008), ενώ άλλοι ελέγχουν τη διακυβέρνηση σε σχέση με την ΤΠ και την επιχειρηματικότητα (Beimborn *et al.*, 2009b). Τέλος, κάποιοι επεξεργάζονται μοντέλα διακυβέρνησης και συνθέτουν νέα (De Leusse *et al.*, 2009; Janiesch *et al.*, 2009). Όμως, μόνο μερικοί επικύρωσαν το μοντέλο τους, είτε μερικώς είτε σε σύγκριση με άλλα μοντέλα (de Leusse and Dimitrakos, 2010; Hojaji and Shirazi, 2010a; Janiesch and Korthaus, 2010; Joachim *et al.*, 2011; Ott *et al.*, 2011a; Schepers *et al.*, 2008a).

Τα μοντέλα και πλαίσια αναφοράς μπορούν να παρουσιάσουν μια σαφή άποψη της έρευνας που γίνεται στον τομέα της διακυβέρνησης ΥΑ. Οι υπάρχουσες προτάσεις ενώ διαθέτουν κοινά στοιχεία, παρουσιάζουν αρκετές διαφορές σε θέματα ορισμού, αναγκαιότητας, χρηστικότητας και ανάλυσης. Επιπρόσθετα, η έλλειψη επικύρωσης και ειδικά στο χώρο της υγείας αφήνει χώρο για περαιτέρω έρευνα.

3. Προτεινόμενο Πλαίσιο Διακυβέρνησης ΥΑ και Μεθοδολογία Έρευνας

Η παρούσα έρευνα έχει ως κύριο στοιχείο το προτεινόμενο πλαίσιο διακυβέρνησης ΥΑ, των στοιχείων που το συνθέτουν και των αλληλεξαρτήσεων μεταξύ των στοιχείων. Η συνοπτική ανάλυση του πλαισίου και των υπολοίπων αποτελεσμάτων της έρευνας παρουσιάζονται στα ακόλουθα τμήματα.

3.1 Προτεινόμενο Πλαίσιο Διακυβέρνησης ΥΑ

Το προτεινόμενο πλαίσιο διακυβέρνησης ΥΑ περιλαμβάνει εννέα κύρια στοιχεία, συγκεκριμένα: (1) Οργανωτική Δομή (Organisational Structure), (2) Βέλτιστες Πρακτικές (Best Practices), (3) Μοντέλο Ωρίμανσης (Maturity Model), (4) Οδικός Χάρτης (Roadmap), (5) Σύστημα Μετρήσεων (Metrics), (6) Ρόλοι (Roles), (7) Πολιτικές (Policies), (8) Διαδικασίες Διακυβέρνησης (Governance Processes) και (9) Υποδομή Διακυβέρνησης (Governance Infrastructure), όπως φαίνεται στο Σχήμα 1.

Αναλυτικότερα τα στοιχεία που απαρτίζουν το προτεινόμενο πλαίσιο Διακυβέρνησης ΥΑ συνοψίζονται στις παρακάτω παραγράφους:

(1) Οργανωσιακή Δομή - Μια νέα στρατηγική προσέγγιση για ολοκλήρωση, όπως η ΥΑ, για να εφαρμοστεί με επιτυχία απαιτεί μεγάλη υποστήριξη σε τομείς οργάνωσης. Πιο συγκεκριμένα η βιβλιογραφία αναφέρει τη δημιουργία μιας ειδικής οργανωτικής δομής ΥΑ. Αναλυτικότερα, οι Bernhardt και Seese (Bernhardt and Seese, 2009b) προτείνουν ότι η οργανωσιακή δομή για διακυβέρνηση ΥΑ θα μπορούσε να περιλαμβάνει ενός τύπου διοικητικού συμβουλίου, ενός γραφείου υπεύθυνου για τον προγραμματισμό της υλοποίησης ΥΑ και μιας σειράς από χαμηλότερα σε δικαιοδοσία όργανα όπως συμβούλια. Επιπρόσθετα, προτείνουν ότι η οργανωσιακή δομή να διαθέτει λειτουργίες, όπως: (α) να

περιλαμβάνει ειδικούς τόσο από τον τομέα της πληροφορικής (IT experts) όσο και τον τομέα της επιχειρηματικότητας (Business managers) με την ικανότητα λήψης αποφάσεων, (β) καθορίζει τις μετρήσεις, τις πολιτικές και τη διακυβέρνηση, (γ) καθορίζει το πλάνο πορείας για τη μετάβαση στη ΥΑ (Bernhardt and Seese, 2009b). Ο ερευνητής αξιολογώντας την βιβλιογραφία πρότεινε μια σειρά από χαρακτηριστικά γνωρίσματα, στοιχεία, οδηγίες και συσχετισμούς για την οργανωσιακή δομή (βλ. Κεφάλαιο 3 – Πίνακα 3.17).

(2) Βέλτιστες Πρακτικές (Best Practices) - Ο όρος βέλτιστη πρακτική έχει χρησιμοποιηθεί με πολλούς τρόπους, κυρίως από κατασκευαστές τεχνολογικών λύσεων που θεωρούν ότι τα προϊόντα τους μπορούν να χαρακτηρίζονται ως τέτοια. Σύμφωνα με τον O'Dell και Grayson (O'Dell and Grayson, 1998) βέλτιστη πρακτική είναι κάθε πράξη, γνώση, τεχνογνωσία, εμπειρία που έχει αποδειχθεί ότι είναι αποτελεσματική και πολύτιμη μέσα σε ένα οργανισμό και που μπορεί να έχει εφαρμογή σε άλλους οργανισμούς. Όταν εφαρμόζεται η αρχή αυτή για ΥΑ, όπου ΥΑ είναι ένα υπόδειγμα ολοκλήρωσης (άρα δεν εκπροσωπείται από μια ενιαία προσέγγιση), η βέλτιστη πρακτική αναφέρεται και είναι απαραίτητη για κάθε μία από τις επιμέρους πτυχές της ΥΑ (π.χ. τεχνολογία, μετρήσεις, πολιτικές, κλπ). Ο ερευνητής αξιολογώντας την βιβλιογραφία πρότεινε μια σειρά από χαρακτηριστικά γνωρίσματα, στοιχεία, οδηγίες και συσχετισμούς για τις Βέλτιστες Πρακτικές (βλ. Κεφάλαιο 3 – Πίνακα 3.17)..

(3) Μοντέλο Ωρίμανσης (Maturity Model) - Τα μοντέλα ωρίμανσης έχουν αναπτυχθεί τα τελευταία χρόνια τόσο από τους επαγγελματίες όσο και από ερευνητές ως μέτρο για την αξιολόγηση των δυνατοτήτων ενός οργανισμού σε σχέση με μια συγκεκριμένη παράμετρο. Τα μοντέλα αυτά αφορούν στενά την ΥΑ. Αναλυτικότερα, τα μοντέλα ωρίμανσης ΥΑ είναι θεωρητικά μοντέλα που περιγράφουν αναμενόμενα, τυπικά, λογικά και επιθυμητά μονοπάτια εξέλιξης προς την ωρίμανση της ΥΑ και χρησιμοποιούνται για την αξιολόγησή της ως-έχει (as-is) κατάσταση ενός οργανισμού. Ο στόχος τους είναι να βοηθούν τον οργανισμό να αντλήσει και να ιεραρχήσει μέτρα βελτίωσης και τελικά να ελέγξει την πρόοδο υλοποίησης της ΥΑ (Becker *et al.*, 2010). Ο ερευνητής αξιολογώντας την βιβλιογραφία πρότεινε μια σειρά από χαρακτηριστικά γνωρίσματα, στοιχεία, οδηγίες και συσχετισμούς για το Μοντέλο Ωρίμανσης (βλ. Κεφάλαιο 3 – Πίνακα 3.17)..

(4) Οδικός Χάρτης (Roadmap) - Η εφαρμογή της ΥΑ απαιτεί αρκετές σημαντικές αλλαγές, τόσο σε θέματα που αφορούν την τεχνολογία, τη νοοτροπία των επιχειρήσεων αλλά και των ιδίων των εργαζομένων. Οδηγίες σχετικά με το πού να αρχίσει και ποια τα επακόλουθα βήματα που θα πρέπει να ακολουθηθούν κατά την έναρξη και την πάροδο του χρόνου, για την εφαρμογή της ΥΑ. Οι απαραίτητες αυτές οδηγίες θα πρέπει να παρέχονται με τη δημιουργία ενός κατάλληλου οδικού χάρτη (Ott *et al.*, 2011b). Ο οδικός χάρτης, στην συγκεκριμένη περίπτωση είναι ένα υψηλού επιπέδου σχέδιο για την

οικοδόμηση της αρχιτεκτονικής και μπορεί να περιλαμβάνει διάφορες παραμέτρους (π.χ. χρόνο-προσδιορισμούς, προϋπολογισμούς κλπ) ή/και σημεία ορόσημα, ή/και στόχους σχετικά με συγκεκριμένες πτυχές (π.χ. πληροφορική, άνθρωποι κλπ). Ο ερευνητής αξιολογώντας την βιβλιογραφία πρότεινε μια σειρά από χαρακτηριστικά γνωρίσματα, στοιχεία, οδηγίες και συσχετισμούς για τον Οδικό Χάρτη (βλ. Κεφάλαιο 3 – Πίνακα 3.17)..

(5) Σύστημα Μετρήσεων (Metrics) - Προκειμένου να παρέχουν μια αξιόπιστη αρχιτεκτονική που να αντιστοιχεί στη στρατηγική που τέθηκε εξ αρχής από τον οργανισμό, απαιτείται η συνεχής μέτρηση και παρακολούθηση των διαφόρων πτυχών της ΥΑ (π.χ. στόχοι οδικού χάρτη, συμμόρφωση με πολιτικές, την απόδοση της επένδυσης κλπ). Από την άποψη αυτή, ορίζονται κατάλληλα κριτήρια αξιολόγησης. Τα κριτήρια αξιολόγησης είναι δείκτες της απόδοσης του συστήματος, που μπορούν να παρατηρηθούν, μεμονωμένα ή συλλογικά, κατά την εκτέλεση σεναρίων (Russell *et al.*, 2006). Χωρίς κριτήρια αξιολόγησης μπορεί να υπάρξει σύγχυση σχετικά με το αν οι προκαθορισμένοι στόχοι επιτυγχάνονται. Έτσι, είναι σημαντικό να καθοριστεί εξ αρχής αλλά και να ανανεώνεται ανάλογα, ένα εύχρηστο σύνολο κριτηρίων αξιολόγησης τα οποία να συνδέονται με τη στρατηγική και τους στόχους του οργανισμού. Ο ερευνητής αξιολογώντας την βιβλιογραφία πρότεινε μια σειρά από χαρακτηριστικά γνωρίσματα, στοιχεία, οδηγίες και συσχετισμούς για το Σύστημα Μετρήσεων (βλ. Κεφάλαιο 3 – Πίνακα 3.17).

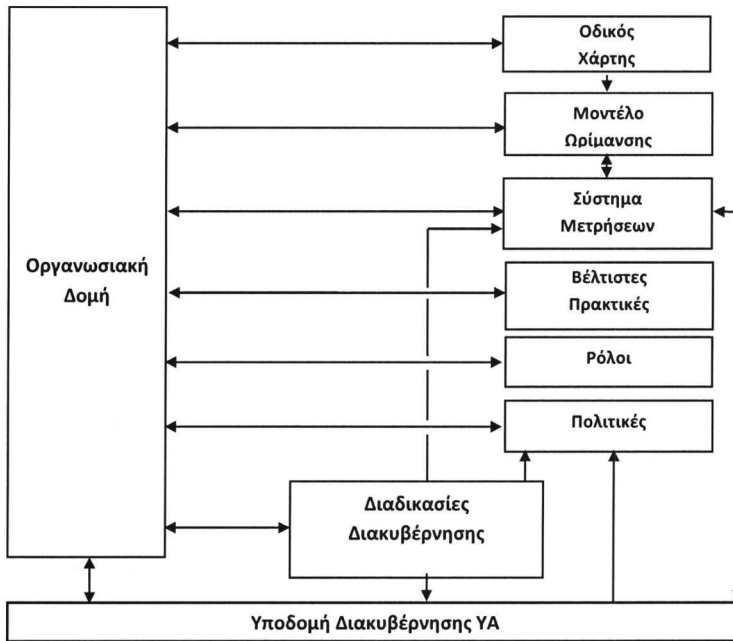
(6) Ρόλοι (Roles) - Πολλοί και διαφορετικοί άνθρωποι με διαφορετικούς ρόλους και επίπεδο ευθύνης συμμετέχουν, επηρεάζουν ή και επηρεάζονται από τη μετάβαση στην ΥΑ. Υπάρχουν περιπτώσεις όπου διάφοροι συμμετέχοντες έχουν διαφορετικές προτεραιότητες, απόψεις ή και συμφέροντα σχετικά με τις τεχνολογικές, επιχειρηματικές και διοικητικές πτυχές αυτής της μετάβασης (κατανομή των πόρων, την ικανότητα απόφασης, κλίμακα κλπ). Υπάρχουν επίσης περιπτώσεις όπου υπάρχει σύγκρουση συμφερόντων μεταξύ των ενδιαφερομένων μελών της ΥΑ. Αυτό δείχνει ότι οι οργανισμοί πρέπει να καθορίσουν μια προσέγγιση για να εξασφαλιστούν οι επιτυχείς διαδικασίες διακυβέρνησης ΥΑ με σαφείς και δομημένους ρόλους άρα και ανάληψης ευθυνών (Biske, 2008). Μια προσέγγιση, δηλαδή που να περιλαμβάνει προτεινόμενη δομή ή λίστα από ρόλους που μπορεί να υπάρχουν ή όχι ήδη στον οργανισμό πριν από την εφαρμογή διακυβέρνησης της ΥΑ. Η εισαγωγή αυτών των εξειδικευμένων ρόλων αν και αρκετές φορές είναι προαιρετική για το σύνολο των ρόλων, είναι σίγουρα ωφέλιμη. Ο ερευνητής αξιολογώντας την βιβλιογραφία πρότεινε μια σειρά από χαρακτηριστικά γνωρίσματα, στοιχεία, οδηγίες και συσχετισμούς για τους Ρόλους (βλ. Κεφάλαιο 3 – Πίνακα 3.17)..

(7) Πολιτικές (Policies) - Πολιτικές είναι ουσιαστικά οι τρόποι με τους οποίους οι θέσεις της διακυβέρνησης υλοποιούνται, προσδίδοντας μια πιο απτή, εκτελέσιμη και με ευκολότερο νόημα για τους ενδιαφερόμενους, μορφή (Marks, 2008). Οι πολιτικές είναι η μεταφορά της στρατηγικής ΥΑ σε δραστική

καθοδήγηση με αρχές, κανόνες και με τέτοιο τρόπο που να ανταποκρίνεται στους στόχους για επιτυχή υλοποίησή της. Αλλά, ανεξάρτητα από την εκπαίδευση και την επικοινωνιακή προσέγγιση που μπορεί να παρέχει ο οργανισμός για να υποστηρίξει τις πολιτικές, εξακολουθεί να υπάρχει η ανάγκη για συμμόρφωση με τις πολιτικές, γεγονός που επιτυγχάνεται με την επιβολή (Biske, 2008). Η επιβολή των πολιτικών εδραϊώνεται είτε κατά τον σχεδιασμό είτε κατά τη λειτουργία της διακυβέρνησης, με αυτοματοποιημένο ή μη τρόπο. Ο ερευνητής αξιολογώντας την βιβλιογραφία πρότεινε μια σειρά από χαρακτηριστικά γνωρίσματα, στοιχεία, οδηγίες και συσχετισμούς για τις Πολιτικές (βλ. Κεφάλαιο 3 – Πίνακα 3.17)..

(8) Διαδικασίες Διακυβέρνησης (Governance Processes) - Διαδικασίες διακυβέρνησης ΥΑ είναι οι διαδικασίες που επικεντρώνονται στο να εκθέσουν τα σχέδια διακυβέρνησης σε πράξεις. Πιο αναλυτικά, η διακυβέρνηση ασχολείται με τη διαδικασία διαχείρισης των υπηρεσιών βάση του κύκλου ζωής και, όπως έχει προαναφερθεί, εξασφαλίζει ότι οι υπηρεσίες έχουν σχεδιαστεί σωστά και επιτυγχάνονται οι στόχοι της ΥΑ. Οι διαδικασίες αυτές είναι απαραίτητες για τον οργανισμό να κατευθύνει την εφαρμογή της ΥΑ και των υπηρεσιών διαχείρισης που ταιριάζουν στις ανάγκες του και να εξασφαλιστεί ότι οι υπηρεσίες που δημιουργούνται ακολουθούν ορισμένες προκαθορισμένες αρχές (Beimborn *et al.*, 2009a). Ο ερευνητής αξιολογώντας την βιβλιογραφία πρότεινε μια σειρά από χαρακτηριστικά γνωρίσματα, στοιχεία, οδηγίες και συσχετισμούς για τις Διαδικασίες Διακυβέρνησης. Ο ερευνητής αξιολογώντας την βιβλιογραφία πρότεινε μια σειρά από χαρακτηριστικά γνωρίσματα, στοιχεία, οδηγίες και συσχετισμούς για τους Διαδικασίες Διακυβέρνησης (βλ. Κεφάλαιο 3 – Πίνακα 3.17)..

(9) Υποδομή Διακυβέρνησης ΥΑ (SOA Governance Infrastructure) – Η ΥΑ δεν είναι μια τεχνολογία, αλλά ένα αρχιτεκτονικό υπόδειγμα και παρότι είναι στενά συνδεδεμένη με λύσεις (ειδικά από τους κατασκευαστές λογισμικού) δεν μπορεί να αντιπροσωπευτεί εξ ολοκλήρου από μια. Ως εκ τούτου, η υποδομή που εκπροσωπεί τη διακυβέρνηση ΥΑ είναι ένα υποστηρικτικό σύνολο τεχνολογιών και λύσεων για την κατασκευή των διαφορετικών πτυχών της διακυβέρνησης ΥΑ (π.χ. επιβολής πολιτικών) (Biske, 2008). Πιο αναλυτικά, η υποδομή διακυβέρνησης ΥΑ βοηθά με τη διαχείριση των πληροφοριών για τη διακυβέρνηση, την αυτοματοποίηση των διαδικασιών διαχείρισης, την εφαρμογή των πολιτικών της διακυβέρνησης, καθώς και τη συλλογή αποτελεσμάτων μετρήσεων (Bernhardt and Seese, 2009a). Ο ερευνητής αξιολογώντας την βιβλιογραφία πρότεινε μια σειρά από χαρακτηριστικά γνωρίσματα, στοιχεία, οδηγίες και συσχετισμούς για την Υποδομή Διακυβέρνησης (βλ. Κεφάλαιο 3 – Πίνακα 3.17)..



Σχήμα 1. Προτεινόμενο Πλαίσιο Διακυβέρνησης ΥΑ

3.2 Μεθοδολογία και Στάδια Έρευνας

Η μεθοδολογία έρευνας αποτελεί καίρια απόφαση για τη διεξαγωγή επιστημονικής έρευνας και βασίζεται κυρίως στην ομοιομορφία και σύνδεση των στόχων της έρευνας σε σχέση με τα χαρακτηριστικά των διαθέσιμων ερευνητικών μεθοδολογιών. Για αυτό τον λόγο και αφού ελέγχθηκαν αρκετές μεθοδολογίες αποφασίστηκε ότι η ποιοτική, ερμηνευτική προσέγγιση με τη αξιοποίηση μελέτης περίπτωσης είναι η πιο κατάλληλη για να ελεγχθεί το προτεινόμενο πλαίσιο διακυβέρνησης ΥΑ σε οργανισμούς υγείας.

Οι λόγοι αυτής της απόφασης συνοπτικά βασίζονται στην πολυπλοκότητα του εννοιολογικού πλαισίου διακυβέρνησης ΥΑ, στην ανάγκη να ελεγχθεί με βάση τα ποιοτικά του χαρακτηριστικά σε πραγματικό περιβάλλον και να διερευνηθούν οι παράμετροι και οι αλληλοσυσχετισμοί που το περιβάλλουν, και η φύση του πεδίου έρευνας (πολυπλοκότητα οργανισμών υγείας).

Αναλυτικότερα, μια ποιοτική ερευνητική μεθοδολογία μπορεί να ακολουθήσει τρία στάδια: (α) το σχεδιασμό της έρευνας (research design), (β) τη συλλογή δεδομένων για την μελέτη περίπτωσης (data collection) και (γ) την ανάλυση των δεδομένων της μελέτης περίπτωσης (data analysis). Ως εκ τούτου,

για την έρευνα αυτή ο ερευνητής ανέπτυξε τη μεθοδολογία της έρευνας με βάση αυτά τα τρία στάδια. Αυτά τα στάδια απεικονίζονται στο Σχήμα 2, μαζί με τα βήματα που ακολουθήθηκαν για την ολοκλήρωση της έρευνας και τα αντίστοιχα κεφάλαια (1-7) της διατριβής.

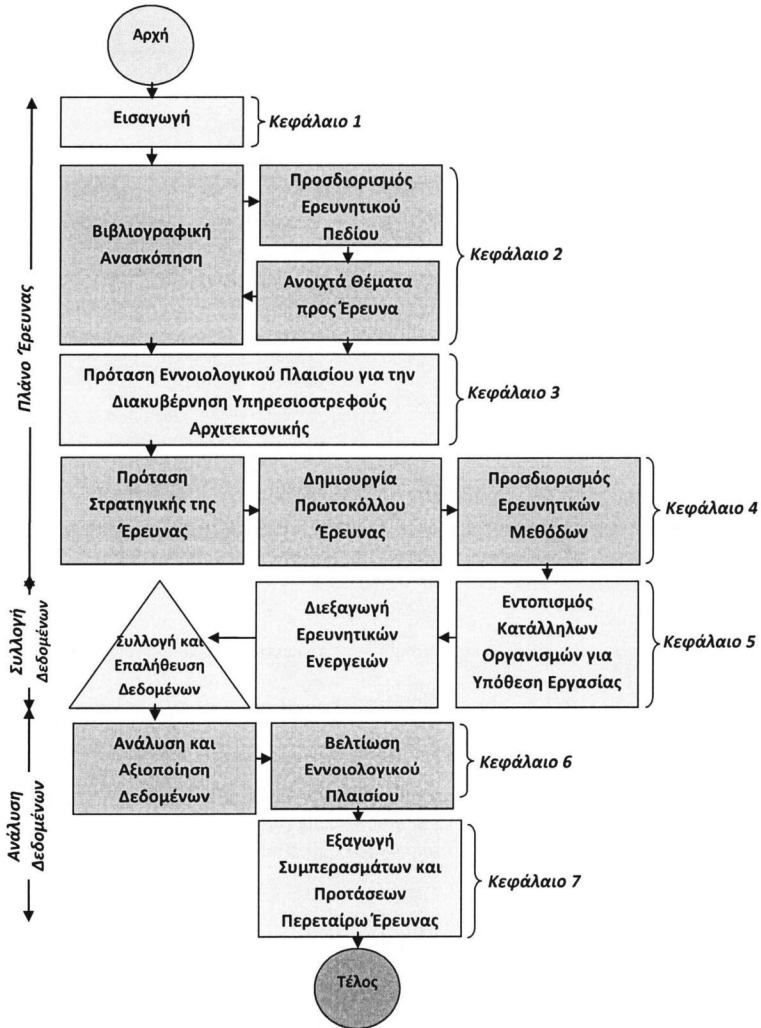
3.3 Μελέτες Περίπτωσης και Αποτελέσματα

Στην παρούσα έρευνα μελετήθηκαν δύο περιπτώσεις οργανισμών υγείας: (α) Ιδιωτικό Νοσοκομείο (IN) και (β) Οργανισμός Ασφάλισης (ΟΑ). Συνοπτικά οι λόγοι για την επιλογή αυτών των περιπτώσεων είναι οι εξής: (α) οι δύο οργανισμοί κατέχουν εξαιρετική φήμη για τις εξειδικευμένες υπηρεσίες υγειονομικής φροντίδας, (β) συμμετείχαν σε πρόσφατες προσπάθειες ολοκλήρωσης των ΠΣΥ τους και αναδιοργάνωση των επιχειρηματικών διαδικασιών (γ) χρησιμοποιούν ΥΑ.

Η συλλογή των δεδομένων βασίστηκε σε βέλτιστες προσεγγίσεις ποιοτικής ερμηνευτικής έρευνας όπως: (α) αναφορές τεκμηρίωσης, (β) συνεντεύξεις, (γ) άμεση παρατήρηση, (δ) συμμετοχική παρατήρηση, (ε) αρχεία-έγγραφα, και (στ) φυσικά αντικείμενα (Yin, 2003).

Οι συνεντεύξεις καταγράφηκαν ψηφιακά, μετατράπηκαν σε κείμενο και έπειτα συζητήθηκαν με τους συνεντευξιζόμενους προς επαλήθευση. Η ανεπιθύμητη προκατάληψη (bias) που μπορεί να παρουσιαστεί κατά τη χρήση ποιοτικών, ερμηνευτικών μεθόδων μελέτης ξεπεράστηκε με τη χρήση πολύπλευρης επαλήθευσης (triangulation) των δεδομένων. Η χρήση πολλαπλών μεθόδων συλλογής δεδομένων (συνέντευξη, εκθέσεις και αρχεία δεδομένων) καθιστά δυνατή την πολύπλευρη επαλήθευση (triangulation) και διατηρεί την αξιοπιστία και την εγκυρότητα των ευρημάτων (Myers and Newman, 2007).

Η ανάλυση των δεδομένων επέφερε αλλαγές και επισημάνσεις στο προτεινόμενο πλαίσιο διακυβέρνησης ΥΑ, των στοιχείων του, και των αλληλοσχετισμού μεταξύ αυτών. Επιπρόσθετα κατέδειξε τη χρησιμότητα της πρότασης στους οργανισμούς υγείας, την ιδιαιτερότητα του χώρου της υγείας και την κρισιμότητα τέτοιων προσεγγίσεων που βοηθούν στη λήψη αποφάσεων και στη διακυβέρνηση. Αναλυτική περιγραφή όλων των προαναφερόμενων ζητημάτων έγινε στα αντίστοιχα κεφάλαια της διατριβής.



Σχήμα 2. Στάδια Υλοποίησης Έρευνας και Αντίστοιχα Κεφάλαια Διατριβής

4. Αποτελέσματα Έρευνας

Τα κύρια ευρήματα που παρήχθησαν από την παρούσα έρευνα παρουσιάζονται παρακάτω:

- Εύρημα 1** Ως αποτέλεσμα της βιβλιογραφικής ανασκόπησης, ο ερευνητής προσδιόρισε και παρήγαγε μια λίστα υφιστάμενων και μελλοντικών προκλήσεων ΟΠΣΥ (βλ. Κεφάλαιο 2 Τμήμα 2.2), μια λίστα πλεονεκτημάτων ΥΑ (βλ. Κεφάλαιο 2 Τμήμα 2.4) και κρίσιμων παραγόντων επιτυχίας ΥΑ (βλ. Κεφάλαιο 2 Τμήμα 2.4). Η συγκεκριμένη ταξινόμηση εμφάνισε την Διακυβέρνηση ΥΑ ως τον πιο καίριο κρίσιμο παράγοντα επιτυχίας ΥΑ.
- Εύρημα 2** Η βιβλιογραφική ανασκόπηση στην περιοχή της ΥΑ, ανέδειξε την έλλειψη ενός ολοκληρωμένου, ελεγμένου θεωρητικού μοντέλου Διακυβέρνησης ΥΑ σε οργανισμούς υγείας. Επιπρόσθετα, η ανασκόπηση των θεωρητικών μοντέλων (βλ. Κεφάλαιο 2 Τμήμα 2.5.7) τόνισε μια σειρά από ομοιότητες (κοινά στοιχεία), διαφοροποιήσεις (κλίμακα, λεπτομέρεια και ανάλυση προσέγγισης) και περιορισμούς (σύγχυση, αλληλοεπικάλυψη, έλλειψη ερευνητικών αποτελεσμάτων και προσεγγίσεων στον χώρο της υγείας).
- Εύρημα 3** Ένα εννοιολογικό πλαίσιο προτάθηκε για να καλύψει το κενό της βιβλιογραφίας σχετικά με την Διακυβέρνηση της ΥΑ στους οργανισμούς υγείας (βλ. Κεφάλαιο 3 Τμήμα 3.4) και να αντιμετωπίσει τους περιορισμούς και την σύγχυση που επικρατεί στην υπό έρευνα περιοχή. Η δομή του προτεινόμενου πλαισίου στηρίζεται σε λεπτομερή ανασκόπηση της βιβλιογραφίας και επί το πλείστον σε αξιολογημένες από κριτές δημοσιεύσεις και εμπεριέχει στοιχεία με χαρακτηριστικά, επιμέρους στοιχεία, οδηγίες, παραδείγματα και επιμέρους θέματα υγείας.
- Εύρημα 4** Ο ερευνητής διερεύνησε δυο οργανισμούς υγείας στην Ελλάδα, βάση της πολύπλευρης έρευνας περιπτώσεων μελέτης, δια την επικύρωση του προτεινόμενου πλαισίου. Οι δυο οργανισμοί παρείχαν επαρκείς πληροφορίες για την έρευνα και μέσα από τα δεδομένα που έχουν ανακτηθεί και παρουσιασθεί βοηθούν στην κατανόηση της ΥΑ στον χώρο της υγείας (βλ. Κεφάλαιο 5). Επί προκειμένου, τα ερευνητικά δεδομένα αποκαλύπτουν εμπειρικές προσεγγίσεις και πρακτικές διακυβέρνησης της ΥΑ και ως εκ τούτου ενισχύουν την κατανόηση

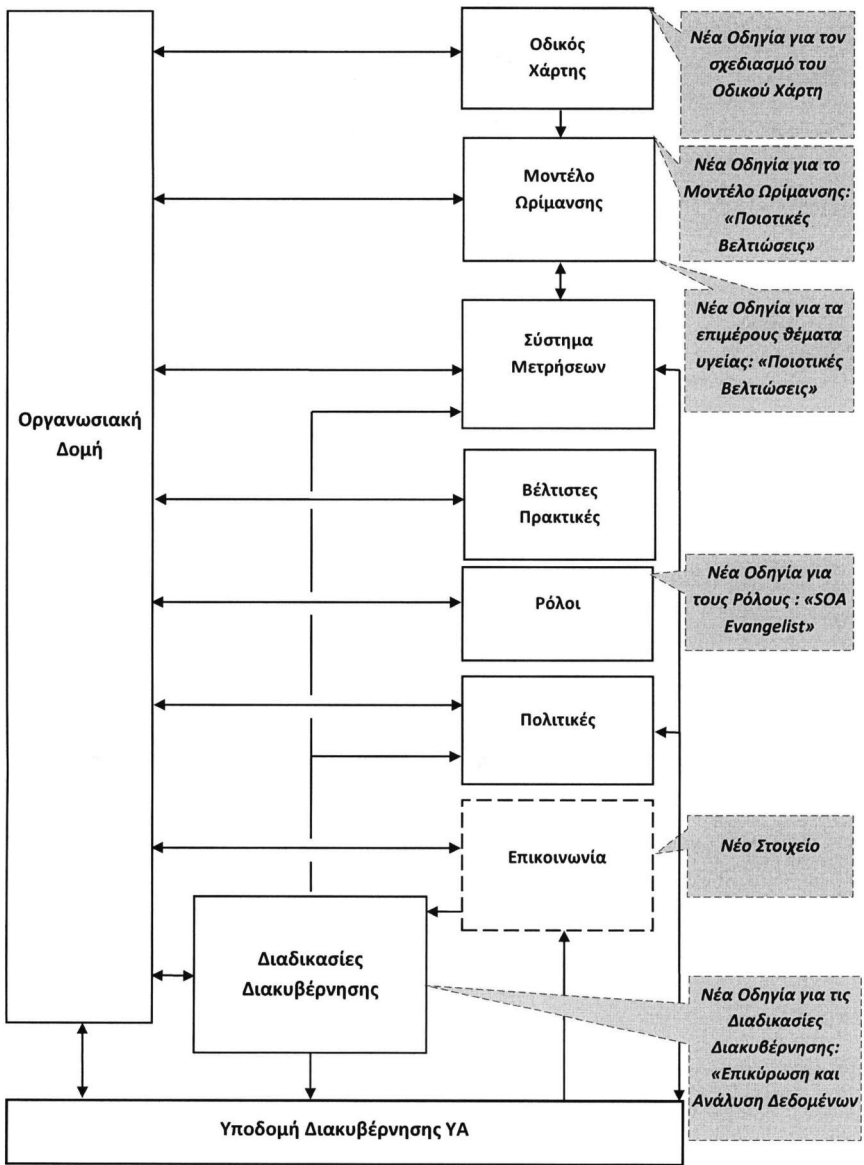
μιας ελλιπώς τεκμηριωμένης περιοχής όπως η Διακυβέρνηση της ΥΑ σε οργανισμούς υγείας .

Εύρημα 5 Από τα εμπειρικά δεδομένα και τη θεωρητική ανάλυση, αναδείχθηκαν θέματα που προτάθηκαν για περαιτέρω έρευνα και το εννοιολογικό πλαίσιο εξετάστηκε και επικυρώθηκε (βλ. Κεφάλαιο 6).

Εύρημα 6 Το προτεινόμενο πλαίσιο διακυβέρνησης ΥΑ ανασκευάστηκε και εμπεριέχει πλέον δέκα στοιχεία, όπως φαίνεται στο σχήμα 3, συγκεκριμένα: (1) Οργανωτική Δομή (Organisational Structure), (2) Βέλτιστες Πρακτικές (Best Practices), (3) Μοντέλο Ωρίμανσης (Maturity Model), (4) Οδικός Χάρτης (Roadmap), (5) Σύστημα Μετρήσεων (Metrics), (6) Ρόλοι (Roles), (7) Πολιτικές (Policies), (8) Διαδικασίες Διακυβέρνησης (Governance Processes), (9) Υποδομή Διακυβέρνησης (Governance Infrastructure) και (10) Επικοινωνία (Communications).

Εύρημα 7 Τα στοιχεία του εννοιολογικού πλαισίου επικυρώθηκαν, περιγράφηκαν και προτείνονται με βάση τα χαρακτηριστικά γνωρίσματα, στοιχεία, οδηγίες και συσχετισμούς με το χώρο της υγείας (βλ. Κεφάλαιο 6).

Εύρημα 8 Το εννοιολογικό πλαίσιο μπορεί να χρησιμοποιηθεί ως εργαλείο για τη λήψη αποφάσεων από τους οργανισμούς υγείας, και επιπρόσθετα επιτρέπει στους ερευνητές να συλλέξουν και να αναλύσουν εννοιολογικά την Διακυβέρνηση ΥΑ σε οργανισμούς υγείας.



Σχήμα 3. Προτεινόμενο Πλαίσιο Διακυβέρνησης ΥΑ