The Business Value of IT in Healthcare:
An Analysis

By

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Master of Engineering (Communications), BEng.

Submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

Deakin University
March 2017
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iv
Abstract

Driven in large part by the success of information technology (IT) investments in other industries, healthcare is also investing heavily in IT to enhance patient outcomes, efficiency, and financial performance. Most recently, Gartner (2015) has ranked the healthcare industry as the fifth highest spender on information systems/ information technology (IS/IT) with about USD108 billion, and a growth percentage of 2.7% compared to 2013. In Australia, we are now witnessing this trend with significant investments being made by various healthcare organisations into various technology solutions to provide and enable better care delivery.

Although significant investments are being made by healthcare organisations in technology, there are many failures, which raise questions about the business value of these large expenses, and the factors affect it. Hence, evaluating the business value of IT in healthcare is crucial. This study attempts to answer the question: “how can information systems/information technology facilitate the generation of business value in healthcare?”

This research is exploratory in nature. It develops a framework to evaluate the impact of different IS/IT on various outputs such as patient outcomes, safety, efficiency, and financial performance. This framework is then tested in a large not-for-profit tertiary healthcare group in Australia. This hospital represents an exemplary single case study with multiple units of analysis within this case. This study uses a qualitative approach with both interviews and archival documents employed to answer the research question.
The conceptual model developed in this study is named ‘The Business Value of IT in Healthcare Model’, and built based on a rigorous literature review in the area of health information systems and their potential impacts on the organisational performance of healthcare providers. This model also builds upon the concepts of IT Portfolio (Weill & Broadbent, 1998) and the Enterprise of Healthcare Delivery Model (W. B. Rouse & Cortese, 2010). The data collected in this research were thematically analysed to test the validity of the conceptual model. The results of this analysis were used to revise the Business Value of IT in Healthcare Model and enhance its coverage to the area of health IS/IT and their impacts on the organisational performance in the healthcare industry.

The findings from this research indicate that evaluating the business value of IT in healthcare is challenging, and needs to take different contextual conditions around healthcare organisations into consideration. These conditions pertain mainly to the healthcare ecosystem, people, processes, and technology. The results also reveal a set of barriers and facilitators to the business value of IT in healthcare. Therefore, this research contributes to the theory by challenging two conceptual models in the Australian healthcare context, and to the practice by issuing a set of recommendations on how to best attain business value from IS/IT in healthcare.

****
# Table of Contents

Access to Thesis ...................................................................................................................... i

CANDIDATE DECLARATION ..................................................................................................... ii

Acknowledgements .................................................................................................................. iii

Abstract ................................................................................................................................... v

Table of Contents .................................................................................................................... vii

List of Figures .......................................................................................................................... xiii

List of Tables ............................................................................................................................ xv

List of Abbreviations ................................................................................................................ xviii

Chapter 1: Introduction .............................................................................................................. 1

1.1 Background ......................................................................................................................... 1

1.2 The Objective and Research Question .............................................................................. 2

1.3 The Context of the Study ................................................................................................... 3

1.4 Significance of this Study .................................................................................................. 5

1.5 Thesis Outline .................................................................................................................... 6

Chapter 2: Literature Review ..................................................................................................... 9

2.1 The Healthcare Delivery: Current State ............................................................................ 10

2.1.1 Different Healthcare Systems ...................................................................................... 11

2.1.2 Healthcare Expenditure .............................................................................................. 13

2.1.3 The Healthcare Delivery: Challenges .......................................................................... 16
4.3.4.1 The Case of Computerised Practitioner Order Entry (CPOE) System ........................................ 132
4.3.4.2 The Case of Incident Reporting System (IRS) ................................................................. 135
4.3.4.3 The Case of Scanned Medical Records System ................................................................. 137
4.3.4.4 The Case of Diseases Classification and Coding System .................................................... 141
4.3.4.5 The Case of Business Information System (BIS) ................................................................ 143

4.4 Themes and Sub-themes for the Business Value of IT in Healthcare ........................................ 145

4.4.1 People ........................................................................................................................................ 147
    4.4.1.1 Visiting Medical Officers ................................................................................................. 148
    4.4.1.2 In-House Users .............................................................................................................. 150
    4.4.1.3 Vendors .......................................................................................................................... 153

4.4.2 Process ..................................................................................................................................... 158
    4.4.2.1 IT Governance and Project Management ........................................................................ 162
    4.4.2.2 Change Management ...................................................................................................... 169

4.4.3 Healthcare Ecosystem ............................................................................................................. 175
    4.4.3.1 External Communications .............................................................................................. 175
    4.4.3.2 Political Influence ........................................................................................................... 182
    4.4.3.3 Competition ................................................................................................................... 187

4.4.4 Technology ............................................................................................................................... 191
    4.4.4.1 Characteristics of IS Products ......................................................................................... 191
    4.4.4.2 Systems Integration ......................................................................................................... 194
    4.4.4.3 Data Issues ..................................................................................................................... 196

4.5 Findings ......................................................................................................................................... 199

4.6 Summary ...................................................................................................................................... 205

Chapter 5: Discussion ......................................................................................................................... 208

5.1 The Business Value of IT in Healthcare: Discussion ................................................................ 210

5.2 The Contextual Components of the Research Framework ......................................................... 223

5.2.1 The Healthcare Ecosystem Context ....................................................................................... 225
    5.2.1.1 External Communications .............................................................................................. 225
5.2.1.2 Political Influence .......................................................... 227
5.2.1.3 Competition ................................................................... 228
5.2.1.4 Recommendations for the Healthcare Ecosystem Context .................................................. 230

5.2.2 The Process Context ............................................................ 231
5.2.2.1 IT Governance and Project Management .......................................................... 232
5.2.2.2 Change Management ........................................................................ 234
5.2.2.3 Recommendations for the Process Context .................................................. 235

5.2.3 The People Context ............................................................... 236
5.2.3.1 The Hospital’s Visiting Medical Officers .................................................. 237
5.2.3.2 In House Users ........................................................................ 238
5.2.3.3 Vendors .................................................................................. 240
5.2.3.4 Recommendations for the People Context .............................................. 242

5.2.4 The Technology Context ........................................................ 243
5.2.4.1 Characteristics of IS/IT Products .......................................................... 243
5.2.4.2 Systems Integration ........................................................................ 245
5.2.4.3 Data Issues .................................................................................. 246
5.2.4.4 Recommendations for the Technology Context ........................................ 247

5.3 The Business Value of IT in Healthcare: Barriers and Facilitators .............................................. 249

5.4 The Revised Business Value of IT Model .................................................................................. 256

5.5 Summary and Next Steps for Rosetta Healthcare ................................................................. 258

Chapter 6: Conclusion .................................................................................. 260

6.1 Answering the Research Question .................................................................................. 261

6.2 Contribution to Theory .................................................................................. 265

6.2.1 Contribution to the IT Portfolio Model ........................................................................ 265
6.2.2 Contribution to the Enterprise of Healthcare Delivery .............................................. 266

6.3 Contribution to Practice .................................................................................. 267

6.4 Research Limitations .................................................................................. 269
6.5 Future Research Directions ........................................................................................................... 270
References ........................................................................................................................................ 275
Appendices ........................................................................................................................................ 295
Appendix A: Ethics Approval from Deakin University ................................................................. 296
Appendix B: Participant Information and Consent Form ........................................................... 297
Appendix C: The Protocol of the Interviews .............................................................................. 302
Appendix D: List of Publications Produced from this Research............................................. 305
# List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 2.1</td>
<td>Health expenditure as a share of GDP in 2013 (or nearest year)</td>
<td>14</td>
</tr>
<tr>
<td>Figure 2.2</td>
<td>Health expenditure per capita in OECD countries in 2013 (or nearest year)</td>
<td>16</td>
</tr>
<tr>
<td>Figure 2.3</td>
<td>The Main Elements of Australia’s Healthcare System</td>
<td>22</td>
</tr>
<tr>
<td>Figure 2.4</td>
<td>How Australia compares to OECD countries in total health expenditure, public health expenditure, and expenditure on pharmaceuticals, all as percentage of GDP between 2000-2012</td>
<td>23</td>
</tr>
<tr>
<td>Figure 2.5</td>
<td>The IT Portfolio Model</td>
<td>47</td>
</tr>
<tr>
<td>Figure 2.6</td>
<td>The Enterprise of Healthcare Delivery</td>
<td>51</td>
</tr>
<tr>
<td>Figure 2.7</td>
<td>The Healthcare Ecosystem</td>
<td>54</td>
</tr>
<tr>
<td>Figure 2.8</td>
<td>Four Stages of Care Cycle</td>
<td>56</td>
</tr>
<tr>
<td>Figure 2.9</td>
<td>The Conceptual Mode of the Research: The BVIT in Healthcare Model</td>
<td>58</td>
</tr>
<tr>
<td>Figure 3.1</td>
<td>Four types of case study designs</td>
<td>71</td>
</tr>
<tr>
<td>Figure 3.2</td>
<td>The flow chart for the research design for this study and its different stages</td>
<td>76</td>
</tr>
<tr>
<td>Figure 3.3</td>
<td>The percentage frequency of the duration of conducted interviews</td>
<td>79</td>
</tr>
<tr>
<td>Figure 3.4</td>
<td>The distribution of the interviewees based on their area of expertise/positions</td>
<td>82</td>
</tr>
<tr>
<td>Figure 4.1a</td>
<td>Total Bed Days at Rosetta Healthcare between 2004-2015, Adopted from the Annual Reports (2004-2015)</td>
<td>96</td>
</tr>
<tr>
<td>Figure 4.1b</td>
<td>Total patients’ admissions and operations performed at Rosetta Healthcare between 2004-2015, Adopted from the Annual Reports (2004-2015)</td>
<td>97</td>
</tr>
<tr>
<td>Figure 4.1c</td>
<td>Day surgery procedures and emergency attendances at Rosetta Healthcare 2004-2015, Adopted from the Annual Reports (2004-2015)</td>
<td>97</td>
</tr>
<tr>
<td>Figure 4.2</td>
<td>Growth Rates at Rosetta Healthcare between 2004 and 2015. Source: Annual Reports (2004-2015)</td>
<td>98</td>
</tr>
<tr>
<td>Figure 4.3</td>
<td>Information Systems for Rosetta Healthcare</td>
<td>100</td>
</tr>
<tr>
<td>Figure 4.4a</td>
<td>Measures to evaluate the organisational performance in healthcare: Clinical perspective as mentioned by the interviewees</td>
<td>115</td>
</tr>
<tr>
<td>Figure 4.4b</td>
<td>Measures to evaluate the organisational performance in healthcare: Non-clinical perspective as mentioned by the interviewees</td>
<td>115</td>
</tr>
<tr>
<td>Figure 4.5</td>
<td>The factors affect the business value of IT in healthcare as discussed in the interviews</td>
<td>147</td>
</tr>
<tr>
<td>Figure 4.6</td>
<td>The Process of IT Governance at the Case Study, Adopted from (Haddad &amp; Wickramasinghe, 2014b)</td>
<td>164</td>
</tr>
<tr>
<td>Figure 5.1</td>
<td>The impacts of the examined IS/IT on clinical and non-clinical performance measures in the healthcare sector</td>
<td>214</td>
</tr>
<tr>
<td>Figure 5.2</td>
<td>The business value of informational and transactional IT in healthcare as the results of this study revealed</td>
<td>221</td>
</tr>
<tr>
<td>Figure 5.3</td>
<td>Barriers to generating business value from IS/IT as found at Rosetta Healthcare</td>
<td>249</td>
</tr>
<tr>
<td>Figure 5.4</td>
<td>The chain of generating business value of IT in healthcare as found at Rosetta Healthcare</td>
<td>253</td>
</tr>
<tr>
<td>Figure 5.5</td>
<td>The Revised Business Value of IT in Healthcare Model</td>
<td>257</td>
</tr>
</tbody>
</table>
## List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2.1</td>
<td>Different types of Healthcare Delivery Systems, as represented in the US, UK, Germany, and Australia.</td>
<td>12</td>
</tr>
<tr>
<td>Table 2.2</td>
<td>The change in health expenditure as a share of GDP in selected OECD countries between 1970 and 2013</td>
<td>14</td>
</tr>
<tr>
<td>Table 2.3</td>
<td>The main features of the Australian public healthcare sector</td>
<td>20</td>
</tr>
<tr>
<td>Table 2.4</td>
<td>How Australia ranks in different healthcare related indicators</td>
<td>24</td>
</tr>
<tr>
<td>Table 2.5</td>
<td>A comparison of rates of health IS/IT use in seven high-income countries including Australia</td>
<td>27</td>
</tr>
<tr>
<td>Table 2.6</td>
<td>IT spending by industry in 2014-2015</td>
<td>29</td>
</tr>
<tr>
<td>Table 2.7</td>
<td>The most popular clinical IS/IT in today's clinical practices</td>
<td>30</td>
</tr>
<tr>
<td>Table 2.8</td>
<td>The impact of IS/IT on productivity in the literature</td>
<td>35</td>
</tr>
<tr>
<td>Table 2.9</td>
<td>The impact of IS/IT on profitability and return on Investment</td>
<td>37</td>
</tr>
<tr>
<td>Table 2.10</td>
<td>The impact of IS/IT on firms' organisational capabilities</td>
<td>40</td>
</tr>
<tr>
<td>Table 2.11</td>
<td>The objectives of the IT Portfolio Model</td>
<td>47</td>
</tr>
<tr>
<td>Table 3.1</td>
<td>Different research approaches and their possible constraints</td>
<td>63</td>
</tr>
<tr>
<td>Table 3.2</td>
<td>The appropriateness of a qualitative approach to this research, based on the work of (Yin 2014, 2011)</td>
<td>64</td>
</tr>
<tr>
<td>Table 3.3</td>
<td>The three paradigms for qualitative research</td>
<td>66</td>
</tr>
<tr>
<td>Table 3.4</td>
<td>The appropriateness of case study as a research strategy for this research, as defined and compared to other research strategies</td>
<td>69</td>
</tr>
<tr>
<td>Table 3.5</td>
<td>The main constructs of the protocol of interviews used in this study</td>
<td>78</td>
</tr>
<tr>
<td>Table 3.6</td>
<td>The details of data collection conducted in this study</td>
<td>81</td>
</tr>
</tbody>
</table>
Table 3.7  Six strategies to enhance the reliability and validity of qualitative research as adopted from Merriam and Tisdell (2015) and how they were used in this study  83

Table 3.8  Themes and sub-themes resulted from the thematic analysis  88

Table 4.1  Different performance indicators at Rosetta Healthcare, Adopted from the Annual Reports of Rosetta Healthcare (2004-2015)  95

Table 4.2  The Main Clinical Information Systems at Rosetta Healthcare  102

Table 4.3  Units of analysis at Rosetta Healthcare, including the interviewee category (executive, clinical, clinical IT or IT) and the number of interviews undertaken for each interviewee  105

Table 4.4  Suggested parameters to be used to measure the organisational performance in healthcare from clinical and non-clinical perspectives as mentioned by the interviewees  114

Table 4.5  The requirements for information sharing facilitated by clinical IS/IT  118

Table 4.6  The identified themes and sub-themes from the interviews conducted with Clinicians, Executives, Clinical IT and IT Personnel.  146

Table 4.7  The requirements for a robust IT governance in the healthcare sector, as confirmed by selected quotes from interviewees  167

Table 4.8  Identified problems with using IS/IT by Rosetta Healthcare to facilitate the communications with external clinical services providers  178

Table 4.9  The requirements of IS/IT in today’s healthcare as revealed by the study  193

Table 4. 10  A summary of the key findings on the business value of IT in healthcare as the data  202

Table 5.1  The factors affect the business value of IT in healthcare and the level of their impacts as the results revealed  209

Table 5.2  Mapping the studied CPOE and IRS systems onto IT Portfolio (Weill & Broadbent, 1998) and the Enterprise of Healthcare Delivery (Rouse & Cortese, 2010) models  215
| Table 5.3 | Mapping the studied DCCS and SMR systems onto the IT Portfolio (Weill & Broadbent, 1998) and the Enterprise of Healthcare Delivery (Rouse & Cortese, 2010) | 216 |
| Table 5.4 | Mapping the studied BIS onto IT Portfolio (Weill & Broadbent, 1998) and the Enterprise of Healthcare Delivery Model (Rouse & Cortese, 2010) | 218 |
| Table 5.5 | The identified elements from the conceptual model based on the literature | 223 |
| Table 5.6 | Identified elements from the conceptual model based on the study findings | 224 |
| Table 5.7 | The barriers to attaining business value of IT in healthcare and their impact on the clinical and non-clinical domains | 252 |
| Table 6.1 | Answering the research question by addressing three sub-questions | 262 |
| Table 6.2 | The contribution of this study to practice as a set of recommendations | 268 |
## List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation / Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIHW</td>
<td>Australian Institute of Health and Welfare</td>
</tr>
<tr>
<td>ASL</td>
<td>Agreed Service Level</td>
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<td>ATM</td>
<td>Automatic Teller Machine</td>
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<td>BA</td>
<td>Business Analytics</td>
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<td>BI</td>
<td>Business Intelligence</td>
</tr>
<tr>
<td>BIS</td>
<td>Business Information Systems</td>
</tr>
<tr>
<td>BPI</td>
<td>Business Process Improvement</td>
</tr>
<tr>
<td>BRAVA</td>
<td>Bain Resources Access for Value Addition</td>
</tr>
<tr>
<td>CAGR</td>
<td>Compound Annual Growth Rate</td>
</tr>
<tr>
<td>CAT</td>
<td>Clinical Audit Tool</td>
</tr>
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<td>CCIO</td>
<td>Chief Clinical Information Officer</td>
</tr>
<tr>
<td>CDR</td>
<td>Clinical Data Repository</td>
</tr>
<tr>
<td>CDSS</td>
<td>Clinical Decision Support System</td>
</tr>
<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
</tr>
<tr>
<td>CFO</td>
<td>Chief Finance Officer</td>
</tr>
<tr>
<td>CIO</td>
<td>Chief Information Officer</td>
</tr>
<tr>
<td>CIS</td>
<td>Clinical Information Systems</td>
</tr>
<tr>
<td>CMMS</td>
<td>Computerised Maintenance Management System</td>
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<td>CPOE</td>
<td>Computerised Practitioner Order Entry</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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</tr>
<tr>
<td>DCCS</td>
<td>Diseases Classification and Coding System</td>
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<tr>
<td>ED</td>
<td>Emergency Department</td>
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<tr>
<td>EF</td>
<td>Expected Finding</td>
</tr>
<tr>
<td>EFT</td>
<td>Equivalent Full Time</td>
</tr>
<tr>
<td>EHC</td>
<td>Electronic Health Card</td>
</tr>
<tr>
<td>EMAR</td>
<td>Electronic Medical Administration Record</td>
</tr>
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<td>EMR</td>
<td>Electronic Medical Record</td>
</tr>
<tr>
<td>ERP</td>
<td>Enterprise Resource Planning</td>
</tr>
<tr>
<td>ET</td>
<td>Emerging Theme</td>
</tr>
<tr>
<td>FQHC</td>
<td>Federally Qualified Health Centre</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GP</td>
<td>General Practitioner</td>
</tr>
<tr>
<td>HER</td>
<td>Health Electronic Records</td>
</tr>
<tr>
<td>HFIS</td>
<td>Health Fund Information System</td>
</tr>
<tr>
<td>HIE</td>
<td>Health Information Exchange</td>
</tr>
<tr>
<td>HIS</td>
<td>Health Information Systems</td>
</tr>
<tr>
<td>HIT</td>
<td>Health Information Technology</td>
</tr>
<tr>
<td>HL7</td>
<td>Health Level Seven International</td>
</tr>
<tr>
<td>HREC</td>
<td>Human Research Ethics Committees</td>
</tr>
<tr>
<td>ICD-10</td>
<td>International Disease International Statistical Classification of Diseases and Related Health Problems, Tenth Revision</td>
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<tr>
<td>ICD-10-AM</td>
<td>International Disease International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
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<td>-------------</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communication Technology</td>
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<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
</tr>
<tr>
<td>IOM</td>
<td>Institute of Medicine</td>
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<tr>
<td>IRS</td>
<td>Incident Reporting System</td>
</tr>
<tr>
<td>IS</td>
<td>Information Systems</td>
</tr>
<tr>
<td>IS/IT</td>
<td>Information Systems/ Information Technology</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>LIS</td>
<td>Laboratory Information Systems</td>
</tr>
<tr>
<td>MBS</td>
<td>Medicare Benefits Schedule</td>
</tr>
<tr>
<td>MRI</td>
<td>Magnetic Resonance Imaging</td>
</tr>
<tr>
<td>ND</td>
<td>Nursing Documentation</td>
</tr>
<tr>
<td>NHS</td>
<td>National Health Service</td>
</tr>
<tr>
<td>OE</td>
<td>Order Entry</td>
</tr>
<tr>
<td>OECD</td>
<td>The Organisation for Economic Cooperation and Development</td>
</tr>
<tr>
<td>PACS</td>
<td>Picture Archiving and Communication System</td>
</tr>
<tr>
<td>PAS</td>
<td>Patient Administration System</td>
</tr>
<tr>
<td>PBS</td>
<td>Pharmaceutical Benefits Scheme</td>
</tr>
<tr>
<td>PCEHR</td>
<td>Personally Controlled Electronic Health Records</td>
</tr>
<tr>
<td>PD</td>
<td>Physician Documentation</td>
</tr>
<tr>
<td>PDF</td>
<td>Portable Document Format</td>
</tr>
<tr>
<td>PM</td>
<td>Project Management</td>
</tr>
<tr>
<td>PMO</td>
<td>Project Management Office</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
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</tr>
<tr>
<td>PMS</td>
<td>Pharmacy Management System</td>
</tr>
<tr>
<td>PrMS</td>
<td>Practice Management System</td>
</tr>
<tr>
<td>POC</td>
<td>Point of Care</td>
</tr>
<tr>
<td>PRINCE2</td>
<td>Projects in Controlled Environment, Version 2</td>
</tr>
<tr>
<td>RIS</td>
<td>Radiology Information System</td>
</tr>
<tr>
<td>ROI</td>
<td>Return on Investment</td>
</tr>
<tr>
<td>SF</td>
<td>Significant Finding</td>
</tr>
<tr>
<td>SMR</td>
<td>Scanned Medical Record</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
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<tr>
<td>UR</td>
<td>Unique Record</td>
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<tr>
<td>US</td>
<td>United States</td>
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<tr>
<td>VMO</td>
<td>Visiting Medical Officer</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
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</table>
Chapter 1
Introduction
Chapter 1: Introduction

1.1 Background

Healthcare delivery systems globally are under pressure to enhance access, quality of care, value of care delivery, and to control the increasing cost of healthcare (Huang, Seitz, & Wickramasinghe, 2010; Troshani & Wickramasinghe, 2016; Wickramasinghe & Tatnall, 2014).

Despite the rising costs of healthcare delivery, there exist some real concerns about the capabilities of different healthcare systems on a global scale to cope with the common challenges (Jha, Doolan, Grandt, Scott, & Bates, 2008; van Loenen, van den Berg, Faber, & Westert, 2015). These challenges are mainly the ageing population, rising rates of chronic diseases, as well as the emergence of new technologies to facilitate superior healthcare delivery (P. Haddad, Gregory, & Wickramasinghe, 2014a; Harper, 2014). These challenges can be seen as external pressure factors on different healthcare delivery systems (Peter Haddad, Schaffer, & Wickramasinghe, 2015). However, recent studies have shown that there also exist some real problems with these systems themselves, such as low levels of coordination, access difficulties, lack of patient-centeredness (Bodenheimer, 2008; Coleman, Austin, Brach, & Wagner, 2009; Detering, Hancock,
Chapter 1

Introduction

Reade, & Silvester, 2010; Dobrow, 2009; Treadwell et al., 2014), and patient safety (Institute of Medicine, 2005; James, 2013; Levinson, 2010).

Adopting information systems/ information technology (IS/IT) has been shown as a key strategy to address these problems (Institute of Medicine, 2001). Today, we are witnessing enormous types and forms of IS/IT applications in the healthcare that promise to deliver higher quality and safety (Peter Haddad et al., 2015; Wickramasinghe & Schaffer, 2010). Advocates point to the role assigned to IS/IT to reduce human errors in the area of prescribing and taking notes on care plans (OECD, 2013c). On a parallel line, the debate about the difference IS/IT solutions can make in healthcare quality, efficiency, and safety has not stopped, driven mainly by not realising the business value of the IT investments, and not enhancing the healthcare outcomes as promised. In the light of these complex circumstances, the need for a framework to evaluate the business value of IT in healthcare is evident.

1.2 The Objective and Research Question

This research investigates the business value of IT in healthcare. To do so, this study develops a conceptual model to identify the IS/IT that are likely to help generate business value. This model then can be used by different healthcare providers to make better decisions about IS/IT investments, and to guide various stakeholders towards attaining the business value of IT.

Therefore, the primary research question for this research is:

How can information systems/ information technology facilitate the generation of business value in healthcare firms?
In order to answer this research question, the following additional questions need to be answered:

- Which IS/IT does healthcare need to invest in to generate business value?
- How can these IS/IT help generate business value in healthcare?
- Under which conditions are these IS/IT likely to generate business value in the healthcare industry?

In defining IS/IT, this study aligns with a well-known classification of IS/IT by Weill and Broadbent (1998) and consists of four layers based on their business objectives: infrastructure, transactional, informational and strategic.

One more precise specification is required for this study; *i.e.* the specific meaning of “healthcare firms”. In this study, we examine an Australian private healthcare group in four interrelated layers: healthcare ecosystems (society), system structure (organisations), delivery operations (processes) and clinical practices (people). This lens is provided by the Enterprise of Healthcare Delivery Model (W. B. Rouse & Cortese, 2010).

### 1.3 The Context of the Study

The context of this study is a large private not-for-profit Australian healthcare group consisting of a number of hospitals that run as different business units across various locations and sites. This group has made massive investments into its clinical and non-clinical information systems during the last few years as later chapters in this thesis will show. These characteristics enable the selected healthcare group to be the context of this study and help answer the research question about the business value of IT in healthcare.
The Australian healthcare system is a two-tier system in general (Wickramasinghe et al., 2015). In other words, it consists of two different components - private and public hospitals, with different funding structures between private and public sectors. These differences are becoming blurred with private hospitals contracted to do public work and public hospitals accessing both private health funds and the Medicare funding for fee-for-service clinics (Cheng & Vahid, 2011; Hall, 2010; Wickramasinghe et al., 2015). The public hospitals are funded by the state, territory, and Australian federal government, while private hospitals are owned and operated by the private sector (Willis, Reynolds, & Keleher, 2016).

In private healthcare, there are not-for-profit and for-profit hospitals (Bloom, 2002). While generating profits for shareholders is one of the primary objectives in for-profit hospitals, the not-for-profit hospitals, owned by religious, charity and community organisations, are not primarily driven by profit, but by committed agreements or values (Bloom, 2002). The distribution of the surplus from not-for-profit hospitals is either directed towards expansion, enhancing the quality of services, or contribution to other charitable enterprises (Wickramasinghe et al., 2015).

The Australian spending on healthcare is slightly below the average of the Organisation for Economic Co-operation and Development (OECD) (OECD, 2015b). However, the Australian healthcare system delivers high-quality outcomes in terms of healthy population, life expectancy at birth (81.4 years) and declining rates of infant and youth mortality between 1988 and 2007 (Australian Government, 2010; OECD, 2013b). However, this lower spending has had negative impacts on some health indicators such as access, equity, and timeliness of care (Davis, Stremikis, Schoen, & Squires, 2015).
The use of IS/IT, including eHealth, is seen as an enabler to reform the Australian healthcare system through the utilisation of new technologies to integrate care, improve patient outcomes, and deliver better capacity, quality, and cost-effectiveness (Australian Government, 2010).

Australia, as with other developed countries, has different levels of use of IS/IT depending on the settings. The literature shows that simpler healthcare settings are currently better environments for health information technology (HIT). For instance, Pearce and Haikerwal (2010) noted that there exists a widespread use of computers in the Australian general practices, while bigger healthcare providers (i.e. hospitals) still lag behind all other sectors of the Australian economy in the use of computerised systems.

1.4 Significance of this Study

This research makes a considerable contribution to the current body of academic and industry-related knowledge in the area of health IS/IT in the Australian healthcare setting.

First, it is one of the first studies that examines the concept of “business value of IT” in the complicated, expensive, and crucial industry of healthcare, as this topic is one of the apparent voids in the current literature as the next chapter will show. Numerous researchers have made attempts to conceptualise the business value of IT and measure it in different industries, but such studies in the context healthcare are still missing. Not only does this mirror the complexity of care delivery, but it also necessitates tackling this issue to bridge this clear void in the health IS literature. The second contribution of this study would be examining the validity of the model of IT Portfolio (Weill & Broadbent, 1998) in the context of healthcare, which will add to this model by challenging it and
expanding it to cover the healthcare domain. The resulting conceptual model will serve to guide future research in the area of the business value of IT in healthcare. In addition, this research explores the benefit of using the Enterprise of Healthcare Delivery Model (W. B. Rouse & Cortese, 2010) as a socio-technical framing for the healthcare delivery.

This research also contributes to practice by identifying IS/IT that potentially generate business value from clinical and non-clinical perspectives. Further, it shows the circumstances under which IS/IT help generate business value. It is particularly crucial given the trend to invest more in health IS/IT (Gartner, 2015), and the increased pressures on the healthcare providers around the world to reduce cost and enhance patients’ outcomes (Wickramasinghe & Schaffer, 2010).

1.5 Thesis Outline

This thesis is organised into six chapters. This chapter (Chapter 1) has served to provide an overview of this study and the research objectives and significance.

Chapter 2 presents the literature review. In this chapter, the research issues and the theoretical underpinnings of this study are explored in details. It mainly covers the area of health IS/IT and the need to examine the business value of IT in the context of healthcare. The current literature shows clearly that the research in this area (i.e. the business value of IT in healthcare) still lags behind other industries such as manufacturing, retail, and banking. This chapter also introduces the Business Value of IT in Healthcare Model.

Chapter 3 describes the research methodology and research design adopted in this study. The use of qualitative methods and case study based on an interpretivist view is justified
and mapped to this study. This chapter also covers the ethical considerations and aligning to them in this research. In addition, an overview of the data collection, data analysis, and the main themes resulted from the data analysis is also presented in this chapter.

Chapter 4 provides the analysis and findings from this study in details. Based on this, the chapter then classifies the results into emerging findings, expected findings, and significant findings.

Chapter 5 discusses the themes and tests their consistency with the theoretical underpinnings of this study. Also, this chapter examines the findings of this study against the theories around health IS/IT and other works in this area.

Finally, Chapter 6 summarises the study and shows how the research questions were answered, the limitations of this study, and future research directions. The implications and recommendations for both practice and theory are also given in this chapter along with the case study reflections.

***
Chapter 2
Literature Review
Chapter 2: Literature Review

This research explores the business value of IS/IT in healthcare and then designs a model that evaluates the business value of different IS/IT in this industry. This model serves as a framework that conceptualises the roles of different IS/IT in enhancing the organisational performance of healthcare organisations at different levels. The literature shows that there exists a real need for such a conceptual model due to three main challenges: 1) the increasing investments in health IS/IT, e.g. (Gartner, 2015), 2) the contradictory findings from the literature on the impact of these investments in healthcare, e.g. (Chae, Koh, & Prybutok, 2014; Chaudhry et al., 2006), and 3) the need of a comprehensive model that addresses the limited scope of current studies on the impact of IS/IT in the context of healthcare, e.g. (P. Haddad et al., 2014a).

This chapter is organised into seven sections that build the case for a conceptual model as follows: Section 2.1 is dedicated to presenting a review of the current state of different healthcare delivery systems around the world. It also includes healthcare expenditures and challenges faced by a selected set of these systems. As the context of this study is the Australian healthcare system, Section 2.2 is an overview of this system, its main components, challenges, and the use of IS/IT to facilitate its different operations. Section
2.3 presents a review of the use of IS/IT in healthcare, and Section 2.4 is set out to introduce the concept of the business value of IT, its extensive applications in different industries, and the dearth of similar applications in the healthcare. Section 2.5 presents the theoretical underpinnings of this study, namely the IT Portfolio (Weill & Broadbent, 1998) and the Enterprise of Healthcare Delivery (W. B. Rouse & Cortese, 2010). Section 2.6 presents the implications of the literature to this study and the development of the conceptual model. Finally, a summary of the chapter and the significance of this study are given in Section 2.7.

2.1 The Healthcare Delivery: Current State

Today, there exist different models of healthcare delivery based on how care is delivered in different countries around the world. Nevertheless, the challenges facing these healthcare systems are relatively similar. These mainly relate to the increasing costs of healthcare delivery as an input, and to real concerns about the quality of care as the output of this expensive industry (OECD, 2012). Increased costs are due to a number of factors, such as demographic changes (P. Haddad et al., 2014a), advances in medical technologies (Nguyen, Bakewell, et al., 2015; Nguyen, Haddad, et al., 2015), and the growing expectations of patients on the quality of care they want to receive (Anderson, Frogner, Johns, & Reinhardt, 2006; P. Haddad, Gregory, & Wickramasinghe, 2014b). On the other hand, poor quality of care is due to complex factors depending on the contextual conditions (Institute of Medicine, 2001). Overall, improving the organisational performance of the different levels of healthcare providers has become an international topic of major interest (Peter Haddad et al., 2015). One reason for this interest is pragmatic, where national health risks such as AIDS, flu, and bioterrorism may have
global impacts on international health, commerce, and politics. Another reason is ethical, which relates to inequities in the access, financing, and delivery of health services. *i.e.* the poor are sicker and pay proportionately more for care than the wealthy (Blendon et al., 2002; Frenk & Gómez-Dantés, 2002; Savage, Feirman, van der Reis, Myers, & Moxley, 2010). In the light of these conditions, reforming national healthcare systems is mainly driven by the endeavour to produce equitable and cost-effective systems (Jacobs, 1998).

The following Subsection 2.1.1 demonstrates different models for healthcare delivery in different countries, while Subsection 2.1.2 is an outlook on the changes in healthcare expenditure globally, and Subsection 2.1.3 is devoted to summarising the challenges facing the healthcare delivery on a global scope.

### 2.1.1 Different Healthcare Systems

Different countries have different healthcare systems (Wickramasinghe, Haddad, & Vaughan, 2016). From a funding perspective, healthcare systems can be classified into mostly private systems (as in the United States (US) for example), mainly public systems (as in the United Kingdom (UK) for example), and two-tiered systems, *i.e.* of both private and public components (as in Australia and Germany for example) (Wickramasinghe, Geisler, & Schaffer, 2006). These differences in funding structures have had different impacts on the way healthcare is delivered. Table 2.1 illustrates some of the differences between healthcare systems in the countries above.
Table 2.1: Different types of Healthcare Delivery Systems, as represented in the US, UK, Germany and Australia, adopted from (P. Haddad et al., 2014a, pp. 58-59)

<table>
<thead>
<tr>
<th>HC System</th>
<th>Country</th>
<th>Description</th>
</tr>
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</table>
| Private   | US      | • In 2013, the US had a total expenditure on healthcare as a percentage of the Gross Domestic Product (GDP) of 17.1% (The World Bank, 2015), and the total expenditure on healthcare per capita (US$) was $8,713.00 (OECD, 2015a). Both figures were the highest value within the OECD countries (OECD, 2015a).  
• In 2012, the US spent 2,809 billion US$ on healthcare; 11% of this spending made by households, 46% by government, and 43% by other domestic funding. 15% of the population had no health insurance (Shankar, 2012).  
• High cost, uneven quality of care, frequent errors as well as limited access to care are the main problems face the US healthcare system (Michael E. Porter & Teisberg, 2006). |
| Public    | UK      | • The National Health Service (NHS) is the fundamental part of UK’s healthcare system, while private health insurance plays a significantly smaller role.  
• In 2013, the UK had a total expenditure on healthcare (% GDP) of 9.1%, which was close to the average ratio of the OECD countries (The World Bank, 2015). Furthermore, the UK’s total expenditure on healthcare per capita (US$) was $3,453 (OECD, 2015a).  
• NHS provides a wide variety of free healthcare services to UK’s ordinarily residents; reliable for 87% of UK’s total healthcare spending (Greener, 2009), while private health insurance accounted for 1% of UK’s total spending on healthcare according to 2006 figures. |
| 2-tier    | Germany | • In 2013, Germany had a total expenditure on health (% GDP) of 11.3%, which was 1.5% higher than the average ratio of the OECD countries (The World Bank, 2015), and a total expenditure on healthcare per capita (US$) 4819 in 2012 (OECD, 2015a).  
• Germany spent 383 billion US$ on healthcare as in 2012, the government-funded 76% of these expenditures, while householder’s contribution was 12% (Shankar, 2012).  
• The healthcare actors in Germany are divided into enrollees, service providers (medical doctors, pharmacists, hospitals) and cost units (health insurance companies) (Shankar, 2012). |
|           | Australia | • In 2013, Australia had a total expenditure on health (% GDP) of 9.5% (The World Bank, 2015), and in 2012 Australia’s total expenditure on health per capita (US$) was $3,866 (OECD, 2015a) |
• The healthcare system in Australia consists of both public and private components. The key feature is public health insurance under Medicare, which is funded by taxation. Enrollees have the possibility to use subsidised medical services and pharmaceuticals as well as free of charge hospital treatment according to their status as a public health enrollee. Besides Medicare, Australian patients have the possibility to use, in addition, a private health insurance, which gives for example patients access to dental services and hospital treatment as a private patient (Australian Government, 2015).

• In 2012, Australia spent 141 billion US$ on healthcare, 19% of it was spent by households, while different levels of governments (state and federal) contributed to 67% of the expenditure (OECD, 2015b).

• Since 1999, the Australian government has supported private health insurance by giving enrollees a rebate of 30% of private health insurance premiums (Australian Government, 2016a).

• Private health insurance in Australia is community-rated, which means that “everyone pays the same premium for their health insurance” (Australian Government, 2016b). In 2009, 47.1% of Australia’s population had a private hospital insurance (Australian Government, 2015).

2.1.2 Healthcare Expenditure
The Organisation for Economic Cooperation and Development (OECD) defines the total expenditure on health as, ‘the final consumption of health goods and services (i.e. current health expenditure) plus capital investment in health care infrastructure. This includes spending by both public and private sources on medical services and goods, public health and prevention programs and administration” (OECD, 2012, p. 37). According to the latest figures, health expenditure is rising faster than incomes in many developed countries, especially outside Europe, which raises questions about how countries will pay for their future health care needs (OECD, 2013a). These increases are particularly notable in the US where the total health expenditure as a share of the GDP was almost 17% compared with 9.5% for Australia and OECD in general (OECD, 2015a) as Figure 2.1 depicts.
Figure 2.1 Health expenditure as a share of GDP in 2013 (or nearest year). Source: (OECD, 2015a).

While the financial crisis in 2009 had created some control on health expenditure, as a share of the GDP, health spending outside Europe has been growing at around 2.5% per year since 2010 (OECD, 2015a) as Table 2.2 below depicts.

Table 2.2 the change in health expenditure as a share of GDP in selected OECD countries between 1970 and 2013 (OECD, 2015a)

<table>
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<tbody>
<tr>
<td>Australia</td>
<td>4.1%</td>
<td>6.1%</td>
<td>6.7%</td>
<td>8.0%</td>
<td>8.5%</td>
<td>8.8%</td>
</tr>
<tr>
<td>Austria</td>
<td>5.2%</td>
<td>7.4%</td>
<td>8.3%</td>
<td>9.9%</td>
<td>10.5%</td>
<td>10.1%</td>
</tr>
<tr>
<td>Belgium</td>
<td>3.9%</td>
<td>6.3%</td>
<td>7.2%</td>
<td>9.0%</td>
<td>11.1%</td>
<td>10.2%</td>
</tr>
<tr>
<td>Canada</td>
<td>6.9%</td>
<td>7.0%</td>
<td>8.9%</td>
<td>8.8%</td>
<td>10.4%</td>
<td>10.2%</td>
</tr>
<tr>
<td>France</td>
<td>5.4%</td>
<td>7.0%</td>
<td>8.4%</td>
<td>10.1%</td>
<td>11.2%</td>
<td>10.9%</td>
</tr>
<tr>
<td>Germany</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>10.3%</td>
<td>10.5%</td>
<td>11.0%</td>
</tr>
<tr>
<td>Italy</td>
<td>N/A</td>
<td>N/A</td>
<td>7.7%</td>
<td>8.1%</td>
<td>9.1%</td>
<td>8.8%</td>
</tr>
<tr>
<td>Japan</td>
<td>4.6%</td>
<td>6.5%</td>
<td>6.0%</td>
<td>7.7%</td>
<td>8.1%</td>
<td>10.2%</td>
</tr>
</tbody>
</table>
The other useful indicator to compare different countries is health expenditure per capita, which measures the amount spent by each country on health, for both individual and collective health services (OECD, 2013a). This is also increasing in most of the OECD countries (OECD, 2015a). The issue is particularly acute in the US, which not only spends much more per capita on health care (USD 8713 for each resident, which is two and a half times the average of all OECD countries and 40% higher than Switzerland as the second biggest spender), but also has had one of the highest spending growth rates with both public and private health expenditures (OECD, 2015a). The Australian per capita health spending increased by 2.9% in 2012-2013 compared with a growth of less than 1% on average across the OECD, which follows a growth of more than 4% the previous year (OECD, 2013b, 2015a) as Figure 2.2 shows.
Although the total spending on health has been increasing overall, these escalating costs are not directly translated into better healthcare outcomes in many countries (P. Haddad et al., 2014a). Today, the challenges faced by the healthcare providers represent a major concern for healthcare providers, patients, and communities despite the devoted efforts and resources to enhance patients’ outcomes as the following subsection explains.

### 2.1.3 The Healthcare Delivery: Challenges

Despite the increasing costs of healthcare delivery, there exist some real concerns about the capabilities of different healthcare systems on a global scale to cope with the common challenges, mainly the increased ageing population, rising rates of chronic diseases, as well as the emergence of new technologies to facilitate superior healthcare delivery (P. Haddad et al., 2014a; Harper, 2014). These challenges can be seen as external pressure factors on different healthcare delivery systems (Peter Haddad et al., 2015). However, recent studies have shown that there exist some real problems with these systems.
themselves. Osborn, Moulds, Squires, Doty, and Anderson (2014) conducted a large-scale international survey on health and care experiences among 15,617 adults aged sixty-five or older in seven industrialised nations, namely Australia, Canada, France, Germany, the Netherlands, New Zealand, Norway, Sweden, Switzerland, the UK, and the US. This study captured three outcomes, namely coordination, access, and patient-centeredness. According to this study, more than 20% of the respondents reported receiving uncoordinated care in all countries except France (Osborn et al., 2014). The access issue is more acute in the US compared to the other six countries, where adults were sicker than their counterparts abroad despite the fact that out of pocket expenses were higher and represented a bigger problem for the US residents (Osborn et al., 2014). Accessing primary care and avoiding the emergency department was a notable problem in Canada, Sweden, and the US compared with the other four countries. The lack of patient-centeredness was a common issue amongst all of the studied countries, with fewer patients having the opportunity to design their own chronic care plans with their clinicians (Osborn et al., 2014). These findings are heavily supported by the literature of quality of care; see for example a study by the Picker Institute, which found that 75% of patients considered their healthcare system fragmented and fractured, a “nightmare” to navigate, and plagued by duplication of effort, lack of communication, conflicting advice regarding treatment, and tenuous links to the evolving medical evidence base (Picker Institute, 2000). Similar findings and discussions can be seen in many other studies in different countries, see for example (Bodenheimer, 2008; Coleman et al., 2009; Detering et al., 2010; Dobrow, 2009; Treadwell et al., 2014). Overall, these and other studies indicate that healthcare delivery tended to be fragmented, disorganised, and unaccountably variable (Yih, 2010).
Patient safety is another clear challenge in today’s healthcare delivery systems. According to a report by the Institute of Medicine in Washington D.C., more than 98,000 Americans die, and more than one million patients are injured as a result of broken healthcare processes and system failures (Institute of Medicine, 2005). Another study found these figures were soaring to 180,000 patients who lost their lives due to medical errors (Levinson, 2010), and another study predicted the real figures of victims of medical errors between 210,000 and 440,000 patients in a given year (James, 2013).

Addressing these and other concerns was the core element of the report ‘In Crossing the Chasm: A New Health System for the 21st Century, a 2001 study by the American Institute of Medicine (IOM)’ (Institute of Medicine, 2001). In this report, a committee of experts identified six interrelated characteristics of a healthcare delivery system that should guide the efforts to improve the quality of care. As this report summarises, the 21st century healthcare must be:

- **Safe**: avoiding injuries to patients from the care that is intended to help them,
- **Effective**: providing services based on scientific knowledge to all who could benefit and refraining from providing service to those not likely to benefit (avoiding underuse and overuse, respectively),
- **Patient-centred**: providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions,
- **Timely**: reducing waiting times and sometimes harmful delays for those who receive and those who give care,
In order to meet these six requirements, the committee urged the engineering community to assist in transforming the healthcare delivery systems (Institute of Medicine, 2001). The use of information and communication technology (ICT) was one of the main recommended approaches to solving the problems facing the healthcare delivery (Institute of Medicine, 2001). For example, the meaning of efficiency can be broadened to include the optimisation of operations, the reduction of costs, and the avoidance of errors; and “timely” healthcare delivery might include better scheduling of facilities and personnel (Institute of Medicine, 2001).

The following section provides the context for this study i.e. the Australian healthcare system.

### 2.2 The Australian Healthcare System

This Section summarises the main features of Australia’s healthcare system, including the definition of a healthcare system, the main features of the Australian healthcare system, and the use of IS/IT in this context.

The World Health Organisation defines a healthcare system as ‘all the activities whose primary purpose is to promote, restore and/or maintain health’ (WHO, 2000, p. 5). Furthermore, a good healthcare system ‘delivers quality services to all people, when and
where they need them’. The Australian healthcare sector is a two-tier system (Wickramasinghe et al., 2015). In other words, it consists of two different components - private and public hospitals, with different funding structures between private and public sectors. These difference are becoming blurred with private hospitals contracting to do public work and public hospitals accessing both private health funds and the Medicare funding for a fee for service clinics (Cheng & Vahid, 2011; Hall, 2010). The public hospitals are funded by the state, territory, and Australian federal government, while private hospitals are owned and operated by the private sector (Willis et al., 2016). Table 2.3 depicts the main features of the public sector.

Table 2.3 The main features of the Australian public healthcare sector, adopted from (AIHW, 2014b; Biggs, 2013)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
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</table>
| **Who is covered by Medicare?** | ● Medicare is a universal coverage for Australian citizens, permanent residents, and asylum seekers through Medicare which was introduced in 1984.  
● Medicare benefits are based on an agreement between the Australian government and the medical profession. This agreement is called Medicare Benefits Schedule (MBS). Adherence to this agreement is not compulsory, i.e. practitioners can charge more than the scheduled fees, which results in patients needing to pay the difference, which is called ‘gap’ in the Australian terminology. |
| **What is covered by Medicare?** | ● Outside hospitals: Medicare covers 100% of the MBS fee for a general practitioner and up to 85% of the MBS for a specialist.  
● Affordable and reliable access to necessary medicines for Australians under the Pharmaceutical Benefits Scheme (PBS).  
● Inside hospitals: Medicare covers 100% of the MBS for public patients in public hospitals and up to 75% of the MBS for private patients in a private or public hospital (accommodation, theatre fees, and medicines excluded). |
• Some healthcare services in selected countries.
• Those who are not covered by Medicare can purchase private insurance policies.

<table>
<thead>
<tr>
<th>What is NOT covered by Medicare?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Not clinically necessary medical and hospital services like cosmetic procedures.</td>
</tr>
<tr>
<td>• Ambulance services.</td>
</tr>
<tr>
<td>• Most dental treatments and services.</td>
</tr>
<tr>
<td>• Glasses and contact lenses.</td>
</tr>
<tr>
<td>• Home nursing.</td>
</tr>
<tr>
<td>• Acupuncture.</td>
</tr>
<tr>
<td>• Most occupational therapy, chiropractic services, physiotherapy, speech therapy, eye therapy, podiatry and psychology services.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How is it funded?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Health expenditure in Australia was estimated at $140.2 billion, or 9.5% of GDP in 2013, compared with $82.9 billion in 2001–2002. Australian governments funded almost 70% of total health expenditure during 2011–2012.</td>
</tr>
<tr>
<td>• As of 2011-12, the Australian Federal Government contributed 42.4%, state and territory governments 27.3%, patients 17%, private health insurers 8%, and accident compensation schemes 5%.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How is it regulated?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The Australian government plays the main regulatory role to assure the safety and quality of healthcare related activities and procedures.</td>
</tr>
<tr>
<td>• Each state and territory has legislations relevant to the operation of public hospitals</td>
</tr>
<tr>
<td>• It is also the state and territory governments’ responsibility to license or register private hospitals.</td>
</tr>
</tbody>
</table>

In private healthcare, there are not-for-profit and for-profit hospitals (Bloom, 2002). While generating profits for shareholders is one of the primary objectives in for-profit

---

1 The Australian Government has agreements with New Zealand, the United Kingdom, the Republic of Ireland, Sweden, the Netherlands, Finland, Italy, Belgium, Malta, Slovenia and Norway. These agreements mean: Australian residents can get help with the cost of essential medical treatment when visiting these countries, and residents of these countries can get some essential medical treatments while visiting Australia (Australian Government, 2016c).
hospitals’, the not-for-profit hospitals, owned by religious, charity and community organisations, are not primarily driven by profit, but by committed agreements or values (Bloom, 2002). The distribution of the surplus from not-for-profit hospitals is either directed towards expansion, improving the quality of services or contribution to other charitable enterprises (Wickramasinghe et al., 2015). Figure 2.3 depicts the structure of the Australian healthcare system.

Figure 2.3 The Main Elements of Australia’s Healthcare System, adopted from (AIHW, 2014a)
2.2.1 Current State of the Australian Healthcare System

The Australian spending on healthcare is slightly below OECD average (OECD, 2015b) as shown in Figure 2.4

![Graph showing healthcare expenditure as percentage of GDP](image)

**Figure 2.4 How Australia compares to OECD countries in total health expenditure, public health expenditure, and expenditure on pharmaceuticals, all as percentage of GDP between 2000-2012 (OECD, 2015a)**

Even though the spending is slightly below the OECD average, the Australian healthcare system delivers high-quality outcomes in terms of healthy population, life expectancy at birth (81.4 years) and declining rates of infant and youth mortality between 1988 and 2007 (Australian Government, 2010; OECD, 2013b). However, this lower spending has had negative impacts on some health indicators. According to Davis et al. (2015), the Australian health system is let down due to accessibility factors such as lack of timely access and cost. In this report, 11 countries were assessed, and their health systems were compared in a number of indicators including quality care (effective care, safe care, coordinated care, and patient-centric care), access (cost-related problems and timeliness of care), efficiency, equity, healthy lives, and health expenditures per capita. Australia’s
best rank was in quality care (Ranked second of eleven), while the worst rank was in access/ cost-related problems (Ranked ninth of eleven). Overall, Australia was the fourth (after the UK, Switzerland, and Sweden) in a list of 11 countries from this report (Table 2.4).

Table 2.4 How Australia ranks in different healthcare related indicators (Davis et al., 2015)

<table>
<thead>
<tr>
<th></th>
<th>AUS</th>
<th>CAN</th>
<th>FRA</th>
<th>GER</th>
<th>NETH</th>
<th>NZ</th>
<th>NOR</th>
<th>SWE</th>
<th>SWIZ</th>
<th>UK</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Ranking (2013)</td>
<td>4</td>
<td>10</td>
<td>9</td>
<td>5</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>• Quality Care</td>
<td>2</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>11</td>
<td>10</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>• Effective Care</td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>11</td>
<td>10</td>
<td>8</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>• Safe Care</td>
<td>3</td>
<td>10</td>
<td>2</td>
<td>6</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>• Coordinated Care</td>
<td>4</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td>11</td>
<td>3</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>• Patient-centred Care</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>7</td>
<td>3</td>
<td>6</td>
<td>11</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Access</td>
<td>8</td>
<td>9</td>
<td>11</td>
<td>12</td>
<td>2</td>
<td>4</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>• Cost-related problems</td>
<td>9</td>
<td>5</td>
<td>10</td>
<td>4</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>7</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>• Timeliness of Care</td>
<td>6</td>
<td>11</td>
<td>10</td>
<td>4</td>
<td>2</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Efficiency</td>
<td>4</td>
<td>10</td>
<td>8</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Equity</td>
<td>5</td>
<td>9</td>
<td>7</td>
<td>4</td>
<td>8</td>
<td>10</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Healthy Lives</td>
<td>4</td>
<td>8</td>
<td>1</td>
<td>7</td>
<td>5</td>
<td>9</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

Key: AUS: Australia; CAN: Canada; FRA: France; GER: Germany; NETH: Netherlands; NZ: New Zealand; NOR: Norway; SWE: Sweden; SWIZ: Switzerland; UK: UK; USA: USA.

This relative lower ranking of the Australian health system in terms of accessibility is consistent with data from (AIHW, 2014a), which reported longer waiting periods and difficulties having specialised tests like magnetic resonance imaging (MRI) or CT scans performed on time. For example, median waiting times for elective surgery grew from 33 to 36 days over the four years to 2012, and the time taken to treat 90 percent of patients blew out to 265 days from 219 days (AIHW, 2014a).
To address these issues, the Australian Government released Australia’s first national primary healthcare strategy in 2010, titled, ‘Building a 21st Century Primary Health Care System’, with more focus on using technology to enhance the overall healthcare system. This strategy suggested that the future healthcare system has to have (Australian Government, 2010, p. 12):

- Universal access to MBS and PBS for episodic medical care,
- Targeted programs and better use of technology to improve outcomes for individuals,
- Integrated local solutions meaning that active management of patients with chronic disease or who are ‘hard to reach’,
- Prevention activity that is well integrated, coordinated and available with regular, risk assessment, support and follow up,
- Systems where patients access quality data to inform their choice of provider, practice or facility,
- A health system that reflects and adjusts practice to improve outcomes and cost-effectiveness.

From the above characteristics of the future Australian healthcare system, improving the accessibility is one of the top priorities (Australian Government, 2010).

The use of IS/IT, including eHealth, is seen as an enabler to reform the Australian healthcare system through the utilisation of new technologies to integrate care, improve patient outcomes, and deliver better capacity, quality, and cost-effectiveness (Australian Government, 2010). The following subsection is a review of the use of IS/IT in the context of the Australian healthcare system.
2.2.2 Information Systems in the Australian Healthcare Context

Australia, as with other developed countries, has different levels of use of IS/IT depending on the settings. The literature shows that simpler healthcare settings are currently better environments for health information technology (HIT). For instance, Pearce and Haikerwal (2010) noted that there exists a widespread use of computers in the Australian general practices, while bigger healthcare providers (i.e. hospitals) still lag behind all other sectors of the Australian economy in the use of computerised systems. In their attempt to explain the reasons behind the extensive use of computerised systems in general practices, Pearce and Haikerwal (2010) suggested three inter-related reasons: 1) the need (especially in the area of e-prescribing) to meet the sophisticated regulatory requirements; 2) incentives (citing the financial incentives the Australian Government introduced in 2005 to promote the use of health IT, as well as the affordability of simple health IS/IT solutions); and 3) support (through the divisions of general practices).

However, this is not the case when it comes to securely transferring and/or sharing electronic clinical information between different healthcare settings. i.e. between general practices and/ or between general practices and hospitals. At a meso level, hospitals experience various types of problems in adopting health IS/IT. These relate mainly to 1) gaps between the care providers (hospitals) and funders (different levels of governments in the case of public hospitals), and 2) technical problems resulting from implementing different and incompatible IS/IT within the hospitals and between hospitals in different boundaries (Pearce & Haikerwal, 2010).

These findings are consistent with another study (Jha et al., 2008) that compares the use of IS/IT in seven nations: Australia, Canada, UK, Germany, Netherlands, US, and New Zealand (NZ). According to this study, the Australian healthcare system has a low rate of
using modern electronic technologies to share and transfer clinical information between different healthcare settings. Table 2.5 shows the summary of the comparison between the studied countries in terms of using health electronic records (HERs) and Computerised Practitioner Ordering Entry (CPOE) systems.

Table 2.5 A comparison of rates of health IS/IT use in seven high-income countries including Australia, adopted from (Jha et al., 2008)

<table>
<thead>
<tr>
<th></th>
<th>Australia</th>
<th>Canada</th>
<th>Germany</th>
<th>Netherlands</th>
<th>New Zealand</th>
<th>UK</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Care</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HER (%)</td>
<td>79 - 90</td>
<td>20 - 23</td>
<td>42 - 90</td>
<td>95 - 98</td>
<td>92 - 98</td>
<td>89 - 99</td>
<td>24 - 28</td>
</tr>
<tr>
<td>CPOE (%)</td>
<td>75 - 81</td>
<td>5 - 11</td>
<td>59</td>
<td>85</td>
<td>90</td>
<td>&gt;90</td>
<td>9</td>
</tr>
<tr>
<td><strong>Hospital Care</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HER (%)</td>
<td>&lt; 10</td>
<td>&lt; 10</td>
<td>&lt; 5</td>
<td>&lt; 5</td>
<td>&lt; 10</td>
<td>8</td>
<td>N/A</td>
</tr>
<tr>
<td>CPOE (%)</td>
<td>&lt; 1</td>
<td>&lt; 1</td>
<td>&lt; 5</td>
<td>&lt; 5</td>
<td>&lt; 1</td>
<td>3</td>
<td>5 - 10</td>
</tr>
</tbody>
</table>

Recent figures show that the adoption of HERs in developed countries is rapidly growing. See for example (DesRoches et al., 2013; Osborn et al., 2015; Sheikh, Sood, & Bates, 2015). According to Adler-Milstein, Sarma, Woskie, and Jha (2014), the adoption of health IS/IT in Australia has gone through two stages; the first happened in the 1990s and early 2000s, during which the Australian Government supported the adoption of EHRs through federal incentives to general practitioners. The second phase is still underway and focuses on health information exchange (HIE) and patient engagement/centeredness. This can be noted by the ongoing efforts to implement and promote My Health Records (known previously as Personally Controlled Electronic Health Records [PCEHR]) (Imran Muhammad & Wickramasinghe, 2014).


2.3 Information Systems for Healthcare

Driven in large part by the success of IS/IT investments in many other industries, healthcare is investing heavily in IS/IT to enhance different outputs, such as patient outcomes (Brenner et al., 2015; Freedman, Lin, & Prince, 2014; Kellermann & Jones, 2013; Nurek, Kostopoulou, Delaney, & Esmail, 2015; Piette et al., 2015; Roshanov et al., 2013), safety (Elliott et al., 2013; Kaushal, Shojania, & Bates, 2003; Nanji et al., 2014; Nuckols et al., 2014; Shekelle et al., 2011; Tang, 2003), efficiency (DesRoches et al., 2013; Georgiou, Lang, Rosenfeld, & Westbrook, 2011; Kellermann & Jones, 2013; Lippi et al., 2015; Waterson, 2014; Wickramasinghe et al., 2016), and financial performance (Appari, Carian, Johnson, & Anthony, 2012; Frisse et al., 2012; Kern, Wilcox, Shapiro, Dhopeshwarkar, & Kaushal, 2012; Low et al., 2013; McCoy et al., 2012; Unertl, Johnson, & Lorenzi, 2012).

This increased use of IS/IT in healthcare can also be seen from the figures of IS/IT investments (OECD, 2013c), with more healthcare providers moving towards digitising their processes and different levels of care delivery (Peter Haddad et al., 2015). Most recently, Gartner (2015) has ranked the healthcare industry as the fifth biggest spender on IS/IT with about USD108 billion, behind banking, communications, education and government, and with a growth percentage of 2.7% compared to 2013 (Table 2.6). In this list, the healthcare was ahead of other industries which had previously invested heavily in IS/IT like manufacturing and natural resources, retail, and transport. Even with the worldwide decline in IT spending in 2015 across different vertical industries due to the rising US dollar and the relative slowdown in emerging markets (Particularly Russia,
Brazil, and China), the healthcare industry was ranked fourth in investing in IT in 2015 after retail, banking and securities, and education (Gartner, 2015) as Table 2.6 shows.

Table 2.6 IT spending by industry in 2014-2015 (Gartner, 2015)

<table>
<thead>
<tr>
<th>Industry</th>
<th>2014 Spending</th>
<th>2014 Growth (%)</th>
<th>2015 Spending</th>
<th>2015 Growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banking &amp; Securities</td>
<td>498,377</td>
<td>2.1</td>
<td>486,278</td>
<td>-2.4</td>
</tr>
<tr>
<td>Communications: Media Services</td>
<td>444,639</td>
<td>1.5</td>
<td>428,675</td>
<td>-3.6</td>
</tr>
<tr>
<td>Education</td>
<td>66,524</td>
<td>1.0</td>
<td>64,182</td>
<td>-2.5</td>
</tr>
<tr>
<td>Government</td>
<td>447,114</td>
<td>-1.2</td>
<td>424,660</td>
<td>-5.0</td>
</tr>
<tr>
<td>Healthcare</td>
<td>107,934</td>
<td>2.7</td>
<td>104,982</td>
<td>-2.7</td>
</tr>
<tr>
<td>Insurance</td>
<td>187,958</td>
<td>1.8</td>
<td>182,572</td>
<td>-2.8</td>
</tr>
<tr>
<td>Manufacturing &amp; Natural Resources</td>
<td>498,995</td>
<td>1.0</td>
<td>476,546</td>
<td>-4.5</td>
</tr>
<tr>
<td>Retail</td>
<td>179,538</td>
<td>2.5</td>
<td>176,916</td>
<td>-1.5</td>
</tr>
<tr>
<td>Transportation</td>
<td>133,785</td>
<td>1.6</td>
<td>129,696</td>
<td>-3.1</td>
</tr>
<tr>
<td>Utilities</td>
<td>149,379</td>
<td>1.3</td>
<td>143,479</td>
<td>-3.9</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>87,707</td>
<td>0.69</td>
<td>82,011</td>
<td>-3.2</td>
</tr>
<tr>
<td>Total Market</td>
<td>2,798,950</td>
<td>1.2</td>
<td>2,699,998</td>
<td>-3.5</td>
</tr>
</tbody>
</table>

This supports other forecasts that rank the healthcare industry first in the list of fastest growing industries in adopting IS/IT over the 2015-2019 forecast period with a five-year compound annual growth rate (CAGR) of 5.5% ((IDC), 2016). According to the same source, spending on software will be the fastest growing market with a 6.7% CAGR, led by the healthcare and financial services investments. In addition, the healthcare industry will also represent, with telecommunication industry, the strongest opportunities for hardware market (IDS, 2016).
Today, investing in IS/IT in healthcare contexts covers a broad range of applications and systems to facilitate the healthcare delivery at different levels, from detection to recovery (W. Rouse, 2009). Table 2.7 describes the main healthcare IS/IT applications that have widely been used in a quest to enhance healthcare outcomes. In addition to this array of clinical information systems, healthcare providers use another array of systems that facilitate the business part of healthcare organisations. This is not any different from other industries (Anderson et al., 2006).

Table 2.7 the most popular clinical IS/IT in today’s clinical practices. Adopted from (HIMSS, 2013; HIMSS Analytics, 2009)

<table>
<thead>
<tr>
<th>IS System</th>
<th>Definition / Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Data Repository (CDR)</td>
<td>A centralised database that allows organisations to collect, store, access, and report on clinical, administrative, and financial information collected from various applications within or across the healthcare organisation that provides healthcare organisations with an open environment for accessing/ viewing, managing, and reporting enterprise information.</td>
</tr>
<tr>
<td>Clinical Decision Support Systems (CDSS)</td>
<td>An application that uses pre-established rules and guidelines, that can be created and edited by the healthcare organisation, and integrates clinical data from several sources to generate alerts and treatment suggestions. Example: All patients who have potassium below 2.5mg% should not have a cardiac glycoside. The physician would enter into the system the prescription for a cardiac glycoside and the system would pop up an alert to the fact that the patient should not be given this medicine due to the low level of potassium in their blood.</td>
</tr>
<tr>
<td>Computerised Practitioner Order Entry (CPOE)</td>
<td>An order entry application specifically designed to assist clinical practitioners in creating and managing medical orders for inpatient acute care services or medications. This application has a particular electronic signature, workflow, and rules engine functions that reduce or eliminate medical errors associated with practitioner ordering processes. It is a computer application that accepts the provider’s orders for diagnostic and treatment services electronically instead of the clinician recording them on an orders sheet or prescription pad.</td>
</tr>
<tr>
<td>Laboratory Information Systems (LIS)</td>
<td>An application to streamline the process management of the laboratory for essential services such as haematology and chemistry. This application may provide general functional support for microbiology reporting, but does not generally support blood bank functions. It provides an automatic</td>
</tr>
</tbody>
</table>
interface to laboratory analytical instruments to transfer verified results to nurse stations, chart carts, and remote physician offices. The module allows the user to receive orders from any designated location, process the order and report results and maintain technical, statistical, and account information. It eliminates tedious paperwork, calculations, and written documentation while allowing for easy retrieval of data and statistics.

| **Nursing Documentation (ND)** | This software documents nursing notes that describe the care or service. Health records may be paper documents or electronic documents, such as electronic medical records, faxes, emails, audio or videotapes and images. Through documentation, nurses communicate their observations, decisions, actions, and outcomes of these actions for clients. Documentation software tracks what occurred and when it occurred. |
| **Order Entry (OE)** | A legacy HIS application that allows for entry of orders from multiple sites including nursing stations, selected ancillary departments, and other service areas; allows viewing of single and composite results for each patient order. The function creates billing records as a by-product of the order entry function. |
| **Pharmacy Management System (PMS)** | An application that provides complete support for the Pharmacy department from an operational, clinical, and management perspective, helping to optimise patient safety, streamline workflow, and reduce operational costs. It also allows the pharmacist to enter and fill physician orders and, as a by-product, performs all of the related functions of patient charging, General Ledger updating, re-supply scheduling and inventory reduction/statistics maintenance. During order entry, the module automatically checks for Drug-Drug and Food-Drug Interactions and monitors for allergy contraindications. Maintenance of an on-line patient medication profile allows easy access by the pharmacist and may be viewed by nursing stations, ancillary departments, and physicians. |
| **Physician Documentation (PD)** | The use of structured template documentation by physicians to capture any of their patient findings that are part of the electronic medical record (e.g., history and physicals, diagnostic findings, discharge notes, etc.). The structured template documentation captures discreet data that is used for interaction with the clinical decision support system relative to evidence-based medicine guidelines and/or protocols. |
| **Radiology Information System (RIS)** | An automated RIS system manages the operations and services of the radiology department. This functionality includes scheduling, patient and image tracking and the rapid retrieval of diagnostic reports. The RIS can be integrated with the hospital information system and a picture archiving and communication system (PACS) to provide an efficient environment for users to collect, process and manage data. |
Investing in IS/IT for healthcare is not limited to healthcare organisations on a meso level. Today, Governments around the world are deploying initiatives on a macro level to leverage the possibilities of IS/IT nationally. These initiatives have different names in different countries. However, they all are centred on providing the so-called ‘e-health’. While this term has been used widely to describe the digitised healthcare delivery on a national level, the literature has different definitions of this term (Oh, Rizo, Enkin, & Jadad, 2005). However, all of these definitions are centred on leveraging IS/IT to provide care. For example, Eysenbach (2001, p. 4) defines e-health as: “an emerging field in the intersection of medical informatics, public health, and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterises not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology”.

Different countries have different structures of their e-health initiatives (Troshani & Wickramasinghe, 2016), such as the National Program for IT in the UK (Greenhalgh & Keen, 2013; Waterson, 2014), the Electronic Health Card (eHC) in Germany (Imran Muhammad, Zwicker, & Wickramasinghe, 2013; Wirtz, Mory, & Ullrich, 2012), and Australia’s My Health Record (Andrews, Gajanayake, & Sahama, 2014; Imran Muhammad & Wickramasinghe, 2014).

These increasing investments in health IS/IT have created numerous studies to evaluate the impact of these investments on the different levels of healthcare delivery (Chaudhry et al., 2006; Sidhartha Das, Yaylacegi, & Menon, 2011). The following section is
dedicated to presenting a holistic literature review in the area of business value of IT in general, and then delineating this concept to cover the healthcare domain.

2.4 The Business Value of IT in Healthcare: The Gap

The use of IS/IT to facilitate processes within and among organisations has raised questions about the possible impacts of IS/IT on the organisational performance (Melville & McQuaid, 2012). With the increased use of IS/IT in different domains, researchers believe that a productive approach is to move from the question of whether IT creates value to how, when, and why benefits occur or fail to do so (Melville, Kraemer, & Gurbaxani, 2004). The research on the business value of IT started as early as the 1990s (Chaudhry et al., 2006; Weill, 1992a, 1992b). One of the first researchers who attempted to tackle this issue was (Weill, 1992a) who introduced the concept of “IT conversion effectiveness” to account for the failure of some of IT investments to reach the firm’s bottom line. Since then, many researchers have proposed theoretical models that trace the path investment inputs take on the way to becoming the outputs of “productivity increases” “realised business value” “organisational performance improvements” and the like (P. Haddad et al., 2014a; Melville et al., 2004). The following subsection is a review of the literature on the business value of IT in different industries, followed by a similar review of the business value of IT in healthcare. While there exist a plethora of studies on the business value of IT in different industries, examining the business value of IT in healthcare still lags behind (Peter Haddad et al., 2015).
2.4.1 The Business Value of IT: Research Directions

Many studies have adopted different definitions of the business value of IT, each of which tends to be focused on limited aspects. For example, Markov and Okujava (2008, p. i) approached the business value of IT from an economic perspective and defined it as: ‘An indicator of the profitability of single IT investments by evaluating their costs, benefits, and risks. On the macro level of analysis, the business value of IT may describe the economic impact of IT on business models and industries’.

Other definitions include other different aspects, such as productivity, return on investments, return on sales, and the link between IS/IT and intangible assets that extends beyond financial and non-financial measures (Guido, 2013).

While the literature still lacks a consistent and widely accepted definition of the business value of IT (Guido, 2013; Oz, 2005), three main streams were possible to capture while synthesising the literature review on the business value of IS/IT within and among organisations (Guido, 2013). These three streams are productivity (Black & Lynch, 2001; Brynjolfsson & Hitt, 1996; Brynjolfsson & Hitt, 2003; Cardona, Kretschmer, & Strobel, 2013; Holt & Jamison, 2009; Tambe & Hitt, 2012), return on investments and profitability (Ho-Chang, Chang, & Prybutok, 2014; Maklan, Peppard, & Klaus, 2015; Masli, Richardson, Sanchez, & Smith, 2011; Mithas & Rust, 2016; Mithas, Tafti, Bardhan, & Mein Goh, 2012), and organisational capabilities and strategic position (M. J. Chen & Miller, 2015; Fichman & Melville, 2014; Love, Simpson, Hill, & Standing, 2013; Raschke & Sen, 2013).

The following three subsections serve to summarise these three streams as found in the literature.
2.4.1.1 Productivity

Productivity is one of the most intensively examined research areas in the IS literature. Not only does this mirror the importance of this topic, but it also reflects the necessity of identifying the ultimate driving forces of productivity (Cardona et al., 2013). IS/IT have been shown as an enabler to higher levels of productivity. Today, there exists a plethora of findings that associate the use of IS/IT to more productivity. Nevertheless, this association is often dependent upon other factors within and among organisations (Brynjolfsson & Hitt, 2003). Table 2.8 summarises the main themes of research findings pertaining to the impact of IS/IT on productivity as found in the literature.

Table 2.8 The impact of IS/IT on productivity in the literature

<table>
<thead>
<tr>
<th>Study, Year (Reference)</th>
<th>Purpose (to determine)</th>
<th>Key Findings</th>
</tr>
</thead>
</table>
| (Cardona et al., 2013)  | The role of ICT in enhancing the overall productivity of different firms in different industries in US and Europe. | • The use of IS/IT is significantly and positively associated with higher productivity,  
• In order to enhance the productivity, IS/IT has to be embedded in complementary organisational investments, skills and industry structures. |
| (Tambe & Hitt, 2012)    | Measuring and modelling of IT productivity to address some long-standing empirical limitations in the IT business value literature | • the role ‘endogeneity’ can play in determining IT productivity tends to be relatively small,  
• IT productivity depends on firms’ size, where it is substantially lower but quicker to be materialised in small and mid-size firms than in Fortune 500 firms,  
• The manufacturing sector is the most beneficiary from IT to enhance productivity rates compared to other sectors. |
(Holt & Jamison, 2009) The role of IT infrastructure (Broadband networks) on growth and productivity

- Rolling fast and reliable IT infrastructure (broadband internet and network access) is positively associated with higher productivity rates,
- Due to lacking valid data, this role cannot be measured precisely.

(Brynjolfsson & Hitt, 2003) The effect of computerisation on productivity and output growth

- Computerisation makes a contribution to measuring productivity and output growth in the short term,
- The productivity and output contributions associated with computerisation tend to be much more significant over longer periods (up to 5 times greater than those in shorter terms).
- This productivity is subject to the existence of significant and time-consuming investments in complementary inputs, such as organisational capital.

(Black & Lynch, 2001) The impact of workplace practices, information technology and human capital investments on productivity.

- IT Investments are associated with significantly higher established productivity.
- The impact of IT on productivity should not be isolated from workplace practices and human capital investments.

(Brynjolfsson & Hitt, 1996) The role of IT to enhance the productivity of firms.

- The benefit of IT to increase the productivity is heavily dependent on the firm effect internally, with a vital role potentially assigned to the elasticity of IT in this regard,
- Limited evidence can be found on the role of IT elasticity between manufacturing and service firms.

### 2.4.1.2 Return on Investment and Profitability

Measuring the financial impact of IS/IT investments and strategies has also been one of the major research trends and needs since the introduction of the first information systems
to facilitate different business aspects (Masli et al., 2011). The research in this area covers various financial aspects of the impact of IS/IT including, but not limited to, ‘return on sales’ (Bharadwaj, 2000), profitability (Mithas et al., 2012), and firms’ market value (Mithas & Rust, 2016). The findings on the impact of IS/IT on firms’ financial performance from earlier studies tended to show a positive and significant association between IS/IT investments and financial performance, while later studies have shown that the financial impact of IS/IT is declining. This change started to be significant with the new millennium, particularity with the move from using proprietary business information systems towards using more standardised and homogeneous IS/IT (Chae et al., 2014). Nevertheless, the financial impact of IS/IT investments and strategies has been shown to be subject to an array of firms’ contextual conditions. Table 2.9 synthesises the main research streams in this area as found in the literature.

Table 2.9 The impact of IS/IT on profitability and return on Investment

<table>
<thead>
<tr>
<th>Study, Year (Reference)</th>
<th>Purpose (to determine)</th>
<th>Key Findings</th>
</tr>
</thead>
</table>
| (Mithas & Rust, 2016)   | The impact of IS/IT investments and strategy on profitability and the market value of firms | • There exists a difference between firms that have a single dominant strategic objective to achieve (revenue expansion or cost reduction) and firms choose to emphasise on both objectives (Dual emphasis),  
• The firms with dual emphasis have a higher market value than the firms with single emphasis, but they both have similar levels of profitability,  
• IT strategic emphasis plays a significant role in moderating the relationship between IT investments and firm performance,  
• Firms with a lower level of IS/IT investments should be of single emphasis, while firms with higher levels of IS/IT investments can aim at revenue expansion and cost reduction at the same time. |
<table>
<thead>
<tr>
<th>Source</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(Ho-Chang et al., 2014)</strong></td>
<td>The validity of earlier studies that had suggested positive links between IS/IT and financial performance during the 1990s</td>
</tr>
<tr>
<td></td>
<td>• IS/IT leader firms did not show better financial performance than control firms,</td>
</tr>
<tr>
<td></td>
<td>• IS/IT play bigger roles in reducing the production cost rather than enhancing the overall financial performance,</td>
</tr>
<tr>
<td></td>
<td>• Reasons of less impact of IS/IT investments on firms’ financial performance include:</td>
</tr>
<tr>
<td></td>
<td>o The move of IS/IT from being proprietary to more standardised and homogeneous played key roles to limit the competitive advantages of IS/IT leaders.</td>
</tr>
<tr>
<td></td>
<td>o The easy access to state-of-the-art IS/IT through outsourcing arrangements</td>
</tr>
<tr>
<td><strong>(Mithas et al., 2012)</strong></td>
<td>The relationship between IS/IT investments and firm profitability. Particularly, comparing revenue growth and IT-enabled cost reduction in terms of their relative impact on firm profitability</td>
</tr>
<tr>
<td></td>
<td>• IS/IT platforms have a positive impact on profitability.</td>
</tr>
<tr>
<td></td>
<td>• The effect of IT investments on sales and profitability is higher than that of other discretionary investments, such as advertising and research and development. (p. 206).</td>
</tr>
<tr>
<td></td>
<td>• More of the IS/IT impact on firm profitability results in from IT-enabled revenue growth compared to that caused by operating cost reductions.</td>
</tr>
<tr>
<td></td>
<td>• Firms should prioritise IT projects that allow revenue growth higher than those focusing on cost reduction.</td>
</tr>
<tr>
<td><strong>(Masli et al., 2011)</strong></td>
<td>The impact of superior IT capabilities on firms’ financial performance over the 1988–2007 period</td>
</tr>
<tr>
<td></td>
<td>• Superior IS/IT capabilities had played a key role in attaining better financial performance until 1999; then this role started to decline in a big subset of the studied firms.</td>
</tr>
<tr>
<td><strong>(Bharadwaj, 2000)</strong></td>
<td>The link between IS/IT capabilities and business performance from profit and cost-based measures</td>
</tr>
<tr>
<td></td>
<td>• Firms with higher IS/IT capabilities tend to outperform smaller encounters.</td>
</tr>
<tr>
<td></td>
<td>• IS/IT capabilities can be seen as rent-generating resource that is not easily imitated or substituted (p. 186)</td>
</tr>
<tr>
<td></td>
<td>• Acquiring and building IS/IT capabilities take a long time, and most importantly highlight the difficulty of embedding them as contemporary resources with conventional resources.</td>
</tr>
</tbody>
</table>
2.4.1.3 Organisational Capabilities and Strategic Position

Investigating the potential roles of IS/IT as a contemporary asset (Davern & Kauffman, 2000) has been one of the main IS research streams over the past two decades. One of the main themes in this area is examining the role of IS/IT in creating organisational capabilities internally within organisations (Fichman & Melville, 2014; Irani, 2002; Love et al., 2013), and more importantly better strategic positioning externally, *i.e.* inter-organisationally (Grover & Kohli, 2012; Irani, 2002; Kohli & Grover, 2008). This trend followed an increasingly important area of research centred on inter-organisational collaboration to achieve competitive advantages as partners rather than competitors; see for example (M. J. Chen & Miller, 2015; Mahoney & Kor, 2015; Vandaie & Zaheer, 2014). The majority of these researches were guided by the theory of relational views of competitive advantages, whose main argument is: “*idiosyncratic inter-firm linkages may be a source of relational rents and competitive advantages*” (Dyer & Singh, 1998, p. 662). According to this theory, generating better rents and competitive advantages by partnering firms may come from four sources: 1) Investments in relation-specific assets; 2) Substantial knowledge exchange; 3) Complementary resources and capabilities; and 4) Effective governance (Dyer & Singh, 1998, pp. 662-664). The majority of the reviewed literature has shown positive roles of IS/IT investments in reinforcing firms’ organisational capabilities and strategic positions. Having said that, a higher attention should be paid to different contextual conditions (Fichman & Melville, 2014; Grover & Kohli, 2012). Table 2.10 summarises the main themes of findings in the literature pertaining to the impact of IS/IT on firms’ organisational capabilities.
Table 2.10 The impact of IS/IT on firms’ organisational capabilities

<table>
<thead>
<tr>
<th>Study, Year (Reference)</th>
<th>Purpose (to determine)</th>
<th>Key Findings</th>
</tr>
</thead>
</table>
| (Fichman & Melville, 2014) | The impact of IS/IT posture-profile misalignment² on creating organisational capabilities from IS/IT investments. | • Innovative use of IS/IT creates a better ground to generate business value from contemporary assets (i.e. IS/IT).  
• Firms suffer from this issue will attain much fewer returns from IS/IT investments due to lacking innovation.  
• Diminished productivity is another side effect of this organisational weakness, which negatively affects the business value of IS/IT investments. |
| (Grover & Kohli, 2012) | The business value of IS/IT as a result of collective leverage of IS/IT among different organisations. i.e. how IT value emanates in multi-firm environments (p.225). | • The business value of IS/IT can be created by multi-partnering organisations at the time.  
• Four layers of IS/IT emerged from the inter-organisational co-creating of business value: relationship-specific assets, knowledge-sharing routines, complementary resources and capabilities, and effective governance (p.232). |
| (Kohli & Grover, 2008) | The IS/IT business value in terms of creating organisational capabilities | • As IS/IT is increasingly and deeply embedded in business processes, they should be understood as organisational capabilities in order to attain their potential business value,  
• The research should address the support, incidence, and nature of IS/IT as various resources that go into building the organisational capability (p. 30)  
• Building the digital capabilities depends on IS/IT and a set of ‘contemporary assets’ (Davern & Kauffman, 2000). This set is in turn dependent upon firms’ unique organisational requirements and characteristics.  
• IS/IT can serve as an accelerator or magnifier of desired business capabilities subject to a set of contextual conditions. |

As Table 2.9 shows, the economic value of IS/IT is one of the most visited aspects in the literature (Fichman & Melville, 2014; Grover & Kohli, 2012; Kohli & Grover, 2008). As

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² Fichman and Melville (2014, p. 203) define IS/IT Innovation posture–profile misalignment as: “a condition that exists when a firm’s innovation posture (the extent to which a firm leads with IT innovation) does not match up with its innovation resource profile (the firm’s stock of resources conducive to effective innovation)”. 
this study examines the role of IS/IT in healthcare, where dollar value is only one aspect of the business value (Wickramasinghe et al., 2006; Wickramasinghe & Schaffer, 2010), this study adopts a wider definition of the business value of IT. This definition is by Melville et al. (2004, p. 287), who defines the business value of IT as: “The organisational performance impacts of information technology”.

2.4.2 The Business Value of IT in Healthcare

The health informatics literature is relatively new (Dalrymple, 2011). In the past decade, the healthcare industry has started to invest heavily in various health IS/IT to enhance the quality of care and control the escalating costs. These two aspects have been major criteria to be addressed by health informatics researchers (Jones, Rudin, Perry, & Shekelle, 2014). Today, there exists a plethora of studies that investigate the impact of IS/IT on specific aspects of healthcare delivery such as patient outcomes, e.g. (Goldzweig et al., 2013; Tucker et al., 2014), patient safety, e.g. (Farley et al., 2013; Middleton et al., 2013), quality of care, e.g. (Kellermann & Jones, 2013), the efficiency of healthcare delivery operations, e.g. (Goldzweig et al., 2013; T.-F. Lee, 2013) and the cost of these operations, e.g. (Balabanova et al., 2013). The majority of the reviewed studies, however, share two types of limitations: 1) they tend to study specific systems and their impacts on a particular output. Therefore, their results are not easily generalisable, and 2) most of these studies lack adopting socio-technical aspects to cover the different levels of healthcare delivery, which makes their findings questionable, especially when issues around patient outcomes and safety are of concern (P. Haddad et al., 2014a).

Furthermore, a considerable portion of the current studies on the impact of IS/IT in healthcare tended to be vague in terms of specifying the examined IS/IT (Peter Haddad
et al., 2015), which also raises questions about the usefulness of these studies and their findings. For example, Frimpong et al. (2013) examined the relationship between ‘health information technology capacity’ and quality of care in 776 federally qualified health centres (FQHCs) in the US. The study found a positive association between health information technology capacity and quality of care in terms of receipt of discharge summaries, the use of a patient notification system for preventive and follow-up care, and timely appointment for specialty care. The problem with these findings is the lack of analysis to show which IS/IT in the studied centres helped enhance the quality of care, and which did not.

Similarly, K. Lee, Wan, and Kwon (2013) studied the relationship between ‘health information systems’ and cost in 577 US hospitals. Using structural equation modelling, they found that ‘health information systems’ were negatively but not statistically significantly associated with hospitals’ total expenses. The major flaw this study shares with many other studies is being generic, and the examined IS/IT were not stated (Chaudhry et al., 2006; K. Lee et al., 2013).

This flaw has represented a gap in the current health IS/IT literature, which has encouraged some researchers to conduct studies that address this limitation by adopting classifications of health IS/IT according to different criteria. For example, Menon, Lee, and Eldenburg (2000) analysed the impact of IT in a healthcare setting using a longitudinal sample of hospital data from 1976 to 1994 in the US by classifying hospitals’ IS/IT into three components: IT capital, medical capital, and medical information technology capital. IT capital included data processing and communication capital (mainly for administrative purposes) (Menon et al., 2000). Medical information
technology capital included equipment used for diagnosis and therapeutic purposes, *i.e.* to collect data from patients or report information to medical personnel (*e.g.*, X-ray machines, magnetic resonance imaging, etc.). Medical capital consisted of equipment used solely for therapeutic purposes (*e.g.*, improvements in acute care wards, or lasers). Labour was also classified into two components; medical and IT labour (Menon et al., 2000). The results obtained from this study showed that both IT and medical IT capital exhibited a positive influence on output. In addition, results indicated that IT labour and medical labour exhibited a positive influence on output as well as a positive impact on mean marginal revenue (Menon et al., 2000).

Similar to prior research that aggregates across various types of capital, this study is subject to problems that occur when the productivity impacts of different information technologies are averaged (Williams, Rana, Dwivedi, & Lal, 2011). Furthermore, hospitals today are way faster in adopting new IS/IT compared to the time this study was conducted (Maklan et al., 2015).

In another study, S. Das, Yaylacicegi, and Menon (2010) developed a framework that disaggregates investments in IT in the healthcare industry into four categories: investments in patient management IT (PMIT), transactional support IT (TSIT), communications IT (CIT), and administrative IT (AIT). This study investigated two problems related to the effect of IT investments on productivity in a healthcare setting (as a branch of the tree of Service Industry) —the lag (*i.e.* when the effect is observed, which can be immediate, *i.e.* near term, or late), and the durability (*i.e.* duration of the effect, which can be short or long term). The authors of this paper concluded that investing in IT in a healthcare setting was associated with improvements in several performance
measures, with their model also revealing the types of healthcare IT investments that have an immediate effect and those that have a later effect (S. Das et al., 2010).

Although this study claims IS/IT investments were classified into four ‘distinct’ categories, their findings have two limitations. Firstly, it ignored the need for a socio-technical perspective (I. Muhammad, Teoh, & Wickramasinghe, 2013) when examining the role of health IS/IT in enhancing the organisational performance in favour of economic value, lag, and duration. Secondly, the four categories of health IS/IT cover non-clinical IS/IT, leaving the complexity of examining the role of clinical IS/IT neglected (P. Haddad et al., 2014a).

Furthermore, the majority of the current literature examines different IS/IT apart from their business objectives, which raises questions about their findings and how valid they are to be used in various contexts (Kumar, Ajjan, & Niu, 2008; Weill & Woerner, 2013). This gap was the reason for adopting the IT Portfolio of Weill and Broadbent (1998) as one of the theoretical bases for this research as Subsection 2.5.1 explains.

In addition, the current literature shows contradictory results from different studies on the impact of IS/IT on different outputs such as quality of care, patient safety, patient outcomes, cost, and efficiency (Chaudhry et al., 2006; Jones et al., 2014). Not only do these results call for a deeper examination of the business value of IS/IT in healthcare, but they also mirror the need for developing a comprehensive framework that takes the contextual conditions into consideration when investigating the impact of IS/IT on the organisational performance of healthcare providers.
2.4.3 Value in Healthcare

Given the difficulties faced by different healthcare systems around the world, many initiatives have been established to support the move to adopting value-based care delivery systems (R. S. Kaplan & Witkowski, 2014; Kawamoto et al., 2015; Rotar, van den Berg, Kringos, & Klazinga, 2016). Particularly, creating rational approaches to lessen healthcare cost growth and enhancing the centeredness of healthcare procedures around patients has been shown as an essential step to building such value-based healthcare systems (CMS, 2013; OECD, 2010). In addition, one of the predominant perceptions on value-based healthcare is identifying and encouraging care delivery patterns that are not only of higher quality but also more cost-efficient (CMS, 2013). The current state of care delivery, though, tends to be on the other side in many cases, i.e. delivering care of poorer quality at higher costs (Wilson, Gole, Mishra, & Mishra, 2016).

ME. Porter (2010); Michael E Porter, Pabo, and Lee (2013) expound that lacking a precise definition of ‘value’ in healthcare and adopting it is the central dilemma that has been challenging the efforts to enhance healthcare outcomes. Instead of adopting such a definition to guide different initiatives to reform healthcare systems, these initiatives have used other aspects such as economic measures like profitability and cost containment (Blumenthal & Jena, 2013; VanLare & Conway, 2012), safety (Chatterjee, Joynt, Orav, & Jha, 2012), patient experience (Hibbard, Greene, Sofaer, Firminger, & Hirsh, 2012), and quality (OECD, 2010). The problem with adopting different goals in healthcare is that they cannot be used as a reliable indicator of value in healthcare because of flawed reimbursement and lack of competition based on actual results (ME. Porter, 2010, p. 2480).
It is important to emphasise that the business value of IT is not a value by itself; rather, it is a model that suggests the value that might be generated by implementing specific IS/IT solutions (Haddad et al., 2014a, p.78).

2.5 Theoretical Underpinnings

This Section presents the theoretical foundations used in this study, namely the IT Portfolio (Weill & Broadbent, 1998), and the Enterprise of Health Delivery (W. B. Rouse & Cortese, 2010).

2.5.1 IT Portfolio

Weill and Broadbent (1998) argue that IT in the service industry is the production technology i.e. the equivalent of the machine tools and production lines of manufacturing. They define IT in this setting as:

“A firm’s total investments in computing and communications technology. This includes hardware, software, telecommunications, the myriad of devices for collecting and representing data, all electronically stored data, and the people dedicated to providing these services (human resources). That includes information technology investments implemented by internal groups (insourced), and those outsources by other providers. The sum of these investments is viewed as the information technology portfolio, which must be managed like a financial portfolio, balancing risks and returns to meet management goals strategies for customer and shareholders”. (p.6)
Principally, firms invest in IT to achieve four fundamentally different management objectives: transactional, infrastructure, informational, and strategic. These management objectives then lead to informational, transactional, infrastructural, and strategic systems, which make up the information technology investment portfolio (Weill & Broadbent, 1998). Figure 2.5 depicts these different management objectives and their relationships as they form the information technology portfolio.

![Figure 2.5 The IT Portfolio Model, adopted from (Weill & Broadbent, 1998)]

The four categories of IT investments have unique characteristics and are used differently in different contexts and industries (Weill & Broadbent, 1998). Table 2.11 briefly describes the objectives of these four categories of IT investments.

Table 2.11 The objectives of the IT Portfolio Model, adopted from (Weill & Broadbent, 1998, pp. 26-28)

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Description</th>
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</table>
| Infrastructure | ● The foundation of information technology capacity which is delivered as reliable services shared throughout the firm and coordinated centrally, usually by the information technology group (IT Department).  
                 ● Include both the technical and the managerial expertise required to provide reliable services. |
• Having the required infrastructure services in place significantly increases the speed with which new applications can be implemented to meet new strategies, thus increasing the firm’s strategic agility and flexibility.

**Transactional**

- Process and automate the basic, repetitive transactions of the firm. These include systems that support order processing, inventory control, bank cash withdrawal, statement production, account receivable, accounts payable, and other transactional processing.
- Transactional systems aim to cut costs by substituting capital for labour or to handle higher volumes of transactions with greater speed and less unit cost. These systems build on and depend on a reliable infrastructure capacity.

**Informational**

- Provide information for managing and controlling the firm.
- Systems in this category typically support management control, decision making, communication and accounting. These systems can summarise and report this firm’s product and process performance across a wide range of areas.
- Two examples of these systems come from Ford Australia (Electronic Corporate Memory), and from the consulting firm Bain & Company which developed Bain Resources Access for Value Addition (BRAVA).

**Strategic**

- The objective of strategic technology investments is quite different from those of the other parts of the portfolio.
- Strategic investments are made to gain competitive advantage or to position the firm in the marketplace, most often by increasing market share or sales.
- Firms with successful strategic information technology initiatives have usually found a new use of information technology for an industry at a particular point in time.
- Two good examples of these strategic initiatives are: inventing automatic teller machines (ATMs) and designing a system that provides immediate 24-hour, seven-day-a-week loan approvals in car dealerships using expert systems technology. Both of these innovative systems have changed their industries forever.

The underpinning theory states that the use of information technology in a firm is governed by a set of rules and policies, which is called “information technology architecture” (Weill & Broadbent, 1998). One of the main roles of this architecture is to draw the path to the way business will be done in both the near and far futures. This architecture is not expected to give rules of decision making; rather, it provides the
technical guidelines for the decision-making process (Weill & Broadbent, 1998). This architecture, which needs to be dynamic and subject to regular reviews, is necessary for a firm-wide infrastructure to:

- Achieve compatibility among various systems
- Specify the policies and mechanics for delivering the information technology strategy
- Describe the technological model of the organisation

According to this model, the ultimate objective of information technology is to provide business value in two related ways: to successfully implement current strategies and to use the technology to enable new strategies (Weill & Broadbent, 1998). The alignment between information technology portfolio and strategy is tough, as they fundamentally have different characteristics. There is enough evidence of better payoff of the information technology investments if well aligned with business strategies (Weill & Broadbent, 1998). This alignment, however, is hard to achieve and maintain, due to the constantly changed business circumstances (Weill & Broadbent, 1998). Nevertheless, each unique strategic context leads to different strategic objectives and different types of information technology portfolios. Thus, a firm’s information technology capabilities are a top management responsibility (Weill & Broadbent, 1998). As the size of investments in IT and the strategic role it may play make investing in IT a very challenging business decision, these are far too important to be left to the technical people, or, worse, to outsource these resources to third parties or sub-contractors with their own business objectives (Weill & Broadbent, 1998).
The use of this classification to be one of the theoretical underpinnings of this study is justified by the need to avoid one of the biggest flaws in the current health information systems literature (P. Haddad et al., 2014a, 2014b). That is, approaching different IS/IT from a heterogeneous perspective, i.e. generalising the findings from evaluating specific information systems to all other information systems that have different business objectives (Berg, 1999; Eysenbach, Powell, Kuss, & Sa, 2002; Peter Haddad et al., 2015).

### 2.5.2 The Enterprise of Healthcare Delivery

The second theoretical basis of this study is the Enterprise of Healthcare Delivery by W. B. Rouse and Cortese (2010). In their book *Engineering the System of Healthcare Delivery*, Rouse and Cortese propose an architecture of the enterprise of healthcare delivery as shown in Figure 2.6. According to this architecture, the healthcare delivery consists of four main layers:

- **The Healthcare Ecosystem**: Covers the society of the healthcare organisations from a macro perspective,

- **The System Structure**: Meant to cover the healthcare organisations on a meso level,

- **The Delivery Operations**: Covers different stages of healthcare delivery from detection to recovery on a micro level, and

- **Clinical Practices**: Covers different clinical practices within healthcare organisations that target people from a functional perspective.

These four layers are interrelated in a way that the efficiencies can be gained at the lowest level are limited by the nature of the next level (Figure 2.6). For example, functionally organised practices are much less efficient than delivery organised around processes.
Similarly, the efficiencies that can be gained in operations are limited by the level above (system structure). Functional operations are driven by organisations structured around specialties, e.g. anaesthesiology and radiology. Furthermore, efficiencies in system structures are limited by the healthcare ecosystem in which healthcare organisations operate (W. B. Rouse & Cortese, 2010).

According to this model, the interaction between different sequential levels is bidirectional. For example, prudent clinical practices positively affect the delivery operations from patient care and healthcare outcomes perspectives, and good delivery operations serve to provide higher care capabilities and better health information to clinical practices (W. B. Rouse & Cortese, 2010). At the same time, these good delivery operations help create economic returns and usable performance information, while well-structured healthcare organisations help delivery operations take competitive positions and benefit from firms’ investments’ portfolios (W. B. Rouse & Cortese, 2010).

![Diagram of the Enterprise of Healthcare Delivery](image)

**Figure 2.6: The Enterprise of Healthcare Delivery, adopted from (W. B. Rouse & Cortese, 2010)**
The use of this framework to support this study is justified by the potential of this model to cover the socio-technical aspects of healthcare delivery. Looking at healthcare delivery from this perspective is an increasingly used, and needed, approach to evaluating health information systems, in particular with the increasing recognition of the importance of the interaction between human, social, and organisational contexts and the role it plays to determine the success or failure of health information systems (Aarts, Callen, Coiera, & Westbrook, 2010). In other words, the interrelation between technology and its social environment is crucial to evaluating the role of health information technology can play to enhance the outcomes of the healthcare delivery in general, either on a macro level such as national e-health initiatives (I. Muhammad et al., 2013; Waterson, 2014), or on a meso and/ or micro level (Singh et al., 2013; Westbrook et al., 2007).

2.6 The Implications of the Literature Review to this Study:

Developing the Conceptual Framework

The conceptual framework in this study serves to provide a theoretical basis to answer the research question of: “How can information systems /information technology facilitate the generation of business value in healthcare firms?”. The model builds on two prior structures; the first is the theory of IT Portfolio by Weill and Broadbent (1998), who classified IT investments into infrastructural, transactional, strategic, and informational. This classification is based on their business objectives (see Section 2.5.1). The second is the model of Healthcare Delivery Enterprise by W. B. Rouse and Cortese (2010), which covers the socio-technical aspects of the healthcare delivery. This includes the Healthcare Ecosystem (Society), System Structure (Organisation), Delivery Operations (Processes), and Clinical Practices (People) (W. B. Rouse & Cortese, 2010). In addition, the
conceptual mode of this study is based on a rigorous literature review to cover different aspects of healthcare delivery (Fichman & Melville, 2014; Kohli & Grover, 2008; Maklan et al., 2015; Melville et al., 2004; Melville & McQuaid, 2012; Ramirez, Melville, & Lawler, 2010). The following subsections explain the elements of the conceptual model.

2.6.1 Healthcare Ecosystem (Society)

Healthcare intervention is complex and typically involves a multiplicity of factors that might be conceptualised as a web of health care players (Wickramasinghe & Schaffer, 2010). These players together form the health ecosystem (Figure 2.7). By analogy with natural life ecosystem, Serbanati, Ricci, Mercurio, and Vasilateanu (2011, p. 628) defined a health ecosystem as ‘the network of a multitude of agents: care providers (physicians, nurses, pharmacists, and other health professionals), health suppliers, together with their organisations and information systems, care consumers, plus the socio-economic environment and including the health institutional and regulatory frameworks’.

Digitising the concept of ecosystem enables the dynamic networking of the organisations, which, in turn, drives the dynamic cooperation of the players on the territory and the connection of the resources in a system, resulting in a community that shares business, knowledge, and infrastructures (Nachira, 2002). It is a self-organising digital infrastructure aimed at creating a digital environment for networked organisations that support the cooperation, the knowledge sharing, and the development of open and adaptive technologies and evolutionary business models (Serbanati et al., 2011). In order to achieve the cooperation and knowledge sharing among the components of the health ecosystem, relevant data, pertinent information, and knowledge can be obtained only via the prudent structure and design of technology (von Lubitz & Wickramasinghe, 2006;
Wickramasinghe, 2007; Wickramasinghe et al., 2006). Similarly, Kling and Scacchi (1982, p. 3) argue that web models make explicit the salient connections between a focal technology and its social and political contexts.

![Healthcare Ecosystem](image)

**Figure 2.7: Healthcare Ecosystem, adopted from (Wickramasinghe & Schaffer, 2010)**

### 2.6.2 System Structure (Organisation)

The evolution of technology during the last few decades has caused tremendous changes in the organisational structures of healthcare organisations (Dahlgren & Cokus, 2007). Traditional hierarchical constructs no longer exist, at least in practice (Eybers, Kroeze, & Strydom, 2013). The use of IS/IT to reshape organisational structures began with the use of voice communications (telephone), and then started to evolve using high speed data lines and facsimiles, which in turn opened the door to the use of computers and related technologies like e-mail, Internet, intranet, extranet, etc. in the different levels of
organisational processes. The amount of information generated by these technologies and the ease of information sharing (in theory) between different stakeholders within and across organisations, coupled with other social changes since the World War II, have had significant influences on the conventional organisational structures (Dahlgren & Cokus, 2007).

The evolution of information technology to information systems is still playing key roles in reshaping organisational processes, or business process improvement (BPI) (Raschke & Sen, 2013). Today, BPI projects aim at achieving better collaborations between different stakeholders, higher integration between the various levels of operations, and improved communications and knowledge sharing internally and externally (Dahlgren & Cokus, 2007). Facilitating these projects is one of the principal justifications of more investments and spending on IS/IT nowadays, especially from collaboration and integration perspectives, both within and among healthcare providers (Laliberte, 2012).

The trend of using IS/IT to facilitate BPI initiatives has created an interest in measuring the impact of IS/IT on the organisational structures in different industries (Bank, 2015; Pope & Mays, 2013). The lack of clear frameworks and measurement for their impacts on the organisational structures, and acutely in healthcare, has caused the majority of these projects to fail (Business Process Improvements, 2011), which necessitates the design of a framework that is capable of measuring the mutual impacts of IS/IT and organisational structures (Raschke & Sen, 2013).

2.6.3 Delivery Operations (Processes)

A typical care cycle consists of four interrelated processes: detection, diagnosis, treatment and recovery (W. Rouse, 2009). Each stage utilises both labour and technological
resources (Figure 2.8). In order to reduce healthcare delivery costs, IS/IT has been shown as a “labour eliminator” in these four stages. For example, web-based scheduling and account management can enable patients to substitute their labour for that of providers, as has been experienced in the airline, banking, and retail industries. Adopting information technology in this area could result in better care, greater patient satisfaction, and lower cost (W. Rouse, 2009).

![Figure 2.8: Four Stages of Care Cycle, adopted from (W. Rouse, 2009)](image)

The above suggested the use of information technology instead of labour is limited to transactional IT, whose primary concern is to perform repetitive duties online instead of communicating with human resources (labour). This trend can be found in different industries, such as banking and manufacturing, and is not limited to the healthcare contexts (Weill & Broadbent, 1998). However, the use of IS/IT to handle more complex processes within the care cycle may be prone to risk (Jones et al., 2014). Given the use of IS/IT in the operationalisation of the actual care delivery has potential impacts and risks
at the time. Thus, a comprehensive framework to assess the impact of different IS/IT on the different stages of care delivery is crucial.

2.6.4 Clinical Practices (People)

Nowadays, electronic medical records (EMRs) and electronic medical administration records (eMAR) are the most popular emerging clinical IS/IT in the healthcare industry. HIMSS (2013, p. ii) defines an EMR as a ‘longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting. Included in this information are patient demographics, progress notes, problems, medications, vital signs, past medical history, immunisations, laboratory data and radiology reports’.

EMRs and eMAR have been in use for more than twenty years (Ilie, Courtney, & Van Slyke, 2007; Park, Parwani, & Pantanowitz, 2014), and they are gradually replacing the paper-based medical and administration records. Today, EMRs as enterprise systems are not only integrating most of the departments within a healthcare provider but also creating an integrative environment between different healthcare providers. In doing so, EMRs use a compilation of clinical practices, such as Clinical Data Repositories (CDR), Clinical Decision Support Systems (CDSS), Laboratory Information Systems (LIS), Nursing Documentation (ND) systems, Order Entry (OE), Pharmacy Management Systems (PMS), Physician Documentation (PD), and Radiology Information Systems (RIS). A summary of these systems and their definitions and functions were presented in Table 2.7 in Section 2.3 (Information Systems for Healthcare).

In combining the two models (IT Portfolio and The Enterprises of Healthcare Delivery) with the literature review conducted to cover the different aspects of healthcare delivery, the conceptual model of this study is shown in Figure 2.9.
Chapter 2

Literature Review

Figure 2.9 The Conceptual Mode of the Research: The BVIT in Healthcare Model
2.7 Summary and Significance of the Study

This chapter has discussed different issues pertaining to the business value of IT in healthcare. It started with giving an overview of the current state of healthcare delivery systems globally, in terms of their structures, financing, and challenges. This section showed that - irrespective of the different structures of healthcare delivery - they all share two types of challenges; the increasing costs and pressures to improve patients’ outcomes and quality of care. These problems have encouraged policy- and decision-makers to adopt IS/IT, which was also discussed in this chapter. Following this increased use of IS/IT in healthcare, the impacts of these costly investments have started to be questioned. This was covered in the third section of this chapter. In order to help answer some of the questions on the business value of IS/IT in healthcare, this study develops a conceptual model that takes into consideration two points; the first is the need of a prudent classification of IS/IT based on their business/ management objectives, and the second is the need for socio-technical lenses to examine the healthcare domain. These two points clearly represent a current void in the health IS literature. The two models that serve to provide these platforms were discussed in this chapter. Then, the different levels and elements of the conceptual model of this study were presented in details.

The literature review has shown clear evidence that a comprehensive conceptual model to evaluate the business value of IT in healthcare is crucial, in particular with the notable trend to invest heavily in health IS/IT with little to show for it in the output.

The next chapter presents the research methodology and research design adopted in this study.

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Chapter 3
Methodology and Research Design
Chapter 3: Methodology and Research Design

This chapter presents the research methodology and research design in this study to facilitate the development of the Business Value of IT in Healthcare Model. In turn, this model is expected to help decision- and policy-makers in the Australian healthcare context to deliver more efficient healthcare delivery and better patient outcomes through identifying the most business value generating IS/IT, and factors affecting their potential business value. These lessons learnt are also transferable to other healthcare systems, as the Business Value of IT Model notes the contextual circumstances of different healthcare systems through one of its tiers; namely the Healthcare Ecosystem. The achievement of this research objective will answer the research question in this study: How can information systems/ information technology facilitate the generation of business value in healthcare firms?

This chapter aims at 1) presenting the research methodology and research design, and 2) justifying the selection of research methods based on the nature of this research. The remainder of this chapter will be organised into six main sections. Section 3.1 describes
the methodology, and Section 3.2 introduces the philosophical perspectives adopted in this research; namely the use of interpretive research. Section 3.3 argues the appropriateness of case study as a research strategy in this study, and Section 3.4 describes the research design of this study, including the participants, interviews, data analysis, validity, reliability, and data triangulation, and the steps taken to obtain ethics approvals and all other ethical considerations in this research. Section 3.5 presents an overview of the data analysis conducted in this study, as well as the themes and sub-themes resulting from this analysis. Finally, Section 3.6 presents a summary of the chapter.

3.1 Methodology

This research examines possible factors that contribute to the business value of IT in the healthcare context. In so doing, this research explores well-formulated and known theories in the unique context of healthcare to confirm, challenge, and build upon these theories. Hence, this research is exploratory in nature, as it is planned to be a ‘broad-ranging, purposive, systematic, and prearranged undertaking designed to maximise the discovery of generalisations leading to description and understanding of the area of research’ (Stebbins, 2001, p. 5).

As noted by Robert K Yin (2014), qualitative research has its own allure as it enables conducting in-depth studies and researches about a broad range of topics and greater latitude in selecting topics of interest. Other research approaches are likely to be constrained by a number of factors, as Table 3.1 summarises.
Table 3.1 Different research approaches and their possible constraints, adopted from (Robert K Yin, 2014)

<table>
<thead>
<tr>
<th>Research Approach/Method</th>
<th>Constraint(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental research</td>
<td>Inability to establish the necessary conditions</td>
</tr>
</tbody>
</table>
| Economic research        | Limitation on data availability in two aspects:  
                          |   o Sufficient data series may not be available  
                          |   o Coverage of sufficient variables may not exist |
| Survey-based research    | Difficulty securing sufficient rates of valid and completed responses,  
                          |   Drawing adequate respondents especially when surveying large populations |
| History research         | Limited scope of studies (being dedicated to exploring past).  
                          |   *i.e.* history research is of limited capability to study an ongoing phenomenon |

Based on the discussion above, a qualitative approach is deemed especially appropriate for this study to avoid these constraints. It also enables exploring a relatively new phenomenon, namely the impact of health information technology and systems on the overall performance of healthcare organisations. Qualitative research uses non-numeric data like thoughts, ideas, expressions, and words used instead of numbers, which helps better understand the underlying issues of the studied phenomena (B. Johnson & Christensen, 2008). To justify this selection, Table 3.2 maps this study to the use of a qualitative approach as stated by (Robert K Yin, 2011, 2014).
Table 3.2 The appropriateness of a qualitative approach to this research, based on the work of (Robert K Yin, 2011, 2014)

<table>
<thead>
<tr>
<th>The need for a qualitative approach</th>
<th>The appropriateness of qualitative approach for this research</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>The need to cover the contextual conditions of the studied area</strong></td>
<td>This study focuses on the business value of IT in the healthcare industry, whose ecosystem consists of a web of players, including regulators, healthcare organisations, suppliers, payers, and patients. The interaction between these components is critical to understanding the impact of IS/IT on the healthcare industry (Wickramasinghe &amp; Schaffer, 2010).</td>
</tr>
<tr>
<td>2. <strong>The need of multiple sources of evidence by representing the views and perspectives of participants of diverse skills and specialties and yet interrelated organisational missions.</strong></td>
<td>Healthcare organisations have three groups of knowledge workers in common, namely: clinicians, executives and management, and IT personnel (Davenport, 2013; Wong et al., 2003). This study attends to the need of multiple sources of evidence by taking insights from a carefully selected coherent of representatives these three groups, and a fourth group whose members are clinicians with sound experience in IT. The selection criteria will be discussed later in this chapter.</td>
</tr>
<tr>
<td>3. <strong>The need to study the phenomena under the real-world conditions.</strong></td>
<td>Due to the busy nature of healthcare organisations, this study had to collect the data during the daily business of the studied hospital. <em>i.e.</em> delivering care to patients, as well as, managing the hospital in different levels, financially, legally, technically, and operationally in general. In so doing, this study benefited from the opportunity to collect relevant data that relate to running the day-to-day business of the hospital and the impact IS/IT can make in this regard.</td>
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</table>

The use of the qualitative approach in the area of health information systems has increasingly been notable in the literature over the last few decades (Bonnie Kaplan & Maxwell, 2005). This is driven in large by the increasing recognition of the value of qualitative approaches in organisational, behavioural, social, and evaluation research (Bonnie Kaplan & Duchon, 1988; G. Lee & Xia, 2010; Spears & Barki, 2010), primarily to benefit from the insights of different participants to understand the studied phenomenon, as well as tackling the complexity of the healthcare industry. See for example (Christiaan P. Katsma, 2007; Mantzana, Themistocleous, Irani, & Morabito,
2007; Sarker, Xiao, & Beaulieu, 2013; Yen & Bakken, 2012). For this research, exploring different micro, meso, and macro factors impacting the generation of business value from IS/IT in healthcare is key. Thus, qualitative research methods were used to identify these factors/ themes, and understand their roles in generating the business value of IS/IT investments. The following Section presents the philosophical assumptions that guide this research.

### 3.2 Philosophical Perspectives

Another classification of the investigation, rather than being qualitative or quantitative, is based on the philosophical assumptions that form the underlying epistemology, which in turn guides the research (Michael D. Myers, 2009). These assumptions work with both qualitative and quantitative research (Michael D Myers, 1997; Sale, Lohfeld, & Brazil, 2002). At present, there exist a number of philosophical classes based on this foundation. For example, Guba and Lincoln (1994) have contributed to this area by classifying competing paradigms of inquiry into positivism, post-positivism, critical theory and constructivism. Similarly, Orlikowski (1991) articulated three paradigms for qualitative research, namely positivist, interpretive, and critical. This last differentiation has been used extensively in the IS research (W. Chen & Hirschheim, 2004; Gregor, 2006; G. Walsham, 1995). Thus, this research will use this classification to justify the choice of the underlying assumption.

The issue practising social researchers have to deal with is that the distinctions between these three paradigms are not always so clear-cut, although they are philosophically distinct (A. S. Lee, 1989; Michael D. Myers, 2009). Table 3.3 summarises the main features of these three paradigms and examples of their use in the IS research.
Table 3.3 The three paradigms for qualitative research, adopted from (Michael D. Myers, 2009; Orlikowski, 1991)

<table>
<thead>
<tr>
<th>Research paradigm</th>
<th>Main feature</th>
<th>Examples of studies used this paradigm</th>
</tr>
</thead>
</table>
| Positivist        | • Common in most business and management disciplines  
• Assumes that reality is objective, described by quantitatively measurable properties, over which the researcher has no control.  
• Typically is based on developing propositions that characterise the investigated subject by using an array of dependent and independent variable and examining the relationships between them. | (Benbasat, Goldstein, & Mead, 1987; Dunn & Jones, 2010; Peter Leung-Kwong & Paul, 2002; Ted & Stuart, 2004). |
| Interpretive      | • More popular now in social science research,  
• Assumes that reality is only through social constructs such as language, consciousness, and instruments.  
• Focuses on the complexity of human sense-making rather than predefined variables (B Kaplan & Maxwell, 1994).  
• Facilitates the understanding of a phenomenon through the meanings that people assign to them.  
• Appropriate for studies that seek to answer research questions such as ‘why’ and ‘how’ (Deetz, 1996)  
• The context determines the real meaning of data (Bernstein, 1983). | (Bjørn & Ngwenyama, 2009; Markus, 1983; Orlikowski, 1991; Sulaiman & Wickramasinghe, 2014; Taylor, 1987) |
| Critical          | • Less common than interpretive and positivist approaches in the business and management disciplines.  
• Has some similarities with both interpretive and positivist paradigms; yet it is a unique approach.  
• Assumes that social reality is the output of consecutive and iterative cycles of production by people.  
• In the process of producing and reproducing the reality, people are under the control of various forms of social, cultural, and political dominations  
• Challenges "prevailing beliefs, values, and assumptions that might be taken for granted by the subjects themselves" (Michael D. Myers, 2009, p. 43) | (Brooke, 2002; Kvasny & Richardson, 2006) |

Based on the discussion above, and given the nature of the current research, the use of an interpretive research approach is deemed appropriate (Michael D. Myers, 2009; Geoff
Walsham, 2006). The primary focus of this research is to evaluate the business value of IT in healthcare, where the process of decision-making in the area of IT investments is subject to complex contextual conditions pertaining to legal, social, and organisational requirements. This supports the argument of (Andrade, 2009; G. Walsham, 1995), who suggest that the interpretive approach is appropriate to evaluate the mutual influences between IS/IT and their contexts and to use that to build theories.

Furthermore, this research does not adopt predefined dependent or independent variables; rather, it opens the door to understanding the business value of IT in healthcare through the meanings that people (participants) assign to them.

It is worth taking two points into consideration regarding the adoption of an interpretive approach to underlay this research:

1. While this research proposes a conceptual model to conceptualise the business value of IT in healthcare, the development of this framework was the output of a rigorous literature review on the area of interest, and it should not be looked on as a set of predefined variables (dependent or independent) where this research studies the relationships between these variables. Rather, it is used as a guide to facilitate the conduct of this research, particularly the data collection phase.

2. Although this research uses well-known theoretical underpinnings, the researcher has taken a flexible approach where data collection and analysis phases can consider new thoughts and insights from the participants in this research. As a proof of the success of this approach, this research has revealed a number of emerging themes that were not available in the used theories. Adopting this
openness helps avoid bias caused by the use of predefined theories (G. Walsham, 1995).

Qualitative approaches utilise a number of strategies to operationalise research (Robert K Yin, 2011), including case studies (Baxter & Jack, 2008), grounded theories (Glaser & Strauss, 2009), and ethnographic studies (Denzin & Lincoln, 1994). This research uses case study to evaluate the business value of IT in the healthcare context. The next Section is dedicated to discussing the choice of case study as a strategy for this research.

### 3.3 Case Study

Robert K Yin (2014, pp. 23-24) defines case study as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used”. Case study research has proven to be ‘well-suited to capturing the knowledge of practitioners and developing theories from it’ (Benbasat et al., 1987, p. 370), especially with the shift that has been experienced by the information systems field from technological to managerial and organisational questions, which has resulted in more interest in the interaction between innovations and different contexts (Bhattacherjee, 2012; W. Chen & Hirschheim, 2004).

In his comparison of case study for other research strategies, and when to use each of them, Robert K Yin (2014) identifies three factors play together a pivotal role in deciding the appropriateness of each strategy to conduct different researches. Those factors are 1), the type of research question; 2), the control an investigator has over actual behavioural events; and 3), the focus on contemporary as opposed to historical phenomena. This
supports Benbasat et al. (1987) who states that the selection of the appropriate research strategy is usually influenced by the goals of the researcher and the research topic. This also supports the argument by Roethlisberger (1977) that case study strategy is appropriate for topics in which both research and theory are at their formative stages, and by Bonoma and Wong (1983, p. 36) that case study researches are designed for ‘sticky, practice-based problems where the experiences of the actors are important and the context of action is critical’.

Furthermore, case study is the viable alternative among the other methodological choices to address the complexity of contextual conditions, in particular for the evaluation type of research (Posavac, 2015; Stufflebeam & Shinkfield, 2007; R. Yin, K., 2013), to which this study belongs, as it sets out to evaluate the business value of IT in the complex context of healthcare.

From the definition of a case study, and the comparison between different research strategies, and based on discussion aforementioned and the nature of this study, a case study is deemed appropriate for this research. To further explain the appropriateness of case study for this research, Table 3.4 maps this study to the use of this research strategy.

Table 3.4 the appropriateness of case study as a research strategy for this research, as defined and compared to other research strategies

<table>
<thead>
<tr>
<th>Case Study</th>
<th>This Research</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Based on the definition (Robert K Yin, 2014)</strong></td>
<td></td>
</tr>
<tr>
<td>An empirical inquiry that: 1) investigates a contemporary phenomenon within its real-life context</td>
<td>This research examines the business value of IT in healthcare. Health informatics is a relatively new discipline (Dalrymple, 2011; Ikram, Ghani, &amp; Abdullah, 2015), the healthcare organisations have recently started to invest in health IS/IT (Audet, Squires, &amp; Doty, 2014). Hence, the phenomenon is contemporary, and the trend to invest more in IS/IT</td>
</tr>
</tbody>
</table>
for healthcare is notable (P. Haddad et al., 2014b). To conduct this research, data collection had to take place in the real-life context, i.e., at the studied hospital/ group of hospitals whilst running the day-to-day business for the hospital.

<table>
<thead>
<tr>
<th>When the boundaries between phenomenon and context are not clearly evident</th>
<th>Hospitals as care providers are only one player of a web of players in the complex ecosystem of healthcare, besides regulators, competitors, payers, patients, etc. (Wickramasinghe &amp; Schaffer, 2010). Evaluating the business value of IT needs further exploration of the contextual conditions and never solely depends on internal factors within the hospitals. Aligning with regulatory requirements, for example, is always needed (Grabara, Kolcun, &amp; Kot, 2014). Hence, studying the business value of IT apart from this fact is neither prudent nor sufficient.</th>
</tr>
</thead>
<tbody>
<tr>
<td>And in which multiple sources of evidence are used</td>
<td>Hospitals have three groups of knowledge workers in common: clinicians, executives, and IT (Davenport, 2013). In order to explore the insider views on the current organisational status from the key informants within the selected organisation, case study is the appropriate research strategy for this type of research (Poulis, Poulis, &amp; Plakoyiannaki, 2012). Based on comparing case study to other research strategies (Experiment, survey, archival analysis, and history) (Robert K. Yin, 2003; Robert K Yin, 2014)</td>
</tr>
<tr>
<td>The form of the research question: Case study, history, and experiment are suitable for “how, why” research questions, while survey and archival analysis are suitable for who, what, where, how many, and how much.</td>
<td>The research question for this study is: How can information systems/ technology facilitate the generation of business value in healthcare firms? Hence, case study, history, and experiment meet this criterion</td>
</tr>
<tr>
<td>The level of control over behavioural events. i.e. the level of manipulation required for relevant behaviours. Only experiment requires this control.</td>
<td>This research does not require any control over the observed behaviours in the data sites. As experiment requires this control, it is now excluded, and only history and case study are appropriate to choose from.</td>
</tr>
<tr>
<td>Focuses on contemporary events. Only history does not focus on contemporary events.</td>
<td>The studied topic is contemporary (The business value of IT in Healthcare). Hence, case study meets the three criteria.</td>
</tr>
</tbody>
</table>
3.3.1 Case Study Designs

There exist four types of case study designs: 1) single case (holistic) designs, 2) single-case (embedded) designs, 3) multiple-case (holistic), and 4) multiple-case (embedded) designs as Figure 3.1 depicts (Robert K. Yin, 2003; Robert K Yin, 2014). According to this widely accepted classification, investigators in a qualitative exploratory case study research need to make two decisions. The first relates to the type of the case study, whether a single-case study or multiple case study. The second relates to the number of units of analysis, whether it is a single unit of analysis (holistic) or multiple units of analysis (embedded). This research adopted an embedded single case study, as the case of choice represents a critical case in testing well-formulated theories (Robert K Yin, 2014).

<table>
<thead>
<tr>
<th>Holistic</th>
<th>Multiple-Case Designs</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Single unit of analysis)</td>
<td>Type 1</td>
</tr>
<tr>
<td></td>
<td>Type 2</td>
</tr>
<tr>
<td>Embedded</td>
<td>Type 3</td>
</tr>
<tr>
<td>(Multiple units of analysis)</td>
<td>Type 4</td>
</tr>
</tbody>
</table>

*Figure 3.1 Four types of case study designs (Robert K Yin, 2014)*

Within this single case study, there exist a number of units of analysis of interest. As the case study is an Australian not-for-profit hospital that has invested in health IS/IT across its different locations/ sites, hence the use of multiple units of analysis can create and highlight theoretical constructs (Baxter & Jack, 2008; Kathleen M. Eisenhardt, 1989;
Eisenhardt, 1991). Furthermore, the intention to investigate the business value of IT in the healthcare industry requires insights from three groups of knowledge workers in the healthcare contexts with different levels of powerfulness; namely clinicians, executive and management, and IT personnel (Davenport, 2013), as well as the group of clinicians with sound IT skills.

3.3.2 The Selected Case

Case selection is one of the essential tasks of the case study researcher (Merriam, 1998). As the case study is meant to be used to elucidate the features of a broader population, the chosen case is asked to perform a heroic role: to stand for (represent) a population of cases that is often much larger than the case itself (Seawright & Gerring, 2008, p. 294). Hence, the decision on case selection needs to be carefully taken based on the objectives of the research, its capabilities to represent broader populations, and its internal and contextual conditions that essentially determine how appropriate it is to answer the questions posed by the case study researcher (Seawright & Gerring, 2008). Furthermore, the case selection needs to be well thought out by considering the nature of the topic, characteristics of firms (industry, company size, organisational structure, profit/ not-for-profit, public or private ownership, geographic coverage, degree of vertical or horizontal integration, and so on (Benbasat et al., 1987, p. 369).

Taking the discussion above into consideration, this research was conducted at an Australian healthcare group comprising of a number of hospitals as Chapter 4 will explain. This choice was based on its own characteristics that make it suitable to test the validity of the Business Value of IT in Healthcare Model, as well as the theoretical underpinnings of this research. Those characteristics pertain mainly to:
1. The increasing amount of IS/IT investments for both business and clinical information systems;
2. Having multiple locations and sizes of hospitals and related facilities with different levels of IS/IT adoption.
3. Its nature as a not-for-profit hospital, which enables tackling the complexity of funding structures, especially funding IS/IT projects.

In order to collect data from different stakeholders at the selected case, the participants for the interviews were recruited from various departments and different locations, with different levels of interaction with IS/IT investments.

### 3.3.3 Addressing the Criticism against Case Study Research

Although case study has become one of the predominant research strategies in different areas of research like information systems (Darke, Shanks, & Broadbent, 1998; Gable, 1994), organisational behaviours (Robbins, Judge, Millett, & Boyle, 2013), education (Thomas, 2015) and social science in general (Ritchie, Lewis, Nicholls, & Ormston, 2013), there still are some traditional prejudices against this research strategy (Gerring, 2006). In addressing this criticism against case study, Flyvbjerg (2006, p. 221) notes that the problems with the conventional wisdom can be summarised in five ‘misunderstandings’ or ‘oversimplifications’ about the nature of such research, pertaining mainly to lacking the ability to:

1. Generalise from case study research,
2. Conduct ‘bias-free’ researches,
3. Provide value to practical context-dependent knowledge,
4. Summarise and develop general propositions and theories, and
5. Test hypotheses and build theories.
This agrees with what is noted by Robert K. Yin (2003, p. 21), who summarises the criticism against the case study strategy in three incubators:

1. Lack of rigour of case study research,
2. Inability to conduct ‘bias-free’ researches, and
3. The long time required dealing with massive, unreadable documents.

Flyvbjerg (2006) notes that most of the researchers who had criticised the case study came back later to this research strategy to conduct rigorous researches, citing Campbell, Stanley, and Gage (1966) who had claimed that case study research suffers a “total absence of control as to be of almost no scientific value” (pp. 6-7), and later made an ‘180-degree turn’ in these views and became active supporters of this method as in Campbell (1975). This also aligns with Robert K. Yin (2003), who argues that these concerns are not limited to case study researches, raising the point that this generalisation is also questionable with other research strategies like experimental approaches. Additionally, conducting bias-free research is debatable in other approaches, like survey research, and lack of rigour research is also possibly the case in other research strategies like historical research approaches. The extent to which these concerns are addressed is dependent upon the selection of case, and the criticality of the chosen case (Flyvbjerg, 2006; R. Yin, K., 2013). As this research is adopting an interpretive approach, generalising from the case study is not a concern, as this is possible through the development of new concepts based on generating or refining theories (G. Walsham, 1995).
3.4 Research Design

This research has three interrelated phases:

1. **Study design:** During this phase, a rigorous literature review was performed to fine tune the research question, and to design the research accordingly, as well as to meet the ethical requirements and obtaining the relevant approvals from the Human Research Ethics Committees at both the academic institution and the selected case.

2. **Qualitative data collection:** During this phase, a number of data collection methods were employed to cover the multi-faceted nature of this research better. This includes semi-structured interviews, researcher observations, as well as archival analysis for available documents like strategic plans, IS/IT strategies, the organisational structure of the selected case, annual reports, etc.

3. **Qualitative data analysis:** This phase was facilitated by the use of QSR NVivo to code the collected data, and then perform iterative thematic analyses on the collected data.

Figure 3.2 illustrates the design of this research and its different phases.
Figure 3.2 The flow chart for the research design for this study and its different stages
3.4.1 Interviews

Interviews are one of the predominant data sources in case study research. Other potential data sources may include, but are not limited to, documentation, archival records, physical artefacts, direct observations, and participant-observation (Baxter & Jack, 2008). In the healthcare domain, qualitative interview techniques have their allure over other data sources, as they increasingly are used to study the range and complexity of ideas and definitions employed by individuals and groups involved in the implementation of health technologies (Murphy, Dingwall, Greatbatch, Parker, & Watson, 1998, p. iv). Accordingly, interviews have been used to access the participants’ interpretations to discover what people think about the world they live in, how they evaluate their experiences within it and why they behave as they do (Murphy et al., 1998, p. 112).

As this research evaluates the business value of IT in healthcare, precious data from different stakeholders are needed to comprehend the contextual conditions under which IS/IT may or may not generate business value. Hence, interviews as a predominant data source are used in this study to access these interpretations.

Different terminologies have been adopted to classify qualitative interviews into types by different theorists and researchers (Flick, 2009). The majority of these classifications are based on the type of interaction between the researcher and the participant, and the nature of questions posed (Kvale & Brinkmann, 2009). Based on these criteria, qualitative interviews are classified into structured interviews, semi-structured interviews, and unstructured interviews (Flick, 2009).

This research uses semi-structured interviews for data collection. This selection is justified by the flexibility of semi-structured interviews, their opportunistic nature that
Chapter 3  
Methodology and Research Design

opens the door to elaborate or further explain responses or add additional perspectives to specific matters, and the flexibility of the data analysis through different techniques such as thematic analysis and earlier coding procedures (both open and axial) (Kvale & Brinkmann, 2009; Robert K Yin, 2014).

As recommended by Creswell and Miller (2000), and supported by (Patton, 2002), the protocol of interview was designed to have 4 sections as Table 3.5 summarises.

Table 3.5 The main constructs of the protocol of interviews used in this study

<table>
<thead>
<tr>
<th>Section</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Firm characteristics</strong></td>
<td>Drawing a comprehensive idea about the selected case, in terms of its locations, sites, number of employees, predominant areas of specialties, and some preliminary indicators on the use of IS/IT.</td>
</tr>
<tr>
<td><strong>Structure of IS/IT in the selected case</strong></td>
<td>Drawing a map of the current IS/IT solutions across the selected case, as well as the level at which different IS/IT are deployed, i.e., corporate wide or business unit wide. In addition, this section aims at collecting data about the areas these systems are used i.e. for clinical needs, business needs, or both.</td>
</tr>
<tr>
<td><strong>Investments in IS/IT</strong></td>
<td>Collecting information on the size of IS/IT investments as well as gaining insights into the process of investing in IS/IT in the selected case. Particularly the reasons of making these investments and exploring the extent to which these investments have met their planned objectives.</td>
</tr>
<tr>
<td><strong>The business value of IS/IT</strong></td>
<td>Gaining in-depth insights into the business value of IT in healthcare firms, on both clinical and non-clinical levels. This section starts with asking about the participants’ thoughts on measuring the organisational performance and the impact (if any) of IS/IT investments on the overall performance of the selected case. In addition, this section is designed to explore the factors that may impact generating business value from IS/IT investments in the selected case, and the possibility of generalisation from this case study to different healthcare providers by noting their contextual conditions covered in the Healthcare Ecosystem layer of the conceptual model of this study.</td>
</tr>
</tbody>
</table>
In summary, 31 interviews were conducted in this research. The shortest interview was 34 minutes, and the longest was 102 minutes. Figure 3.3 depicts the percentage frequency of the duration of conducted interviews.

![The duration of interviews conducted in this research](image)

**Figure 3.3 The percentage frequency of the duration of conducted interviews**

### 3.4.2 Participants

As the primary focus of this research is evaluating the business value of IT in healthcare, insights from four groups of knowledge workers with different levels of influence on IS/IT investments were indeed beneficial. Those groups are clinicians, executive, and management, and IT personnel (Davenport, 2013; Wong et al., 2003), and the group of clinical IT.

As noted by Bosman et al. (2003), it is prudent to implement pilot interviews to enhance the interviews with 'real participants further'. Accordingly, there were 3 participants for the pilot study. The first participant for the pilot interview was an oncologist as well as
an expert in clinical information systems and health IT in general. The second participant for the pilot-interviewing phase was the former Clinical Chief Information Officer (CCIO) at the selected case, who had been appointed to this unique position about four years ago to promote the use of EMRs across the hospital. The third participant of this phase was an academic in the health domain, with direct interactions with implementing different IS/IT in the healthcare, especially from the research and development point of view. At the end of the pilot interviewing, all comments and feedback from the interviewee were taken into consideration to design the final protocol for the real interviews. The changes were mainly pertaining to some internal processes the researcher had been not aware of. The final protocol can be found in Appendix C. The participants were approached after obtaining the relevant ethics approvals from the Human Research Ethics Committees at both the academic institution and the selected case. Most of the participants were contacted via email, and appointments were made at the convenience and availability of the participants. During the first few interviews, the researcher understood that a number of IS/IT covered in the conceptual model were not available across the selected case. Rather, different locations had different unique IS/IT that may not be compatible with other systems. This issue required the researcher to spend more time to figure out the map of IS/IT at different organisational levels. To address this fact, the snowball technique (Hakes & Whittington, 2008) was used to identify prospect participants across the various sites and locations of the selected case. Prior to starting the interviews, all participants were given a Plain Language Statement that summarises this

3 At the time of data collection, the current Clinical Chief Information Officer (CCIO) was not appointed yet.
research and its objectives. Furthermore, all participants were given a Consent Form and consented that they were comfortable to take part in the interviews. As an important component of the Consent Form, the participants were to agree their voice be audio-recorded; with a clear statement that the researcher only uses the resulted audio file for the purpose of data analysis. A copy of these documents can be found in Appendix B. Table 3.6 is a summary of the data collection phase, which depicts the pilot interviews, real interviews, and other sources for data, and Figure 3.4 illustrates the distribution of the interviewees across the four groups of participants.

Table 3.6 The details of data collection conducted in this study

<table>
<thead>
<tr>
<th>Type of interviews</th>
<th>No. of interviews</th>
<th>Positions/ specialties</th>
<th>Departments</th>
<th>Other sources of data</th>
</tr>
</thead>
</table>
| Pilot interviews   | 3                 | • An oncologist and expert on clinical information systems  
|                    |                   | • The previous Clinical Chief Information Officer (CCIO)  
|                    |                   | • An academic in the healthcare domain with IS/IT experience (Research and development)  
| Main interviews    | 31                | • IT  
|                    |                   | • Executives and management  
|                    |                   | • Clinicians  
|                    |                   | • Clinical IT  
|                    |                   | • Clinical  
|                    |                   | • Medical Services/ IT  
|                    |                   | • Research  
|                    |                   | Executive Directors, IT, Finance, Strategy, Medical Services, Project Management Office, Nursing, different clinical departments  
|                    |                   | Archival documents, annual reports, the selected case’s website  |
In summary, this research uses multiple data collection methods (interviews, archival documents, observations, and annual reports). This approach aligns with a set of recommended practices to enhance the validity of qualitative studies (R. B. Johnson, 1997) and better challenge existing theories and build new theories through data triangulation (K. M. Eisenhardt, 1989; Eisenhardt, 1991).

### 3.4.3 Validity, Reliability, and Data Triangulation

Examining the validity and reliability of quantitative research is crucial, and has been reconsidered for qualitative research paradigm (Golafshani, 2003). According to Merriam and Tisdell (2015), ensuring the validity and reliability of qualitative research can be approached through careful attention to the conceptualisation of the study and the way the data is managed regarding data collection, analysis and interpretation.

Reliability is the extent to which research findings can be replicated. In other words, if the study were repeated would it yield the same results? (Merriam & Tisdell, 2015, p. 220). Internal validity focuses on answering the question around how research findings

---

**Figure 3.4 The distribution of the interviewees based on their area of expertise/ positions**

<table>
<thead>
<tr>
<th>Area of Expertise/ Positions</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical IT</td>
<td>26%</td>
</tr>
<tr>
<td>Clinical</td>
<td>26%</td>
</tr>
<tr>
<td>Executives</td>
<td>32%</td>
</tr>
<tr>
<td>IT</td>
<td>16%</td>
</tr>
</tbody>
</table>

The distribution of the interviewees based on area of expertise/ positions.
match reality (Merriam & Tisdell, 2015, p. 213), and external validity is the extent to which the findings from one study can be applied to other situations (Merriam & Tisdell, 2015, p. 223). As human behaviour is ‘never static’, Merriam and Tisdell (2015, p. 221) argue that the most important question for qualitative research is whether the results are consistent with the data collected. Furthermore, the differences in purposes of evaluating the quality of studies in qualitative and quantitative research represent one of the reasons that the concept of reliability is irrelevant in qualitative research (Golafshani, 2003, p. 601). For similar considerations, Lincoln and Guba (1985, pp. 316-317) argues that demonstrating the internal validity in qualitative research is sufficient to assure the reliability. Furthermore, these two concepts (reliability and internal validity) are still more relevant to quality control in quantitative research (Golafshani, 2003). Terms such as Credibility, Neutrality or Confirmability, Consistency or Dependability and Applicability or Transferability (external validity) are key aspects that need to be carefully checked in qualitative research (Lincoln & Guba, 1985). In order to enhance the validity and reliability of any qualitative research, Merriam and Tisdell (2015) suggest six strategies that can help address these aspects. Table 3.7 shows these strategies, and how they were applied in this study.

**Table 3.7 Six strategies to enhance the reliability and validity of qualitative research as adopted from Merriam and Tisdell (2015) and how they were used in this study**

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Description</th>
<th>The application in this study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Triangulation</strong></td>
<td>The use of multiple sources of data and data collection techniques as well as the use of various theories</td>
<td>The study used semi-structured interviews with four categories of participants and examined different archival documents from the case study. Theoretically, the study used two previous works (W. B. Rouse &amp; Cortese, 2010; Weill &amp; Broadbent, 1998).</td>
</tr>
<tr>
<td><strong>Member checks (also called)</strong></td>
<td>Discussing the interpretations with the key participants in the research to ascertain</td>
<td>This strategy was implemented and maintained since the beginning of the initial data analysis phase. Some interviewees confirmed their agreement with the findings.</td>
</tr>
</tbody>
</table>
respondent validation) the validity of the findings is another strategy to avoid the possibility of misinterpreting the results (p.218). and some further clarified them in a second interview. As the results were being published, the key informants were also informed about the results, and they had no issues with the interpretations.

| Adequate engagement in data collection | Allocating adequate time for data collection and purposefully looking for variation in the understanding of the phenomenon (p. 219) | The researcher spent about two years in the data collection. The interviews were designed to capture the highest level of variation by interviewing four different categories of participants. The data collected through archival documents covered the last decade, which was sufficient to capture the different directions the selected case had adopted within that timeframe. |

| Researcher's position/ reflexivity | The researcher must state their biases and assumptions regarding the research to be undertaken (p. 219) | The researcher adopted a neutral position due to the exploratory nature of the study. No pre-defined assumptions or bias were adopted throughout the study. |

| Peer review/ peer examination | Peer review of the study helps ascertain the internal validity of the research (p.220) | This study was reviewed by a number of academics who are very familiar with the topic, including both the supervisory team and the reviewers of different publications produced based on this study. |

| Audit Trail | Independent readers can authenticate the findings of a study by following the trail of the researcher (p. 222) | The study employed this strategy at two levels; first, the researcher had an external adviser, and second, this study has produced a number of publications. All of which were read by independent readers through the blinded review processes, especially regarding data collection, data analysis, and results interpretations. |

### 3.4.4 Ethics

Ethical considerations represent an essential step in designing case study research (Cooper & Schindler, 2003; Merriam, 1998). Hence, this study aligns with the ethical requirements of both the researcher’s academic institution and the selected case. As this study has no interaction with patients, it was classified as ‘Negligible and Low-Risk Research’ by the respective Human Research Ethics Committees (HREC) at the academic institution and the selected case. Applying for the ethics approval started at the academic institution. The application had a lengthy form that the researcher had to address a number
of questions about the researcher, the research study, researcher’s qualifications, experience and skills, participant details, participant information, informed consents and advice of the project’s expected outcomes, data privacy and confidentiality, and the research funding and finance. The ethics application also included the Participant Information and Consent Form, which must be seen, read, and signed by all participants prior to taking part in the research. Based on the ethics approval from the academic institution, the researcher approached the HREC at the selected case and applied for ethics approval. This study was also classified as a ‘Low-Risk Project’ and followed a very similar approach to make sure the research fully aligns to the ethical considerations.

Data collection then started based on the ethics approvals from the academic institution and the selected case using the methods mentioned before.

All types of data, including signed consent forms, electronic data, audio recordings, transcriptions and archival records, have been securely stored in a locked cabinet at the academic institution. For the soft copy of collected data, this study has used a dedicated computer with enough security procedures to ensure that no unauthorised access will take place. Strong passwords have also been used and changed regularly; internet security software has also been used as well to minimise any cyber risks. A redundant internal disk drive has also been used for data backup. As per the ethics approvals from both the academic institution and the selected case, the collected data will be destroyed using confidential waste disposal techniques after five years following the last publication of the research. Before that, the data will be still protected and secured using same procedures above.
3.5 Data Analysis

This Section is designed to explain the methods used to analyse the collected data in this research. Given this study adopts an interpretive research approach, thematic analysis is particularly useful (Braun & Clarke, 2006; Fereday & Muir-Cochrane, 2006). Thematic analysis is a widely used qualitative analytic method within different disciplines, such as psychology (Braun & Clarke, 2006), healthcare (Ward, House, & Hamer, 2009), education (Darbyshire & Baker, 2012), and information systems (Sulaiman & Wickramasinghe, 2014).

In order to understand thematic analysis, themes need to be understood. Boyatzis (1998, p. 161) defines a theme as a “pattern in the information that at minimum describes and organises the possible observations and at maximum interprets aspects of the phenomenon”. Accordingly, Braun and Clarke (2006, p. 6) define thematic analysis as “a method for identifying, analysing, and reporting patterns (themes) within data”.

Performing thematic analysis on qualitative data normally consists of three interrelated stages (Boyatzis, 1998). These are 1), articulating sampling and other design issues; 2), developing codes and themes accordingly; and 3), testing the validity of the codes and using them to further capture themes. While the first stage was carried out prior to conducting the interviews, aligning with the requirements of the other two stages was maintained all the time during the data analysis phase.

In order to perform the thematic analysis in this research, all conducted interviews were transcribed by the research, and preliminary identification of potential themes was worked on. Three guidelines were used throughout the data analysis process:
1. The conceptual model which had been designed based on a rigorous literature review. This model helped recognise the recurring themes in the text, especially with the four categories of IT investments.

2. The theories used to underpin this study: Both the IT Portfolio (Weill & Broadbent, 1998) and The Enterprise of Healthcare Delivery (W. B. Rouse & Cortese, 2010) were used to capture repetitive patterns within the collected data, especially in regard to realising the business value of different IS/IT investments (Weill & Broadbent, 1998), and the socio-technical aspects of this realisation (W. B. Rouse & Cortese, 2010).

3. The openness to any new thoughts and/or perspectives (Dearnley, 2005) which had been covered by neither the theories nor the literature. This openness is particularly important for semi-structured interviews (Dearnley, 2005; Doody & Noonan, 2013).

This study used QSR Nvivo Version 10.2.2 (1380) for Mac, which gives the qualitative researcher more control over the collected data and helps identify possible themes (Joffe, 2012; King, Cassell, & Symon, 2004). The decision to use this system was made to facilitate some descriptive analyses of the themes, and their occurrences in the transcriptions, and in no way did it replace the in-depth examination of the collected data by the researcher. As a result of the thematic analysis performed during this research, four main themes were identified as Table 3. 8 shows.
Table 3.8 Themes and sub-themes resulted from the thematic analysis

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare Ecosystem</td>
<td>External communications</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Competition</td>
</tr>
<tr>
<td></td>
<td>Political Influence</td>
</tr>
<tr>
<td>Process</td>
<td>Change Management</td>
</tr>
<tr>
<td></td>
<td>Project Management</td>
</tr>
<tr>
<td></td>
<td>IT Governance</td>
</tr>
<tr>
<td>People</td>
<td>Visiting Medical Officers (VMOs)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>In-house users</td>
</tr>
<tr>
<td></td>
<td>Vendors</td>
</tr>
<tr>
<td>Technology</td>
<td>IS Products</td>
</tr>
<tr>
<td></td>
<td>Integration</td>
</tr>
<tr>
<td></td>
<td>Data Issues</td>
</tr>
</tbody>
</table>

The following subsections briefly summarise these themes and their sub-themes. A thorough description of each of these themes can be found in the next chapter (Chapter 4), and the interpretation of these themes in Chapter 5.

3.5.1 Healthcare Ecosystem

The Healthcare Ecosystem theme refers to the ecosystem of the selected case, which is the web of players surrounding the selected case (Wickramasinghe & Schaffer, 2010). Within this theme, the data analysis resulted in three sub-themes that shown their impact on the business value of IS/IT. The first is the current structure of communications with other organisations and providers of medical services such as pathology, radiology, and pharmacy; particularly the hybrid digitisation of these communications. The second is the
impact of competition between different healthcare providers on the decision-making process regarding IS/IT investments, as well as the implications of this on attaining business value from various IS/IT solutions. Lastly, the third sub-theme is the political influence of different stakeholders on IS/IT purchases and the business value of these investments.

### 3.5.2 Process

The Process theme is a bi-directional theme (Pan et al., 2012) that refers to the processes that affect attaining business value from IS/IT investments in the selected case, as well as the impact of these investments on the business processes. Based on the data analysis performed in this study, three sub-themes were found to be relevant to generating business value from different IS/IT investments. The first relates to change management, as introducing IS/IT into the context of healthcare represents a significant change in both processes and culture. The second and third sub-themes relate to the project management and IT governance processes respectively. These two sub-themes were also agreed upon by different stakeholders within the selected case.

### 3.5.3 People

The People theme refers to human resources (Sulaiman & Wickramasinghe, 2014) that play key roles in determining the business value of IS/IT and the extent to which they contribute to the success or failure of different IS/IT systems. Three sub-themes were found to play key roles in attaining business value from various IS/IT solutions. The first is the so-called Visiting Medical Officers (VMOs) in the Australian terminology, where senior clinicians work for different healthcare providers without necessarily being employed by any of them. Rather, they practice as doctors and care providers to their
patients by using the facilities of various hospitals. The second sub-theme covers the in-house users, which includes employed staff such as nurses and allied health, administrative, finance, and other supporting services. The third sub-theme is relatively different and covers the relationships between healthcare providers and their IS/IT vendors. This type of relationships also was shown to play a fundamental role in attaining business value from IS/IT in the healthcare domain.

3.5.4 Technology

The Technology theme refers to the characteristics needed in health IS/IT to potentially generate business value. The literature has extensively concentrated on examining different IS/IT to evaluate their impacts. As discussed in the previous chapters, the majority of these studies suffer from their limited scopes, and from lacking a comprehensive coverage of the contextual conditions surrounding these systems. This theme is structured to cover these circumstances as much the data analysis reveals. This theme also covers the internal technological requirements within healthcare organisations to integrate with new investments and possibly generate business value from these systems. Mainly, it highlights the issues around lacking standardised and agreed upon data sets that can feed different IS/IT.

3.6 Summary

This chapter has served to provide an overview of research methodology and research design used in this study. It started with describing the methodology and justifying the exploratory nature of this study. It then introduced the philosophical perspectives adopted in this research, namely the use of interpretive research, and then moved onto arguing the
appropriateness of case study as a research strategy for this study. The research design of this study was then presented, including the participants, interviews and data analysis, validity, reliability and data triangulation, and the steps taken to obtain ethics approvals and all other ethical considerations in this research. An overview of the data analysis conducted in this study, as well as the themes and sub-themes resulting from this analysis, were also briefly presented.

The next chapter serves to present the results of the data analysis performed in this study.

* * * *
Chapter 4
Data and Analysis
Chapter 4: Data and Analysis

This chapter describes the analytical approach and the results obtained from Rosetta Healthcare\(^4\) in Australia. Rosetta Healthcare was used in this research as an exemplary case study to answer the research question: How can information systems/ information technology facilitate the generation of business value in healthcare firms?

The results revealed by this analysis can then be used to better understand the potential role of IS/IT to generate business value in the context of healthcare, as well as the factors affect the business value of IT in this industry.

This chapter is organised as follows: Section 4.1 describes Rosetta Healthcare and gives a summary of its operations. Section 4.2 summarises the use of IS/IT to facilitate these operations. The units of analysis and their perspectives on the Business Value of IT in Healthcare Model are given in Section 4.3. Clinical and non-clinical perspectives on the topic of the business value of IT in healthcare are also given in Section 4.3 while the

\(^4\) For ethical reasons, Rosetta Healthcare is used as a pseudonym. The case study is named after Rosetta stone, which was created about 196 BC and discovered in 1799, and led to understanding the ancient Egyptian hieroglyphs.
themes and sub-themes are given is Section 4.4. The findings from the interviews are given in Section 4.5. A summary of the chapter is given in Section 4.6.

4.1 Rosetta Healthcare: The Case Study Site

Rosetta Healthcare is one of the largest not for profit private healthcare groups in Australia. It is recognised as a pioneer hospital in diagnosis, treatment, care, and rehabilitation in the Australian context.

The group provides care for a vast range of medical conditions and diseases from the birth of a child to cardiac care, rehabilitation, hip and joint replacements, robotic surgery, and comprehensive cancer treatment, among others in around 40 specialties. Rosetta Healthcare offers its medical services to patients mainly through two channels, the Emergency Department (ED), and the hospital’s Visitor Medical Officers (VMOs). In terms of its physical structure and interior facilities, Rosetta Healthcare has about ten sites and locations, mostly in suburbs that commonly are supposed to have populations ranking higher in the socioeconomic status.

4.1.1 Rosetta Healthcare: A Historical Overview

Rosetta Healthcare had humble beginnings with the opening of a 25-bed community hospital in the 1920s. It was built initially on a land purchased and refurbished using donated funds.
Since then, Rosetta Healthcare has continued to expand its reach and operations in its original location (which currently is witnessing a major development) and about ten other sites and locations and acquired hospitals.

4.1.2 Rosetta Healthcare: Performance Indicators

As a not-for-profit private health care group, Rosetta Healthcare continues to invest most of its surplus funds into its services and rely on the generosity of donors to help achieve its goals.

During the last ten years, the performance of Rosetta Healthcare has shown positive growth in different parameters like total bed days (256% growth rate), total patient admissions (192%), overnight occupancy (2.6%), intensive care unit (ICU) bed days (320%), operations performed (200%), and day surgery procedures (309%) as Table 4.1 and Figure 4.1 depict.

Table 4.1 Different performance indicators at Rosetta Healthcare, Adopted from the Annual Reports of Rosetta Healthcare (2004-2015)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Bed Days</th>
<th>Total patient admissions</th>
<th>Overnight occupancy</th>
<th>ICU bed days</th>
<th>Operations performed</th>
<th>Emergency attendances</th>
<th>Day surgery procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2005</td>
<td>186,000</td>
<td>48,000</td>
<td>83%</td>
<td>3000</td>
<td>30000</td>
<td>21,000</td>
<td>10000</td>
</tr>
<tr>
<td>2005-2006</td>
<td>223000</td>
<td>63000</td>
<td>75%</td>
<td>4000</td>
<td>39000</td>
<td>21000</td>
<td>15000</td>
</tr>
<tr>
<td>2006-2007</td>
<td>311000</td>
<td>92000</td>
<td>77%</td>
<td>4000</td>
<td>56000</td>
<td>26000</td>
<td>25000</td>
</tr>
<tr>
<td>2007-2008</td>
<td>365,000</td>
<td>100,000</td>
<td>85%</td>
<td>6000</td>
<td>60,000</td>
<td>28000</td>
<td>27000</td>
</tr>
</tbody>
</table>

The figures are rounded to the nearest thousand (and to the nearest integer for the percentage of overnight occupancy) for ethical considerations.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Days</td>
<td>365,000</td>
<td>370,000</td>
<td>383,000</td>
<td>383,000</td>
<td>395,000</td>
<td>416,000</td>
<td>424,000</td>
</tr>
<tr>
<td>Increase</td>
<td>108,000</td>
<td>113,000</td>
<td>115,000</td>
<td>115,000</td>
<td>122,000</td>
<td>133,000</td>
<td>141,000</td>
</tr>
<tr>
<td>Percentage</td>
<td>88%</td>
<td>87%</td>
<td>89%</td>
<td>89%</td>
<td>89%</td>
<td>85%</td>
<td>85%</td>
</tr>
<tr>
<td>2008-2009</td>
<td>15,000</td>
<td>15,000</td>
<td>16,000</td>
<td>16,000</td>
<td>14,000</td>
<td>14,000</td>
<td>14,000</td>
</tr>
<tr>
<td>2009-2010</td>
<td>66,000</td>
<td>71,000</td>
<td>72,000</td>
<td>73,000</td>
<td>78,000</td>
<td>85,000</td>
<td>90,000</td>
</tr>
<tr>
<td>2010-2011</td>
<td>26,000</td>
<td>27,000</td>
<td>28,000</td>
<td>28,000</td>
<td>27,000</td>
<td>27,000</td>
<td>26,000</td>
</tr>
<tr>
<td>2011-2012</td>
<td>29,000</td>
<td>32,000</td>
<td>34,000</td>
<td>32,000</td>
<td>34,000</td>
<td>37,000</td>
<td>41,000</td>
</tr>
</tbody>
</table>

*Figure 4.1a Total Bed Days at Rosetta Healthcare between 2004-2015, Adopted from the Annual Reports (2004-2015)*
Chapter 4  Data and Analysis

Figure 4.1b Total patients’ admissions and operations performed at Rosetta Healthcare between 2004-2015, Adopted from the Annual Reports (2004-2015)

Figure 4.1c Day surgery procedures and emergency attendances at Rosetta Healthcare between 2004-2015, Adopted from the Annual Reports (2004-2015)
Although there have been noted increases in total patients’ admissions, operations performed, and day surgery procedures at Rosetta Healthcare, the emergency attendances had been experiencing about 9.5% decline since 2010-2015, which may indicate that Rosetta Healthcare is pushing towards receiving patients through the VMOs more than through the ED (Figure 4.2). This trend has had direct impacts on IS/IT investments at Rosetta Healthcare as Subsection 4.4.1.1 will explain.

![Figure 4.2 Growth Rates at Rosetta Healthcare between 2004 and 2015. Source: Annual Reports (2004-2015)](image)

**4.2 Information Systems for Rosetta Healthcare**

The information systems at Rosetta Healthcare are categorised into three main groups: business information systems, clinical information systems, and research and education information systems. While the first two are advanced and have some strong foundations in the organisation, the last group (i.e. research and education information systems) is different, it is still underdeveloped, so is the strategic direction on how to establish it and
later how to manage it. For this reason, the current research will focus on the business information systems and clinical information systems at Rosetta Healthcare.

Overall, there exist a total number of 276 information systems on the service catalogue at Rosetta Healthcare. Some of these systems are corporate-wide, i.e. they are used by all sites, and others are campus-specific (business unit wide). This is due to the expansion Rosetta Healthcare is experiencing. For example, in 2006, Rosetta Healthcare acquired one of its current campuses, where that specific hospital had a technology bent, possibly because it was on a Green Fields site. They invested heavily in different information systems, most of them were not used and reinvigorated, and some were used to facilitate the operations of that specific hospital and not across the whole group. Currently, there have been serious attempts by Rosetta Healthcare to standardise and consolidate all of these information systems, as well as introducing enterprise systems, where the deployment of any new information systems takes place on the corporate-level, but with the different conditions of the different campuses taken into consideration. Figure 4.3 illustrates the generic structure of the main information systems at Rosetta Healthcare.

While all of the business information systems are group-wide systems, i.e. they are used by all of the hospitals within the group, some of the clinical information systems are campus-specific systems as Figure 4.3 shows.

Rosetta Healthcare does not have a sophisticated Radiology Information System (RIS), Pharmacy Information System (PIS), or Laboratory Information System (LIS), as these three services - namely pathology, radiology, and pharmacy - are all outsourced to different organisations, with whom Rosetta Healthcare has partnerships, agreements, or co-ventures to provide these services. According to this form of inter-organisational
interaction, Rosetta Healthcare does not have control over these systems, apart from viewing the results and archiving them in its Patient Administration System (PAS) system.

![Figure 4.3 Information Systems for Rosetta Healthcare](image)

### 4.2.1 Business Information Systems at Rosetta Healthcare

Several years ago, Rosetta Healthcare made the decision to invest in a business information system that can manage its substantial asset base amounting to more than $1 billion in value, as well as meeting compliance requirements of its facilities across the whole group. Prior to purchasing this system, Rosetta Healthcare had paper-based systems in most of the facilities, and three computerised maintenance management
systems (CMMS), whose capacity and consistency were low and did not meet the requirements of Rosetta Healthcare. The processes and systems varied across different campuses, resulting in inconsistent data and duplication of information, which limited its ability to manage corrective and preventative maintenance of all its assets.

To overcome these two limitations, Rosetta Healthcare purchased an integrated, group-wide information system, and it has been in use in all its locations and sites since it was purchased in 2009. Throughout this thesis, the term Business Information Systems (BIS) will be used when discussing it in general, and the names of its different components will be used where the discussion is about the individual modules.

In addition to BIS, Rosetta Healthcare added a group-wide system/module to the BIS to manage the relationships with different health funds in Australia. This system, which will be named Health Fund Information System (HFIS) throughout this thesis, is an electronic claiming capability that allows pushing the information from the hospital’s systems through a hub to the health funds that they relate to. The motivation to invest in this specific system was to make sure that the cash flow is being reinforced and to have a sustainable capacity to manage a high volume of routine transactions every single day with different health funds in Australia.

4.2.2 Clinical Information Systems at Rosetta Healthcare

Today, Rosetta Healthcare does not have a complete EMR solution. Rather, it has a number of clinical information systems for different purposes. Some of these systems are group-wide, while others are campus-specific as Table 4.2 summarises:
### Table 4.2: The Main Clinical Information Systems at Rosetta Healthcare

<table>
<thead>
<tr>
<th>System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient Administration System (PAS)</strong></td>
<td>The Patient Administration System (PAS) at Rosetta Healthcare is an information system that aims at enabling the continuum of care by managing patient flow from admission to discharge. In order to do so, this system uses the IT infrastructure in all medical departments such as outpatient, waiting lists, emergency department, private practices and inpatient. This system is group-wide, and it is based on assigning a unique record (UR) number for each patient at Rosetta Healthcare. This enables sharing information about patients across the different sites and locations without having the risk of using incomplete or duplicated information. The PAS system sits on the base of the clinical and business information systems at Rosetta Healthcare and feeds different information systems with required information and reports electronically in a timely and secure manner across the group’s multiple sites.</td>
</tr>
<tr>
<td><strong>Computerised Physician Order Entry (CPOE)</strong></td>
<td>This CPOE system is used at Rosetta Healthcare to facilitate electronic scheduling for oncology patients which was originally a paper-based system at multiple sites. The system also comes to overcome the limitations Rosetta Healthcare used to have with designing its chemotherapy protocols and related processes such as nurse assessment and notes and radiology planning for cancer patients. The system itself combines radiation, medical and surgical oncology information modules into one CPOE system. This system helps create customised care plans for cancer patients based on their unique health conditions. It also provides a comprehensive view of recorded patient information for oncology patients treated at Rosetta Healthcare. The implementation of this system took place at one of the major campuses at Rosetta Healthcare with the vision to expand it to be a group-wide system.</td>
</tr>
<tr>
<td><strong>Scanned Medical Records (SMR) System</strong></td>
<td>SMR is a clinical information system which is seen as a cornerstone of the vision of EMRs. The system is customised and designed to make daily clinical practice easier by enabling higher speed and quality in capturing and distributing health information. The system is web-based and consists of a number of modules such as scanning medical records, e-forms, e-results, and other modules around medical images and medications. The main functions of the system that currently are being</td>
</tr>
<tr>
<td>System</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Point of Care System (POC)</td>
<td>POC is an integrated solution at the bedside that caters the information needs for patients, clinicians, nurses, and other services such as environmental services, logistic services, food services, etc. This system has been up and running in different prestigious hospitals in some developed countries. However, Rosetta Healthcare is one of the first hospitals to implement this system in the Australian context. Currently, it has been in one of the hospitals within Rosetta Healthcare, with a plan to roll it out across all other locations.</td>
</tr>
</tbody>
</table>
| Clinical Decision Support      | This CDSS is an electronic prescribing and clinical decision support system. It includes pharmacy review and nurse administration of medication orders. It also includes a drug reference viewer that can be accessed during electronic prescribing or independently from the desktop. It allows:  
1. Prescribing of medication by generic or brand name as an item on an inpatient medication chart, a prescription, or both (the choice of medication for inpatient prescribing is governed by the hospital formulary and the choice of medication for discharge or outpatient will be dependent on local legislation);  
2. Pharmacy review of all electronically prescribed medication orders and the creation of dispensing worksheets;  
3. Electronic recording of nurse administration of medication orders.  
This system is campus-wide, and it is planned to be integrated within the POC system in that specific hospital. |
| System (CDSS)                  |                                                                                                                                                                                                                                                                           |
| Incident Reporting System      | This system is used across large parts of Australia, for capturing clinical incidents. It serves two purposes:  
1. To allow the documentation of an incident at the time it occurs, to support the classification via an inbuilt algorithm into how serious the incident is to  
                                                                                                                                      |
| (IRS)                          |                                                                                                                                                                                                                                                                           |
|                                |                                                                                                                                                                                                                                                                           |
standardise the information that’s being captured through validation fields,

2. To ensure distribution of that information where it needs to be and then to drive it through into a larger data set of all clinical incidents to support more detailed analyses.

| **International Disease Classification System** | This system utilises the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification ICD-10-AM (Australian Consortium for Classification Development, 2015; Elsworth et al., 2013). This database comprises a tabular list of diseases and accompanying index. |
| **Group-wide** | This database, which was derived from the World Health Organisation (WHO) ICD-10, was prepared by a team of clinicians and clinical coders and has been in use since 1998. The main objective of this database is to provide a single point of reference for diseases and external causes of injury. |
| **International system. Localised for the Australian context** | This system has been in use group-wide by different clinical specialties as an agreed reference for diseases and their causes. |

| **Clinical Audit Tool (CAT)** | Used as an electronic clinical audit tool. Aims at allowing doctors and other clinical users to create records for each operation or admission that occurs within each specialty. The record will include a structured data set, representing all of the information pertinent to clinical audit within that specialty. |
| **Campus-wide** | Recently, CAT for General Surgery and Spinal Surgery went live at Rosetta Healthcare. Both of these projects have extensive clinical content relevant to each specialty. They are also both integrated directly with the group’s PAS via HL7. The integration includes patient demographics, diagnosis, theatre details and discharge information. |
| **Australian Made** | |

---

6 **Health Level Seven International (HL7)** is a not-for-profit, ANSI-accredited standards developing organisation dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of electronic health information that supports clinical practice and the management, delivery and evaluation of health services. It was founded in 1987. HL7 is supported by more than 1,600 members from over 50 countries, including 500+ corporate members representing healthcare providers, government stakeholders, payers, pharmaceutical companies, vendors/suppliers, and consulting firms (HL7 International, 2016).
4.3 Rosetta Healthcare: Units of Analysis

Four categories of units of analysis have been identified in this study. The identified categories are Executives, Clinicians, Clinical IT and IT Personnel. Table 4.3 shows the number of the interviews conducted for the purpose of this research, and how many interviews took place with each interviewee. The assigned codes to each interviewee are also shown in this table, and they will be used throughout this thesis.

Table 4.3 Units of analysis at Rosetta Healthcare, including the interviewee category (executive, clinical, clinical IT or IT) and the number of interviews undertaken for each interviewee

<table>
<thead>
<tr>
<th>No.</th>
<th>Interviewee</th>
<th>Interviewee category</th>
<th>Number of times interviewed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CC 1</td>
<td>Clinical</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>CC 2</td>
<td>Clinical</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>CC 3</td>
<td>Clinical</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>CC 4</td>
<td>Clinical</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>CC 5</td>
<td>Clinical</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>EXE 1</td>
<td>Executive</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>EXE 2</td>
<td>Executive</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>EXE 3</td>
<td>Executive</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>EXE 4</td>
<td>Executive</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>EXE 5</td>
<td>Executive</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>EXE 6</td>
<td>Executive</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>EXE 7</td>
<td>Executive</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>EXE 8</td>
<td>Executive</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>CIT 1</td>
<td>Clinical IT</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>CIT 2</td>
<td>Clinical IT</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>CIT 3</td>
<td>Clinical IT</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>CIT 4</td>
<td>Clinical IT</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>CIT 5</td>
<td>Clinical IT</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>IT 1</td>
<td>IT</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>IT 2</td>
<td>IT</td>
<td>2</td>
</tr>
<tr>
<td>21</td>
<td>IT 3</td>
<td>IT</td>
<td>1</td>
</tr>
</tbody>
</table>
As Table 4.3 shows, a total number of 31 interviews were conducted with professional workers. The purpose of having interviewees from these four groups was to ascertain that inputs and perspectives from different stakeholders across the spectrum of the healthcare industry are taken on board when discussing the business value of IT in healthcare. Some interviewees were asked to participate in a second interview to further elaborate on specific issues of interest.

In order to better understand the context of this study, the following subsection evaluates the IT infrastructure at Rosetta Healthcare.

### 4.3.1 IT Infrastructure at Rosetta Healthcare

Empowering the physical infrastructure for information systems at the corporate level is key for Rosetta Healthcare. Having a consolidated infrastructure across the group, that is shared by most business units, is the predominant strategy to achieve this empowerment. This intent has required lots of resources (time, effort, money) by Rosetta Healthcare as can be understood from this interviewee:

“We basically have two server rooms. We virtualised most of our applications. There is a little bit of single server more in the clinical space, so monitoring or the non-invasive cardiac unit have their own servers. Slowly we are trying to bring all of those together so that it’s on the one infrastructure. We have our two data centres. Two of them are in [Site A]. One’s called the Red room. They house the majority of our applications that run the whole organisation. We then have the...
wider area network that connects everybody and at each site, they have some local servers that help with authentication, with the delivery of our standard operating environment, the things that need to manage things at a local level. It’s a communication room. It’s not a data centre. Most of the stuff is run centrally”.

[IT 1]

As a result of using a shared infrastructure, virtualising most of the information systems, and adopting one wide area network across the group, a physician at Rosetta Healthcare would only need one login from any hospital within the group to the shared PAS system to look up their patients’ details using their UR numbers.

When asked about the readiness of the physical infrastructure to support the current information systems, a wide agreement was found across the executives and IT groups that the current infrastructure is robust, solid, and flexible:

“... We recently did a readiness for growth audit in our infrastructure space. It showed that we had established a really good platform to bounce off. That doesn't mean to say that there aren't things that have to be added at a cost. That's in our capital plan. I would think that we've got a great platform to start with; that is an infrastructure up 99.7% of the time. We have a pretty good, solid base to come from”.

[IT 5]

.."It’s strong; it’s robust. The guys that we have within the infrastructure team are amazing, absolutely amazing. When they build something, they build it to
make it resilient. They don’t want to get called in the middle of the night so they make sure that what they put in place is resilient so that they don’t get those calls.

[EXE 2]

Furthermore, the physical infrastructure at Rosetta Healthcare is believed to be an enabler to the current plans to implement business intelligence (BI) systems, on both business and clinical levels:

“..Yeah. I'm comfortable that there are parts of the IT infrastructure more so business intelligence area... we've made a strategic investment in the infrastructure and made some strategic plans around that area to get us into a better space. The data warehouse, etcetera, etcetera, was a bit like spaghetti. It's now been cleaned up, and we've got a clear strategy for where we're going for that.”

[IT 1]

The human component of the IT infrastructure is also very important for Rosetta Healthcare. A short time after a senior IT executive commenced, they formed three specialised core teams: infrastructure, technical services and service delivery teams. Furthermore, the executive appointed a new position whose primary role is to be the liaison point with the business teams. This newly appointed staff member describes their role as:

“My role is to have a good and trusted relationship with the key executive team across the business, in understanding the needs and any concepts they might come up with, working out whether or not those concepts fit within our strategic direction, whether or not something is a concept we could look at applying across
the organisation, so looking at a group approach to any ideas that come up and ensuring that it fits our strategic direction and also making sure that it fits our enterprise architecture so that when we put a system in place then everything fits happily, plays happily together”.

[IT 4]

Similarly, the IT executive appointed three clinical informatics specialists to work with a coordinating clinical informatics manager, to be a conduit between the clinical staff and IT staff. All of these three specialists have both clinical and IT background and/or knowledge. The objective of creating these positions was to combine the clinical and technological knowledge as one of those specialists describes:

“... To marry the two together and try and find a fit for the clinicians and also make it cost effective for IT”.

[IT 3]

Based on the discussion above, the following subsections present different perspectives on the business value of IT in healthcare. This includes clinical perspectives, which come from clinicians and clinical IT experts, as well as non-clinical perspectives, which come from IT and executive categories.

Before discussing the business value of IT in healthcare, it is prudent to present different clinical and non-clinical views on defining the organisational performance and what it means for Rosetta Healthcare.
4.3.2 Measuring the Organisational Performance in Healthcare

As stated by Melville et al. (2004), the business value of IT is the impact of IT on the organisational performance. While different industries have defined the organisational performance and constructed specific measures to evaluate it, the literature shows that the healthcare industry lags behind other industries in adopting a widely agreed definition of the organisational performance (P. Haddad et al., 2014b; P. Haddad & Wickramasinghe, 2014a). Thus, we started our investigation to highlight this area, and what it means for Rosetta Healthcare.

Measuring the organisational performance in the context of healthcare seems problematic as most of the interviewee agreed, especially from a clinical perspective. This is partly due to the unique nature of healthcare industry as one interviewee notes:

“I'll start by comparing it to other industries that have defined outcomes because they know what product they are trying to produce. In our case, we had a very long journey from where we are to where we need to be, understanding what the patient wants to get out of their visit. What product did they want? We decide on their behalf what they're going to get, largely. Even in the settings where we discuss what they want, we don't document what they want. So, we can't measure against the objective in the first place. The objective is set, in a very paternalistic way, by the healthcare staff. I mean that broadly, because it depends on the setting, as to who defines it. That's your first challenge. That we do not actually measure the real outcome. Let's accept that”.

[CIT 1]
As a result of this uniqueness, measuring the clinical performance is limited to process measures, and does not cover the clinical outcomes as another interviewee explains, calling for action to address this gap:

“..... What we end up measuring is a large amount of process measures. Did we do to them what we set out to do to them? Some outcome measure: Did they survive? Is the vessel unblocked that was originally blocked? We have to put together structure process and outcome measures”.

[CIT 4]

The question about the problems and challenges face defining well structures to measure both clinical processes and outcomes revealed several reasons. Most of these reasons are centred on the uniqueness of healthcare industry itself. One clinician notes that the traditional models of organisational performance are not very relevant to healthcare, as:

“Healthcare in general, and hospitals, in particular, are not organisations in the traditional sense... They're not organisations. They're loosely affiliated groups of people trying to do the same thing. For instance, in the private sector, in particular, you have a whole lot of individual private contractors, i.e. doctors providing services. You hope that they coincide with what the hospital wants. There's little in the way of organisational structural process to enforce that”.

[CC 1]

Even public hospitals, which have employed doctors, seem to have this problem, as another interviewee explains:
“Public hospitals are more organisations in the traditional sense, but even in those cases, the medical specialists don’t see themselves as employees. Their major loyalty is to their craft group, not their organisation”.

[CC 3]

This goes hand in hand with views from both the executives and IT groups, as some interviewees note:

“Unlike healthcare, they [Other industries] are very structural, very line of authority driven. There’s a chain of command, and they follow it.

[EXE 1]

“… They [Healthcare organisations] don’t have hierarchical line authority from top to bottom, particularly in the private sector”.

[IT 3]

As such, defining the organisational performance in this complex area is challenging, as:

“…When you look at organisational performance, that’s a major issue because the things that are important to a craft group in terms of organisational performance are not necessarily important to the hospital”.

[CC 1]

Another problem that faces defining the organisational performance in the healthcare relates to the inability to monetise inputs and outputs as one interviewee describes:

“… The organisational performance literature basically focuses on monetised outputs so that all the outputs of the organisation can be expressed in dollar terms.
Health has always seen itself as being different in that some of its outputs and inputs can't be monetised”.

[CC 2]

This opinion was widely agreed upon across the four categories of interviewees in this research. Another agreement between the interviewees is that the complexity of care represents the main reason inputs and outputs are not monetised was healthcare, and not useful in the current model of care to help define the organisational performance as one interviewee states:

“Clinical care is complex, and you cannot say that you change one parameter in the way you care for a patient, and that will definitely, positively, affect their outcome and the overall performance. It is multi-factorial, and people's reaction to disease is multi-factorial. It's challenging. It's very nebulous; it's not a direct correlation between if I fit this detail, then the outcome will be this. That's not the way that sort of people responds clinically to changes in the way that they're managed or cared for. So that's a challenge”.

[CIT 2]

Furthermore, one of the reasons clinical care is difficult to measure is the high number of indicators need to be taken into consideration as one of the clinical IT experts notes:

“There's millions of indicators. I think that that's part of the problem of measuring our performance. You have clinical outcomes that are procedure-based, or physiologically-based. That's about the disease process or the surgical procedure, and what are the outcomes of that. You then have quality KPIs or outcome data around a patient's inpatient stay, so that's around risk, whether it's pressure
injuries, falls, medication errors, malnutrition, VTA, etc. That's often not related to the surgical procedure or the primary diagnosis. It's how we care for them while they're here. You've got a couple of different tracks you can go down. If you think about patient experience or satisfaction, that's their ability to tell you that something going's wrong, and many, many other indicators”.

Apart from the challenges face defining the organisational performance in the healthcare, the interviews at Rosetta Healthcare, revealed several measures for the healthcare delivery processes and outcomes, both from clinical and non-clinical perspectives. Table 4.4 and Figure 4.4 show these measures, and the percentage frequency of times each of these measures was mentioned by the interviewees during the discussion on defining the organisational performance in healthcare.

Table 4.4: Suggested parameters to be used to measure the organisational performance in healthcare from clinical and non-clinical perspectives as mentioned by the interviewees

<table>
<thead>
<tr>
<th>Clinical measures</th>
<th>Percentage Frequency</th>
<th>Non-clinical measures</th>
<th>Percentage Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient-centeredness</td>
<td>80%</td>
<td>Bottom line</td>
<td>85%</td>
</tr>
<tr>
<td>Safety (Fall, medication errors, risk factors)</td>
<td>78%</td>
<td>Efficiency of operations</td>
<td>90%</td>
</tr>
<tr>
<td>Accessibility to care</td>
<td>75%</td>
<td>Net gain</td>
<td>40%</td>
</tr>
<tr>
<td>Equity of care</td>
<td>25%</td>
<td>Operating gain</td>
<td>65%</td>
</tr>
<tr>
<td>Continuity of care</td>
<td>54%</td>
<td>Cost efficiency</td>
<td>90%</td>
</tr>
<tr>
<td>Length of stay against the planned stay</td>
<td>55%</td>
<td>Resources utilisation</td>
<td>78%</td>
</tr>
<tr>
<td>Consistency of care</td>
<td>65%</td>
<td>Length of stay against the planned stay</td>
<td>65%</td>
</tr>
</tbody>
</table>
Figure 4.4a: Measures to evaluate the organisational performance in healthcare: Clinical perspective as mentioned by the interviewees

Figure 4.4b: Measures to evaluate the organisational performance in healthcare: Non-clinical perspective as mentioned by the interviewees
4.3.3 The Business Value of IT in Healthcare

This study has identified two major categories of analysis to answer the research question: How can information systems/ information technology facilitate the generation of business value in healthcare firms? These two categories are clinical perspectives and non-clinical perspectives. This division was made mainly due to 1) differences in expectations by clinical and non-clinical participants on the business value of IT, and 2) differences in clinical IS/IT and business IS/IT as the first interviews revealed. Findings from these two categories are presented below.

4.3.3.1 Clinical Perspectives

The clinical personnel at Rosetta Healthcare can be classified into two main groups according to their work arrangement with the organisations. The first group is VMOs, who are not employed or salaried. Rather, they bring their patients to Rosetta Healthcare and use the hospital’s resources through legal agreements. The clinicians in this group tend to be more senior and practice through Rosetta healthcare and other hospitals and clinics, including public hospitals7. The second group includes nurses and other clinicians like allied health and other junior health personnel. The members of this group are employed and salaried by Rosetta Healthcare. Apart from this classification, the clinical personnel at Rosetta Healthcare have one shared objective, i.e. providing care to patients through a value-based approach centred on an organisational set of values. Nevertheless,

7 Further discussion of the impact of VMOs can be found in 4.4.1.1
there exist some obstacles that make fulfilling this objective harder as one interviewee explains:

“I think there are very few nurses that go to work or any clinicians, go to work and don’t want to do a really good job, but I think a lot of people feel that the systems and the process are getting in the way of doing that good job and doing what they would like to do”.

[CC1]

Currently, clinical IT is not a high priority at Rosetta healthcare compared with other strategic options like building or investing in medical technologies as one interviewee notes:

“Well, how do we justify the spend on a clinical system versus spending on building another wing on the hospital, for example, what’s going to be better... or are we buying a new operating robot... is always comes up in a hospital”.

[CIT 3]

As a result, healthcare can be considered to be in a hybrid state in terms of adopting IS/IT as another interviewee describes:

“I think we're in that hybrid state where we partly digitised. We're still on paper, and it's actually less efficient and harder than it was. That's not to say that it can't get better, and in fact, I'm optimistic that we will get to a state where we can fix this and I don't know if it's going to be five or 10 years before I can go to a fully digitised healthcare environment in Australia, but from a technology point of view, there's
nothing to stop that happening if there's political will and there're finances to enable it, and that's just often the difficult things to get”.

[CIT 5]

Apart from the level of adoption IS/IT for clinical purposes, the most important role of IS/IT in the clinical perspective is facilitating information sharing:

“Quality and safety go hand in hand. From a clinical point of view, in order to deliver high-quality healthcare, you need to have the right information at the right time to the right person”.

[CC 1]

In order for clinical IS/IT to play a key role in facilitating information sharing within the hospital, the following requirements were captured during the interviews as table 4.5 summarises:

**Table 4.5 The requirements for information sharing facilitated by clinical IS/IT**

<table>
<thead>
<tr>
<th>Information sharing requirements</th>
<th>Selected Quotes</th>
</tr>
</thead>
</table>
| **Labour requirements for data entry:** | “Without that large junior techno savvy workforce who can do that, the question for us is, well, are we going to put a system in that no one's going to use because they're not going to spend an hour a day typing notes in”.

[CC 4] |
Standardisation of data:
A number of different IS/IT exist, and they don't share same data dictionary, which creates a number of information silos that cannot be used to create usable information.

“If the data going in is rubbish, if it’s not standardised according to a common agreement or definition, if it’s not available in a usable, reliable, robust, valid form in a timely manner, so I don’t get the information, if I get rubbish, if it doesn’t come in a manner that, or a time that allows me to deal with it, and I can’t put it into a format that meets my audiences’ needs, then all of those things would prevent it; any of those things”.

[ CIT 4 ]

Engaging clinicians and building higher levels of trust with them:
A number of clinicians stated they felt they had been left behind with the decision-making of clinical IT investments. Even when they were consulted, they were not given what they had asked for, which has negatively affected their trust in future IT investments.

I think it [not engaging the clinicians the decision on clinical IT investments] probably means that clinical people don’t have the information they need and just carry on doing things as they always did, or ignoring the information they get because it doesn’t meet their needs or they don’t trust it.

[ CC 5 ]

Intelligent IS/IT:
Having IS/IT systems that can manage today’s ‘data tsunami’ is a fundamental requirement for the participating clinicians to move into the 21st century in terms of delivering better care outcomes. These systems are needed to 1) handle massive datasets whether it be genomic and proteomic information or whether it be unstructured data like Fitbits, personal monitors, Internet of

From my point of view as a clinician, I want timely, accurate information, but I also need to filter out essentially information overload. See, that's a big problem we have to wrestle with. I need to have the irrelevant information filtered out, and I need to have the significance of information pointed out. The drive to put information systems in was initially to fix access to information, and fix dissemination of information problems, but moving forward, we need to start thinking about how we make those systems sophisticated.

[ CC 5 ]

Without those systems, we're not going to be able to deliver better care. Without those systems, we're not going to be able to even measure what our performance is, our
Things, and 2) to filter these data and help create useful stories out of them.

outcome, the quality of the care that we deliver. We can’t easily see whether or not we have complications and we can’t start to benchmark ourselves against expected outcomes.

[CC 1]

The earlier stages of the data collection showed that clinical information systems were not as advanced as business IT at Rosetta Healthcare. When the researcher asked about the reasons behind that, a number of interviewees cited three reasons. All of these reasons are centred on the organisational characteristics of healthcare organisations in general and their maturity in terms of investing in clinical IT. The first reason is the engagement of clinicians, as the majority of the medical specialists are private i.e. VMOs. This arrangement limits their levels of engagement with the clinical IS/IT at Rosetta Healthcare as one of the interviewees explains:

“They really drive the gold standard in terms of clinical quality of care and it’s really challenging to get them engaged when they're running their own private businesses. The driver for them to actually devote time, effort, and energy to clinical quality improvement issues [at Rosetta] is understandably very limited. If I had the choice to consult new rooms we’d be making some money, or contribute to [Rosetta] which in of itself brings no revenue. The choice would be pretty obvious and clear and understandable”.

[CIT 2]

The second reason is the lack of in-house expertise in this area and of people who have practiced in this space a lot as another interviewee notes:
“I think across all spectrums, all levels of both management and operational stuff. We haven't had people who've worked with clinical information systems in the past on a large scale and who have seen the realisation of the value through those. I think there's been a legacy history of systems being implemented”.

[CIT 3]

Due to this lack of expertise, a number of project failed to deliver business value to the organisation. This, according to a number of the interviewees, has negatively affected the top management commitment to investing in clinical IT:

“We haven't necessarily recognised that in previous projects and I think there was a bit of a history of the management feeling scarred by that and being hesitant to consider significant financial outlays, not just on the systems but on all the other aspects of project implementation and ongoing maintenance you would need to apply. So there was some hesitancy about a commitment in the clinical space in a much more difficult space than they've worked in before”.

[EXE 3]

The third reason relates to not learning from previous lessons, by not conducting proper pre-implementation assessments of the organisation’s baselines and establishing objectives to actually meet them and then measuring at the end and then keeping that measurement going. Rather, according to this interviewee:

“It tended to be, which is not unique to [Rosetta], but it has tended to be whack a system in, get it up and going, be so exhausted by the end outcome that move on to the next thing and not recognise and look back and say we've got to keep nurturing the system. We haven't achieved everything we've met. Really evaluate,
did we meet our objectives if we haven’t, figure out where the gap is and address that gap and remeasure in and make sure we get back. That all takes time, it takes effort, it takes focus, it takes you away from the next thing you want to do and requires upfront thinking that hadn't necessarily been applied.”

[CIT 5]

Another aspect of the business value of clinical IT is that it is much slower to be realised compared to this of business IT. Three reasons were possible to capture during the data collection: The first reason relates to the nature of clinical care as described before (Subsection 4.3.2) and emphasised by another interviewee:

“Clinical care isn't necessarily process oriented such that it's a linear process every time. Clinical care is very ad-hoc, interrupted, chaotic in many ways and that's got to do with the clinician people it involves, do these processes that all manifest themselves in a different way in every individual, individual response to the treatments you apply”.

[CC 3]

The second reason relates to the first, and it is about the complexity of developing valid measurements of the business value of clinical IT compared to business IT as another interviewee notes:

“It’s how you measure that 10% contribution, you can't portion- you can say, it seems to be a small contribution, a medium contribution or a large contribution to improving their outcome. But there's so many other factors that it's very hard to isolate the impact to perhaps a clinical IT initiative on their end outcome. So
that's challenging. To some extent it needs to be- you can study individual, we changed this and it changed this parameter and we know that to be a positive. The combination of 3 changes, a positive, must have affected the outcome but to what extent they contributed to the ultimate outcome, that's very hard to measure”.

[CC4]

While the first and second reasons relate to the complexity of clinical care and subsequently the difficulty of developing valid measures for the business value of clinical IS/IT, the third reason is the lack of adaptability of clinical IS/IT as one interviewee notes:

“You've got to have some adaptability within your system and IT systems aren't built to be adaptable. They are built still, assuming a linear process and care. You're asking people to do even more difficult manoeuvres than they would be given a finance system where they can process an invoice linearly or deal with financial information linearly”.

[CIT 1]

This flaw in clinical IS/IT requires significant adaptability by clinicians and change in human process in general as another interviewee explains:

“They're going to have to interact with a clinical IT system which still wants to go in a linear fashion and themselves adapt around that, if the patients not responding in the way that they would hope. You are asking for a really significant change in human process and approach. A lot of flexibility and adaptability in individual circumstances from the people working with it is required”.

[CIT 4]
In the light of these contextual conditions, the question that needs to be answered is how to enhance the realisation of the business value of clinical IS/IT. The majority of the interviewees agreed that clinical IS/IT at Rosetta Healthcare, and in a wide range of Australian healthcare providers, are still in their infancy, and the journey of a thousand miles to a fully digitised environment has just started with a few single steps. Two recommendations were agreed upon by most of the interviewees to enhance the realisation of the business value of clinical IS/IT:

1. Developing a limited number of measurements to evaluate the business value of these systems. It is important to not be ambitious and avoid developing a complex matrix of measures at the beginning as one interviewee explains:

   “I don't know if there's a magic bullet but I think it's having that philosophy that you take it in bite-sized chunks. You don't overwhelm people because people do become fatigued by the effort. You chunk it down into ‘bite-sized pieces, the achievements, and you look to where can you implement measures where you can actually look to achieve a benefit in a time frame from a human perspective people feel is sufficiently efficient in achieving a benefit”.

   [CIT 5]

2. Bringing external independent bodies to evaluate the business value of clinical IS/IT. The importance of this is to benefit from their experience and unbiased position to challenge the way of thinking of the internal decision makers, as another interviewee notes:

   “I think sometimes it's hard to think of objective measures to measure your success. So, bringing in external independent people who can be objective and
can really grill you on why you are doing this is really beneficial. What values are you expecting to realise? How are you going to measure that? They make you force your thinking in terms of that's as important as working out technically how you're going to do it and what equipment you're going to need; what functionality you actually want”.

[CIT 2]

The second recommendation was agreed upon amongst the clinicians and clinical IT experts. The previous experience of big clinical IS/IT and deep knowledge of the health environment are must for such external bodies as per one interviewee’s comments below:

“I think the people who have to understand had some experience in major system implementation, clinical system implementation in the past and understand all the challenges that are associated with implementing these sorts of systems. That they also understand the health environment and the value of the measures you're looking to select and identify and apply. Are they valid in the environment? Are you really going to demonstrate benefit if you achieve them? And how do they translate financially? How do they translate from a quality perspective? How do they translate into patient outcomes?”

[CIT 3]

4.3.3.2 Non-clinical Perspectives

As in other contexts, there exists an increasing recognition at Rosetta Healthcare of the role IS/IT can play to enhance the organisational performance. This view is summarised by the following interviewee:
“In terms of how IT is viewed, IT is viewed as a very integral part of how we can make it [the business] work better. There's a better understanding or recognition of the role that IT can apply in healthcare”.  

[EXE 6]

Based on this view, Rosetta Healthcare has made significant investments to use IS/IT in the business domain in the last few years, as we understand from a senior finance executive in the organisation:

“In terms of probably our capital budget every year, probably 30% is dedicated to IT. It's a significant amount. Operational budget, I couldn’t tell you off the top of my head, to be honest. It would be anywhere near that, but for my capital budget, it’s about $5 million of a total about 16 to 17. We also have a five-year capital plan, which is another $25 million over five years. That, in this current financial year, is 3 million, so this year, we have $8 million for, I suppose, new projects, and that also covers... That’s business projects, infrastructure, and audiovisual/video conferencing.

[EXE 2]

The audiovisual/video conferencing has a small allocation of that investment (less than 5%), while the share of investments in business information systems is about 60% and the rest (about 35%) are dedicated to investing in the infrastructure:

“..There is a small allocation for audiovisual/video conferencing. There’s an allocation for obviously physical infrastructure. Of the 8 million, about $5 million is business projects”.

[EXE 2]
Similar views can be seen from the clinicians at Rosetta Healthcare. The views on the IT investments at Rosetta Healthcare were commented upon by one interviewee:

“I see we've made a very significant investment in what I would say would be business systems, rather than clinical systems, and we have a very rich repository of data around business performance.”

[CIT 2]

In an attempt to explore the non-clinical perspectives of the reasons behind investing more in business IT than in clinical IT at Rosetta Healthcare, a set of exploratory questions were posed to the participants from the IT and executives groups. The low engagement from VMOs to use the clinical information systems at private hospitals was something everyone agreed on, and that was consistent with findings from the clinical perspectives [refer to 4.3.3.1]. This arrangement has played a key role in making the majority of investments in clinical IT systems limited to facilitating nursing processes as will be discussed in 4.4.1.2.

The slow progress in changing the clinical environment has created greater focus on investing in business IS/IT in the healthcare context as another interviewee notes:

“It might be that we need to think about a path where physicians are more engaged etcetera along those lines and are paid for the work that they do. In most private hospitals, which is where I've come from, the focus has been on your billing, revenue, finance systems, etcetera, not so much on your clinical systems”.

[EXE 5]
Another reason that may explain why business IT are more advanced in the healthcare domain relates to the ease of measuring their return on investments and other benefits compared to the clinical IT systems as these interviewees explain:

“It’s difficult to put a return on investment of a clinical IT system because the benefits are intangible... it’s hard to quantify the benefits of a scanned medical records system for example in some ways. Whereas with something like equipment tracking, we can say if it’s taking an hour or a day to look for one person in one area to look for equipment and we look at all the areas where we have equipment and at a high level we look at what would it cost, on average cost, that resource. We can say it would be around about this cost just look on productive time. Other things we would look at, EFTs on productive time and a whole lot of other things. We can give them a high level which will give them an idea.”

[IT 2]

“We do both the financial return investment, both the soft and hard benefits. What are your soft benefits around patient experience, things that are not be as easy to measure, but what are they? What are your hard benefits, which are your dollars and cents. It might be reduction in food waste, etc. You have to itemise all of that. The soft ones are much harder to capture though”.

[EXE 7]

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8 EFT stands for Equivalent Full Time, and refers to full time workers in the Australian context
In order to understand the main driver for the decision makers at Rosetta Healthcare in regard to IS/IT investments, we posed a number of exploratory questions about the view of IS/IT and its possible roles to enhance the organisational performance. Two main views were captured during the interviews. The first was viewing IS/IT as an enabler to reduce costs and increasing the efficiency of operations, while the second was portraying IS/IT as an enabler to achieve the business strategy. The first view was the predominant one, with all of the interviewees across the three groups of participants agreed on that, while much less agreement was found regarding the second view (enabling the business strategy) [Refer to 4.3.2].

Overall, three objectives of investing more in business IT in the short and long terms at Rosetta Healthcare were possible to capture. The first is to better manage disparate sources of information as one of the hospital’s executives describes:

“IT gives the ability to have access to accurate data, the ability to have access to data quickly and efficiently. One of the struggles that every hospital that I've worked in has is the ability to have something quickly so that you’re not spending hours data mining things from different sources. People seem to try and mine things to tell a story”.

[EXE 8]

That is something IT people look at with agreement with the executives as this interviewee states:
“There are lots of disparate systems that are there that have got good quality information that we should be trying to pull together and having them in one place”.

[IT 3]

The second objective is to enhance the business performance by predicting the future needs and market conditions for the organisation as some of the interviewees state:

“If we have all that information electronically in the right data warehouse, where you have some sort of a data warehouse that sits across it, where it trends the data, it runs reports for you. It is intuitive enough to tell you: "Here is where you need to focus"“.

[EXE 5]

“I think that the reason why we're investing in IT solutions is that I strongly believe that there is such a rich source of information that's collected manually on pieces of paper everywhere that we can't physically have that opportunity to see what outcomes we are achieving. By putting in some information systems or decision making solutions, we will get more information that will help to support the business drivers and where we're heading”.

[IT 5]

The third objective of investing in IT at Rosetta Healthcare is reducing cost and better allocating resources by reducing repetitive works or automating them as summarised below:
“I also think that there is some repetitive work that happens and that often we've got expensive, great resources, nursing resources, allied health resources that are doing things that you really could pay a clerical person to do. Where I get excited with projects in IT is that where you can make a difference and you save them time”.

[EXE 1]

In all cases, increasing the efficiency of operations is continually sought at Rosetta healthcare. IS/IT plays a key role to facilitate this goal as a number of the interviewees agreed. It is worth taking into consideration that Rosetta Healthcare has added two more buildings without the need to increase staff. The approach Rosetta Healthcare has adopted to facilitate that can be partially understood by assigning a bigger role to IS/IT to do transactional works as well as reengineering the processes accordingly as a senior IT executive states:

“We're trying to move that team to think more about their processes and working differently. Overall, it will mean that we'll probably keep the same number of staff but the number of transactions etcetera and the number of different things that they'll be able to do using IT will help us in the longer term. It could be even a potential reduction in staffing too”.

[IT 1]

4.3.4 The Business Value of IT in Healthcare: Multiple Case Vignettes

In order to demonstrate the business value of various IS/IT, the following serves to highlight the impact of selected systems used at Rosetta Healthcare.
As mentioned in Table 4.2, the common core information system at Rosetta Healthcare is the Patient Administration System (PAS). This system is used for both clinical and business purposes and aims at enabling the continuum of care by managing patient flow from admission to discharge. Furthermore, it sits on the base of the clinical and business information systems at Rosetta Healthcare and feeds different information systems with required information and reports electronically in a ‘timely and secure manner’ across the group’s multiple sites as a number of the interviewees described. The business value of this system will be explored by examining the business value of different clinical and non-clinical information systems that receive their inputs from the PAS.

4.3.4.1 The Case of Computerised Practitioner Order Entry (CPOE) System

Rosetta Healthcare purchased an American made CPOE system about three years ago primarily for cancer care. The system is relatively expensive, and three main drivers enabled the justification of this investment:

1. To serve cancer patients, who represent no less than 20% of the population of patients at Rosetta Healthcare
2. The popularity of the selected system, as about 40% of the hospitals around the world use this specific system
3. The complexity of drug prescribing process in oncology. One oncologist explains the need for such a system as follows:

   “Drug prescribing systems typically prescribe a single drug for blood pressure or antibiotics and dizzy dotted period. In the cancer treatment, there are things called chemotherapy private calls, which are often five or six drugs given at very
specific individuals, specific doses for lengthy periods and the prescribing function in those is quite complex because they have to be given according to certain recognised protocols”.

[CC 2]

The implementation of this system was complex and took longer than the planned time as understood from several interviewees. This is due a number of factors relate to the complexity of the product as well as the organisational characteristics of the group.

**The System Characteristics**

The system is an American product, and it was designed and tested in the US. Although it serves its main functionality (drug prescribing) reasonably well, it has some weaknesses addressing the localisation needs for the Australian needs:

“It is an international software that struggles with local billing practices which are different everywhere, and so are the drug protocols. It needs more domestication because it’s an American product.”

[EXE 4]

Secondly, Rosetta Hospital invested in some of the components of the system and did not buy the complete platform. As summarised in Table 4.2, the system has three modules, namely radiation, medical and surgical oncology information. Rosetta Healthcare bought only the first two modules which provide two different levels of efficiency to the group:

“These two modules are... one really is good; the other is okay, and we are trying to get them to talk to each other”.

[IT 4]
The Organisational Characteristics

As Rosetta Healthcare is a private hospital group, the majority of the oncologists are VMOs, who have invested heavily (both emotionally and financially) in their own IT systems. Although there’s a lot of mutual interest in IT between the VMOs and the group, there exists a clear misunderstanding about the role and the shape of IS/IT in this context as one interviewee describes:

“They’re talking about different sorts of IT. That leads to a massive amount of misunderstanding.”

[CIT 3]

This misunderstanding seems to result in an incompatibility between the two parties. This incompatibility is more conceptual rather than technical:

“The incompatibility between IT systems is fixable, and it’s mostly achieved by standards like HL7. But the incompatibility that I’m talking about between medical professional staff in the hospital is a conceptual incompatibility.”

[CIT 2]

The other organisational problem is resourcing. IT in Rosetta Healthcare is mainly handled by project management approach. i.e. all IT projects have project managers. These project managers are not dedicated to managing these project. Rather, they have other full day-to-day responsibilities. As a direct result of adopting this approach, delays in meeting the milestones, and realising the wins and tangible impacts of the IT investment on the short-term are frequently reported.
Nevertheless, the introduction of this system has positively impacted the patients’ outcomes as the majority of the interviewees agreed, not only from the clinicians group but also from the IT and executives/management group. This impact is represented in better patients’ safety by continuously providing consistent care, and aligning to care protocols and standards, which has helped to shorten the length of stay of many patients:

“There’s been a significant reduction in errors because we prescribe according to the protocol. These protocols are quite common and human error in transcribing is common. We are able to provide the same level of care on a daily basis. It has reduced legibility errors, and assured the compliance with the accepted standards, and all that sort of stuff”.

[CC 3]

4.3.4.2 The Case of Incident Reporting System (IRS)

As summarised in Table 4.2, the IRS system is used across large parts of Australia for capturing clinical incidents. This system serves two purposes:

1. Enabling the documentation of an incident at the time it occurs and supporting the classification via an inbuilt algorithm into how serious the incident is, and to standardise the information that's being captured through validation fields.

2. Ensuring the distribution of that information where it needs to be and then to drive it through into a larger data set of all clinical incidents to support more detailed analysis. This system is quite popular in the Australian context, mainly due to its cheap cost and reliability, so that most Australian hospitals use it.

It is understood that this system is a web-based reporting system that enables all stakeholders to report different levels of incidents irrespective of their criticality. Along
with capturing clinical and/or non-clinical incidents, the IRS enables sharing information with different levels of management and employees without any delay, as one of the administrators of this system explains:

“That is about people anywhere in the organisation reporting clinical - or incidents of any sort - that a staff [member] or patient may have. That's dependent upon an IT system having someone locally doing something that's reasonably easy that makes the information available where it needs to be.

Off the back of that incident being reported, there are potential triggers or alerts launched to people who need to know. So, if it's a staff incident, O.H.S [Occupational Health and Safety] staff know about it, as soon as it's entered. If it's a very serious incident, all of the senior management and appropriate clinical risk people know about it straightaway. There are some real benefits in terms of information provision”.

[IT 2]

This system is cheap, simple, intuitive, and easy to use, as the majority of the interviewees agreed. These features make this system very popular in the Australian Healthcare context.

Rosetta Healthcare bought this system a few years ago, to address an obvious gap in the information flow about incidents across the hospital as several interviewees agreed:

“... [Without IRS] we will have no capacity to know, or no realistic capacity, to know what things are going wrong with our patients, and therefore the ability to monitor them, to improve them and to attract that improvement”.

[CIT 4]
The use of this system has created a ‘cultural shift’ towards reporting in the group as one interviewee notes:

“We’ve got numbers of things that happened at the time we implemented it. We’ve seen the cultural shift towards reporting; so increased numbers of incidents being reported not occurring because we don't know what occurred. Then we’ve seen the severity of those events go down in the time we’ve used it. Then the frequency of things happening goes down, while we have other indicators implying that reporting is still up”.

[EXE 3]

This shift, in turn, has had other impacts on the overall performance of the group. A number of the interviewee emphasised that the use of IRS had been associated with increased patient safety, healthcare delivery efficiency, as well as reduced cost of healthcare provision:

“If we’re not having patients stay longer because something went wrong, then it’s more efficient. If a patient comes to have a heart operation, and then falls over and breaks their leg, then they stay for another week, have another operation; all of which we potentially are not paid for, so there’s a cost imposed. So there are real benefits.”

[EXE 6]

4.3.4.3 The Case of Scanned Medical Records System

As described in Table 4.2, Rosetta Healthcare invested in SMR as a necessary step to EMRs by digitising all medical records around all admissions occur at the different sites
of the group. Currently, Rosetta Healthcare uses SMR mainly to scan medical records, code clinical episodes, and track paperwork around every admission to all sites of the group.

The system is relatively cheap and easy to use as described by the majority of the interviewees. The use of this system helped increase the efficiency of operations and reduce time to perform different duties as described below:

“It saves us a huge amount of time, all of our sites and now using it.”

[CIT 3]

“It was put in for HIS reasons, and it's been very good to centralise the records. Traditionally, we used to have patients who'd come from [Site A]’s ED, come across to the [Site B]’s ICU and a manila folder would follow the patient, but we would actually create our own physical record at [Site B], and we wouldn't be able to write in the [Site A]’s record because that was the [Site A]’s record. We'd have to photocopy or transcribe the ED admission into our record, and take notes in there, and then send the [Site A]’s record back. We had a single patient within [Rosetta Healthcare] with a single UR and multiple physical records. It [SMR] has allowed us to centralise a single record, so that's been very beneficial. It also means that you can then have multiple users looking back through [SMR], and it's a repository for previous admissions. In the old days, if you wanted to look at

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9 Health Information Systems
the past history, you had to pull the physical history from medical records. They had to find it, they had to bring it to you, and no one else could look at it while you had it, whereas now, any number of people can look at the records simultaneously”.

[CIT 2]

The SMR system also helped Rosetta Healthcare to better utilise its resources as described by this interviewee:

“From that point of view, it's been very good. It's also reduced space from the HIS point of view, and it means that the coders can then also do work through the records. It's the same reasons multiple people can be doing similar things with the record at the same time”.

[IT 3]

This system, however, suffers from its limited functionality. It is understood that it does not offer the medical records in a way that enables data analytics or business intelligence. This limitation makes this system incapable of coping with today’s digital requirements of healthcare delivery as described by this interviewee, who also mentions some issues around the relationship with the vendor of this system:

“... But [SMR], essentially is a PDF repository, so we scan handwritten progress notes, and we scan faxed documents into it at the end of a patient’s stay. It's not collecting data in an atomic fashion. It's not collecting it in a structured way, and it's not collecting it in a well thought out data mode, shall we say. We have no
insight into the database underlying [SMR] and the vendors actually refuse to
give us a data model or any enterprise documentation about that”.

[CIT 5]

It also is slow, which does not give clinicians any incentives to adopt it in their daily work
as described by this interviewee:

“I've tried to use [SMR] at times. The problem with it is that it's actually slower
than the previous systems I've been using for 15 years, so when [SMR] came in, I
didn't change my workflow because it was more cumbersome, more tedious, and
slower than what I've been doing for 15 years. There was no incentive for me to
change what I do.”

[CC 3]

Another problem that SMR suffers from is its limited coverage. Currently, the system is
used only for inpatients and does not cover outpatients. The following interviewee
explains the limited coverage of SMR by a story happened in the selected case:

“Earlier this year, we had a surgeon at [Site C] who was frustrated because he
couldn't find the report or the images for a patient who had a CT done in April.
He put a complaint in, and when we looked into what we found is that the patient
had cancer and had multiple admissions, but they'd been an inpatient and an
outpatient about four or five times over six months, had had 12 studies done, eight
as an inpatient, four as an outpatient. Those four outpatient studies, we never got
a report or results send to us. [SMR] was aware of eight of those tests, whereas if
you log into the radiology provider's system directly, which is what I've continued
to do, you can see all 12 tests and see the reports. It was only that his doctor knew
that a CT had happened in April, and he was looking for so he could make a
comparison with the latest scan that he was complaining that it wasn't available, and it wasn't in [SMR] because it had been an outpatient study. Consequently, it hadn't been sent to us appropriately because it hadn't been done from within the hospital with a UR. It had been done from a doctor's rooms with no request to CC (carbon copy) us, and so again, we've got the problem of not knowing what you don't know”.

[CIT 1]

Not only has this limited the business value of this system, but it has also posed serious concerns around the safety and quality of care, but it has also affected the efficiency of operations as described below:

“If you're not questioning the completeness of what you're seeing, and this surgeon obviously did question it, then he might reorder the test, and then that delays making decisions because while I'm waiting for that test to come back, they'll have to do it again, and if you have to redo radiology tests, you're exposing patients to radiation and potentially contrast, so potential morbidity from repeating a test that you don't need to repeat. Again, that gets into the quality and safety, and efficiency comes down to really the time it takes chasing all this information”.

[CIT 1]

4.3.4.4 The Case of Diseases Classification and Coding System

The (DCCS) system utilises the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM).
ICD-10-AM, which is a derived version of the World Health Organisation ICD-10 (Elsworthy et al., 2013; WHO, 2012), has been in use since 1998, and it was developed by the National Centre for Classification in Health with assistance from clinicians and clinical coders. It uses an alphanumeric coding scheme for diseases and external causes of injury. It is structured by body system and aetiology and comprises three, four and five character categories. ICD-10-AM is updated on a regular basis, with the regular updates of ICD-10 being included as a part of the updating process (Elsworthy et al., 2013; WHO, 2012).

DCCS provides an excellent platform to capture information that IRS is not capable of capturing (P. Haddad et al., 2014a). One interviewee explains an example of such information:

“Complications of surgery aren’t really captured in IRS unless the person had an unplanned intensive care stay or returned to theatre. But if somebody had a bleed after surgery that was able to be drained without going back to the theatre, then we wouldn’t know about it there, but I’ll know about it in the other data set [DCCS].”

[CIT 4]

The use of this system has improved “clinical knowledge” as a number of the interviewees from the clinical, and clinical IT groups agreed. It has also enhanced the alignment and compliance with standards and regulations as another interviewee explained:

“We’ve been successful to benefit from this system to align wherever possible, with an external body particularly where it affects lots of hospitals”.

[CC 5]
Across the IT and executives groups, there existed similar opinions about the role of this system in enhancing the quality of care by enhancing patient safety, providing consistent care, and helping improve the seamlessness or continuity of care. This is mainly due to its ability to establish higher levels of accountability and common understanding between different craft groups across Rosetta Healthcare. A number of interviewees noted that the introduction of this system had reduced medical errors and shortened the stay length in specific clinical areas, particularly managing chronic diseases.

4.3.4.5 The Case of Business Information System (BIS)

As described in 4.2.1, the BIS is a group-wide information system that was purchased by Rosetta Healthcare in 2009 to meet the daily needs of the group in the areas of finance, enterprise budgeting, asset management, enterprise cash receipting, business intelligence (BI), and supply chain.

This system is used universally across the group, and has been seen as an enabler for higher efficiency of the daily operation of the group as well as better utilisation of the available resources as can be understood from the following interviewee:

“... it’s been our daily tool to manage our busy 8 hospitals [the different sites of Rosetta Healthcare] … we have been able to manage a lot more assets using the system; we’re literary doing more with the same number of staff, and we do it consistently.”

[EXE 4]
This consistency seems to have contributed to the operating gain of the group as a whole by ensuring the compliance with standards and agreed service levels (ASLs) as the following interviewee explains:

“... One of its greatest benefits is enabling us to meet compliance requirements without having to pay more every new day.”

[EXE 6]

The system is also providing rich data sets about the overall performance from a business perspective. These sets of information are being used by the BI platforms to better manage the different sites of the hospital. Answering a question whether this system is used only to perform repetitive works such as billing, budgeting, and human resources, many interviewees agreed that it does that, but it also enables a wider visibility of the hospital and the performance of the individual divisions and assets as this interviewee explains:

“It does all of that [repetitive works], but more importantly, it gives us better visibility of employees, divisions, and business units. This output is feeding our BI with great indicators about where we should be heading next right from my BI dashboard on my desktop.”

[EXE 3]

The other integrative component of this system is the Health Fund Information System (HFIS). This system/module has also been used to help manage the cash flow between the hospital and its health funds. Prior to purchasing this system, the hospital had to send invoices out to the health fund manually and wait a standard forty-five days for them to come up with the outcome if they were going to pay the invoice. With HFIS, invoices can be sent out as soon as they have been created, and they automatically go off to the health
fund. The response is expected within the next 24 hours as to whether they are going to pay the hospital and then the payments go into the bank account of the hospital.

Asked about the direct impact of this system, many interviewees agreed that this system had been very beneficial as the following interviewee describes:

“The turnaround time and the revenue streaming, getting our revenue in is really efficient and so in the billing area we have been able to reduce the number of EFT because it’s all now computerised”.

[EXE2]

“I think they probably dropped to 4 staff out of 25 at this point in time. There is still a lot of work to do in getting our major funds on and getting the rest of the funds on and there is also all of the outpatient billing that we need to do. once that’s all done then we might see some more EFT drops but it’s also meaning that we are moving staff around and instead of having a lot of staff at the back end in the credit area, we are actually moving them in the billing area and being a lot of efficient in that way because there is no need anymore to actually do that credit functionality”.

[IT 2]

4.4 Themes and Sub-themes for the Business Value of IT in Healthcare

Different issues relating to the business value of IT in healthcare were discussed with the participants. As mentioned in Chapter 3 (Section 3.5), four main themes of the business value of IT were identified. These are Healthcare Ecosystem, People, and Process and
Technology. These themes are the main factors seemingly affecting the generation of the business value of IT. Hence, Table 4.6 and Figure 4.5 show these themes and the percentage of times they were mentioned and/or discussed during the interviews with the participants.

**Table 4.6 The identified themes and sub-themes from the interviews conducted with Clinicians, Executives, Clinical IT and IT Personnel.**

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-theme</th>
<th>Percentage of participants mentioning a specific sub-theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare Ecosystem</td>
<td>Competition</td>
<td>55%</td>
</tr>
<tr>
<td></td>
<td>Political influence</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>External communications</td>
<td>65%</td>
</tr>
<tr>
<td>People</td>
<td>VMOs</td>
<td>75%</td>
</tr>
<tr>
<td></td>
<td>In-house users</td>
<td>45%</td>
</tr>
<tr>
<td></td>
<td>Vendor</td>
<td>60%</td>
</tr>
<tr>
<td>Process</td>
<td>IT governance</td>
<td>65%</td>
</tr>
<tr>
<td></td>
<td>Project management</td>
<td>65%</td>
</tr>
<tr>
<td></td>
<td>Change management</td>
<td>75%</td>
</tr>
<tr>
<td>Technology</td>
<td>IS product</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>Integration</td>
<td>65%</td>
</tr>
<tr>
<td></td>
<td>Data issues</td>
<td>80%</td>
</tr>
</tbody>
</table>
It is worth mentioning that these themes cover the factors affect the business value of IT in healthcare. Other issues also discussed during the interviews relate to the business value of specific IS/IT in both the clinical and non-clinical spaces, covered in Section 4.3.

### 4.4.1 People

This subsection presents the impact of people on the business value of IS/IT in Rosetta Healthcare as an exemplary case study. This includes, 1) visiting medical officers as powerful stakeholders and their influence on current and future IS/IT in the selected case, as well as the alignment between their business objectives and the hospital’s business objectives (if any); 2) In-house users, which include clinical and non-clinical users and their engagement, skills, and acceptance of IS/IT to facilitate their daily works; and, 3) IS/IT vendors in terms of their relationships with the hospital, their impact on the business value of IS/IT investments, and particularly evaluating the levels of mutual trust with the selected case and healthcare providers in general.
4.4.1.1 Visiting Medical Officers

As a private hospital, Rosetta Healthcare does not have many junior doctors employed. Rather, it has a high number of VMOs who are more senior, more experienced, very busy, and tend to have streamlined workflows. The Australian Institute of Health and Welfare (2005) defines the VMO as:

“A medical practitioner appointed by the hospital board to provide medical services for hospital patients on an honorary, seasonally paid, or fee for service basis. This category includes the same Australian Standard Classification of Occupations codes as the salaried medical officers’ category”. (p. i)

In the case of Rosetta Healthcare, VMOs are paid on a fee for service basis. As a result of these arrangements, meeting the requirements of these VMOs is a key criterion to be met in any IS/IT, as described by this interviewee:

“Any information system that we put in has to be able to, at worst, not make their [VMOs] day any harder, and at best, should improve it”.

[CIT 5]

Given the VMOs have their own clinics, they run their own IS/IT for managing their patients, as this interviewee explains:

“They all have their own systems, so 99% of them would have practice management systems, and this is the other problem we have in private, which is from public, in that the VMOs maintain their own patient records in their own clinical system practice management software.”

[EXE 4]
There exist two type of information systems used by these officers; smaller VMOs and clinics have what is called in the Australian context Practice Management Systems (PrMSs). These systems are used on a clinic level to manage patients with the capacity to add clinical notes and, in some cases, to generate prescriptions. These PrMSs are cheap and available through different vendors, and they are not necessarily designed to align with standards such as HL7. More powerful and wealthier VMOs have more complicated systems that can manage more patients across different hospitals with whom these VMOs have legal arrangements to practice at their premises as this interviewee describes:

“They have a heavy emotional and financial investment in this software or that, and achieved in terms of their own personal practices.”

[CIT 3]

These conditions are playing a negative role in attaining the business value of clinical IS/IT at Rosetta Healthcare as many interviewees across the four groups of the participants in this research agreed. Particularity, these arrangements are causing two notable problems to Rosetta Healthcare:

1. **Creating additional information silos:** By the VMOs insisting to use their PrMSs to manage their patients’ records. The problem with these systems as described by this interviewee is:

   “Those systems don't talk to our systems, and our systems don't talk to their systems, and in fact, we don't have a way to securely share information with them, either, so we've got information silos...”

   [CIT 4]
2. **Security and privacy issues:** The problem of creating information silos is causing both the VMOs and Rosetta Healthcare to lack an approach to securely exchange medical information about their patients, so they use other means such as fax or email, which in turn raises the issue of security and privacy. However, addressing the privacy issue by introducing proper encryption methods does not seem to have enough acceptance by the VMOs as this interviewee explains:

   "Currently, information is typically shared by faxing or emailing, but it is not secure email, so there are problems around that as well, and we're trying to implement a process of encrypting all emails because there is a misconception that email is as secure as fax. There is a lot of pushback from VMOs. "Why do we have to encrypt this? This is just extra work? It is an extra step. It is an extra headache for us" because they don't understand the importance of it, but their systems are just another information silo that we cannot really have access to". [CIT 4]

### 4.4.1.2 In-House Users

Given the problem around VMOs is multifactorial as discussed in 4.4.1.1, the direct impact of this is directing any future IS/IT investments to facilitating nursing processes, as this interviewee describes:

   "We, in private hospitals, because they're visiting medical officers, they will not sit behind a computer and put information in. In a private sector, one of the key
things to acknowledge is that really our clinical information systems will be
focused on our nursing processes”.

[EXE 1]

The results of this study revealed that internal users are not assigned significant roles in
designing or investing in IS/IT. During the interviews with participants of different levels
of power and authorisation, it was evident that feedback and inputs from different
prospect users of IS/IT were collected, but not taken on board when actually making the
decision of investing in IS/IT. This has limited their motivation to use these systems and
benefit from them. This applies on both business IT and clinical IT. Not only does this
limit the business value from these systems, but they also causes massive waste of
organisational resources such as time, effort, planning, and re-planning as described by
this interviewee:

“I think you have to listen to the lessons of your users, and they're all the same generic
issues that come out at times. It is project management 101, but we go out, we do
select visits, we hear people say, "you’ve got to think about this," then we come home.
We don’t take any of that on board. We actually do not put a focus on it”.

[EXE 4]

As a result of this behaviour, the intention of the internal users to use IS/IT systems when
they first know about them dwindles when they realise their inputs were not taken into
consideration.
The other important finding in this area is that IS/IT users, especially in the clinical domain, have a low level of trust in the information they produce or receive in the current structure of IS/IT of the selected case:

“I think when people enter something into a computer they imagine it’s either going nowhere, or they expect to see it back. I think they should get it back or know that it goes somewhere useful. So to them, that will encourage them to do their job; to enter the information.”

[CIT 3]

This issue was agreed upon by different interviewees. As a solution to this problem, many interviewees suggested engaging users by showing the full path of the information they deal with as this interviewee explains:

“If we can report back data quality to them, and what we do with it, that will drive them to do their data better. I understand there is a reason for it. If I think back to being a nurse, I knew I had to put some numbers in things. But I didn’t know, why, I didn’t know where it went. Then I changed from that role to something more like my current role, and suddenly, I saw where all the information went. I realised that, had I known that I would have been more engaged in capturing the first piece of information which just seemed like a problem to me. “Why do I have to do that? It’s got nothing to do with me.” If you give me my information back, then I think, people go, “Ah! I should do it properly. Shouldn’t I?”

[CC 4]

Not only does this issue negatively affect user satisfaction and intention to use IS/IT systems, but it also limits the business value of IT in general as this interviewee stated,
emphasising the importance of engaging clinical people on the business side of managing healthcare organisations:

“I think it limits your potential business value. I don’t think it’s unavailable. I can still do things sitting at my desk that will drive things, or even if the clinical user doesn’t know that. I think you’d get much greater value if clinical people are engaged in the business side of things”.

[CIT 3]

4.4.1.3 Vendors

During the interviews, the majority of the participants emphasised that the core business of the selected case is providing care to patients, not developing IS/IT as described by the following interviewees:

“We are here as a hospital to provide healthcare. We are not here to be a software development shop- its primary purpose is not to devote its efforts to helping a vendor develop a product that’s failing in it’s infancy to be a much better product”.

[EXE 3]

“you have to make a decision about whether you are an IT shop or whether you’re a healthcare company. My personal view is that your core business is about healthcare. It's about managing patients, managing relationships with doctors, really caring for that patient.”

[IT 1]
“They [vendors] are software developers. They are IT shops. We are healthcare.
We just want to make their systems work in our environment”.

[CIT 2]

As a result of this mentality, the majority of IS/IT needs of Rosetta Healthcare are met through multiple relationships with different vendors. These relationships vary from being comfortable partnerships to a source of trouble depending on the area of interest (business IT, clinical IT, and research and learning IT). The best relationships seem to be with business IT vendors, followed by clinical IT vendors, and learning and research IT vendors are ranked last on the list as described by this interviewee:

“Look you know for different products. [BIS] has many modules like the finance system and supply management, so we have a relationship with them. They give us upgrades every year. We work through that process, but it's inbuilt. It's institutionalised. That's our [BIS]. For our PAS system, we can make enhancements along the way, but there's a way of doing business with them. We know that. With [learning and research IT vendor] which is our learning solution, we've got a relationship with them, and they need to understand better. Probably it's not a great relationship.”

[EXE 7]

Overall, the relationships with different vendors seem to be treated cautiously by Rosetta Healthcare. In other words, the level of trust between the organisation and its different vendors seems to be low. This in large part is due to the approach used by different vendors to sell their products as this interviewee explains:
“Because they promise you the world and very few of them ever deliver the world, and I think they always ... I think they always over promise and under deliver... So we tend always to be cautious with all vendors”.

[EXE 8]

“Vendors come in all the time. They say, “Yeah, our system can do this, this, this, this.” Half of them can’t, and half of them, they promise the world, and then it’s very expensive, and it’s challenging in terms of what they say the system can do and then when it actually comes into your environment.”

[EXE 2]

As a result of these practices, Rosetta Healthcare went through a number of tough experiences. A senior finance officer recalls a bad example with an IS/IT vendor in 2008 when Rosetta Healthcare purchased a rostering IS/IT product and started implementing it through an outsourcing contract. Fairly quickly, the executive team started to see this relationship negatively affecting the hospital performance. To solve this problem, Rosetta Healthcare had to pay the vendor to terminate the contract:

“... and we paid ... I can’t remember ... $2-3 million to terminate their contract and said: “Go away because this is not working from a relationship, from a business perspective.” We spent a lot of money. We sunk a lot of costs. We then spent more money to get rid of them. But at the end of the day, if we had kept going on down the path, it would have been disaster for the business, and we were just throwing good money after bad”.

[EXE 2]
This missing trust has played a key role in limiting the business value from different IS/IT investments at Rosetta Healthcare, which motivated the decision makers to adopt stricter criteria and higher scrutiny measures to manage the relationships with prospective vendors. These criteria and measures are summarised by this interviewee:

“You are looking for vendors who have got longevity in the market. Who’ve got sufficient resources themselves to continue to invest in the product and develop it. Where you can get feedback on some of the challenge of implementing with that particular vendor and the efficacy of that particular system. To us, it’s pretty fundamental”.

[EXE 5]

Not only does this apply to the vendors, but also to their IS/IT, as another interviewee emphasises:

“Part of the security and the risk management of investing in information systems is to look at systems that have an established track record and particularly used in Australian private hospitals, even though the systems are pretty much okay. It’s the vendor behind them. The support and the maintenance and the team behind the system that make a fundamental difference.

[IT 2]

Furthermore, the trouble with vendors seems to escalate with investing in systems that are customised to fit the specific needs of healthcare organisations, whereas investing in generic IS/IT is less damaging as this interviewee describes:

“If you’re going to make an investment in a particular product, which is off the shelf. It’s vanilla approach. If you go down a path with a vendor where you want them to
develop something that's fit for you, you have to know that you're customising something. That means you're going to have a long-term relationship with that company whereas if you buy something off the shelf, and it's standard, you go through an upgrade process, its maintenance, its fine, and you implement it in accordance with the way in which the system runs”.

[IT 3]

The problem with customising IS/IT to fit the specific needs of healthcare organisations is briefly explained by the following interviewee:

The minute that you ask people to develop something for you that's purpose built, you've got a reliance on that person unless you're going to have someone that's working alongside them that can be the subject matter expert and take over that expertise”.

[EXE 7]

Even the idea of having an in-house ‘subject matter expert’ is not a widely agreed upon solution as it implies extra cost for the organisation, and does not solve the main problem centred on creating single points of failure as this interviewee explains:

What worries me in healthcare is that sometimes we do builds of things which are reliant, single point sensitive with people, whether it's the vendor person or ourselves, who has all that knowledge. If they got run over by a bus or a tram or whatever, we would lose all of that intellectual property. It's that hard piece.

[IT 4]
Overall, Rosetta Healthcare appears to need to establish a good account management process with different vendors to choose the right products that fit the day to day needs of the organisation without exposing it to single points of reliance on vendors or subject matters experts.

### 4.4.2 Process

Healthcare is one of the oldest industries in the world (Coleman et al., 2009; Treadwell et al., 2014). Even though numerous changes on the processes have taken place in other industries, the processes in healthcare do not seem to have taken the same trend as most of the interviewees agree:

> “Healthcare today is an old wine in a new bottle, most business processes in health are traditional and structured around organisational roles that are 100 years old, like the doctor, the nurse, etc.”

[CC 3]

Similar views can be seen from the executive and IT perspectives:

> “I don't think that we spend enough time visioning where we could possibly be and to looking outside of our own backyard and up into other industries to think, "Hey we could do this differently”.

[IT 1]

A number of interviewees agreed and went further to explain why healthcare is still ‘an old wine’ even though IS/IT (the new bottle) are attracting higher interest by the decision makers in healthcare. One reason is that new IS/IT are not making any revolutionary changes in the processes of delivering care as this interviewee explains:
“When I was in my clinical role, I would often have been working for anything up to 8 to 10 different orthopaedic specialists in terms of who would do the surgery. They would hand me 8 to 10 different protocols of care for all of the different patients, even though they'd had exactly the same kind of procedure or surgery or whatever. You'd walk around essentially, with like, "Okay, this is Mr So and So's protocol. This is what I've got to do." You'd literally have these cards that would tell you. Now all you're doing today is actually transferring it onto an iPad or some system that actually says there's not a lot different, but has the business process behind it actually changed? No."

[IT 3]

Another example from the day to day healthcare delivery processes is expressed with these observations from a nursing perspective:

“.. For example, patients with cancer having treatment often have anything like 11 to 12, on average, symptoms at the same time. They've got pain, they've got fatigue, they're not sleeping, they're nauseated, they're itchy, there's a lot of things that they're experiencing as a function of the treatment. Now, in order for a good high quality care to happen for management of their symptoms, nurses need to sit down with the patient and spend some time talking about them and prioritizing with the patients about which symptoms they want treated, because sometimes, if you treat the pain, you increase their fatigue, or you might increase their nausea. Often, patients have a preference for what they want treated and what they want, perhaps, to do with themselves. The routines don't allow that in depth
conversation with the patients, so we weren’t seeing that. You’d need to change the routine of care as well”.

[CC 3]

Thus, due to the absence of substantial efforts to redesign the care delivery processes, the role of IS/IT in the current organisational structure of healthcare providers is limited to three main areas. The first is facilitating current processes:

“I guess what I’m saying is, [IS/IT] would absolutely facilitate that process, but unless you have a whole of care redesign, then the IT will be there and has the potential to do it but it won’t. There are human factors.”

[CC 2]

The second role is to help measure healthcare outcomes:

“In health, because of the difficulty in measuring some of the outputs that becomes a bigger problem. IT to me is an important part of addressing these issues in that it measures what it can be measured”.

[CC 3]

Third, implementing new IS/IT plays a key role in revealing any issues with the organisational structures in the healthcare, as several the interviewees note:

“IT implementation reveals organisational dysfunction, and we all who work in health know that there are a lot of issues, and not surprisingly when you try to introduce IT, those issues become apparent”.

[CIT 3]
Thus, the current organisational characteristics limit the role IS/IT can play in enhancing the overall performance of healthcare providers:

“The IT does not fix organisational dysfunction. It just shows you what you got to deal with that through a separate change management process”.

[EXE 6]

As a solution to this organisational barrier, a number of interviewees called for rethinking about the traditional organisational roles, especially on the clinical side:

“Most modern healthcare requires a team burst approach and the traditional nursing medical and other roles mitigate against that because largely there are some way roles with that much integration”.

[CC 3]

There are other factors that limit the ability of IS/IT to generate business value. These factors are mainly caused by the ‘immaturity’ in managing IS/IT investments in the healthcare, as a number of interviewees called it. Compared to other industries, the healthcare domain still lags in managing these investments, as funds most of the time are directed towards tangible investments without addressing the underlying issues of managing these investments, such as time management, change management, and project management as this interviewee notes:

“Once again, the money isn't allocated to time management or the rigorous work and the time you need to devote towards looking at performance measures and measuring benefits. It's allocated towards purchase of equipment and implementation service fees”.

[CC 2]
Another interviewee is even more pessimistic:

“There's almost disincentives to put your effort or put your time or put your allocation of money there because that's not what you're getting granted funding for. You get granted funding for something businessy and touchy”.

Based on the insights from the interviews, IT governance, project management, and change management are key to attain the business value of IT investments. These factors and their impacts on the business value of IT in healthcare are discussed in the following subsections.

4.4.2.1 IT Governance and Project Management

Investing in IS/IT at Rosetta Healthcare goes through a rigorous governance process. Adopting this approach started informally in 2009 during a project to change the payroll systems, and over the last few years, it has become more formal and documented.

This starts with a business initiative, which needs to be submitted to the Project Management Office (PMO) within the IT department. A high-level assessment and a review are to be done on this initiative, to make sure it complies with the organisational agreed norms. The idea then is explored. As needed, a project manager from the PMO will be working with the initiator that’s put up the proposal and enhance it according to the used standards at Rosetta Healthcare. The project management approach from this point is Projects in Controlled Environment, version 2 (PRINCE2) (P. Haddad & Wickramasinghe, 2014b). After having this done, the initiative would go up to the IT Steering Committee, which is the main IT committee at Rosetta Healthcare, and whose
responsibilities are centred on making the *'the right investments in IT'* as a senior IT officer describes. It is worth mentioning that under the central IT steering committee there exist a number of sub-steering committees in different business units (different hospitals) (P. Haddad & Wickramasinghe, 2014b). These committees are responsible for managing IT projects based on the approval from the corporate’s steering committee. This IT Steering Committee is chaired by the CIO and most of the executive directors and the CEO. The IT Steering Committee discusses whether the hospital is interested in such a project. This, ideally, depends on its expected benefits and fit within the business strategy and IT architecture of the hospital. In that case, more work needs to be done. This starts by deeper discussions between the PMO and the initiator of the project. Upon this, a business case is created. The path from this point depends on the budget required for this project; if it is less than a threshold (One million Australian dollars as of the time of data collection), then the business case is put in the so-called ‘Prioritisation List’, on which all planned projects are listed based on their importance to the business. If the required budget is more than this threshold, then the business case is escalated to the Finance Steering Committee and then to the Board, who will decide whether or not this business case will be sent to the Prioritisation List (P. Haddad & Wickramasinghe, 2014b). Figure 4.6 depicts this process.
If the business case is deemed appropriate and the suggested IT system passes this scrutiny, then a ‘sponsor’ is assigned to the project. A sponsor in the context of the selected case would be a senior employee whose tasks are functionally aligned with the nature of the proposed IT system. Thus, there have been two criteria to appoint a sponsor for an IT project:

1. The nature of the IT project (financial, clinical, administrative, IT, etc.)
2. The experience/expertise required to sponsor each IT project.

For example, if the suggested system addresses the financial aspects of the business, then the sponsor would ideally be the CFO or the executive director of procurement and facilities depending on the nature of the project. These people would have had enough expertise dealing with similar investments. The sponsor has a relatively high level of authorisation within the dedicated budgets for their assigned projects. If they need
additional resources beyond 5% of the allocated budget, they still can ask for it, but they have to go through another cycle of governance to demonstrate the reasons and the commitments to the Board. At the same time, they are fully accountable, and the failure or success of their assigned IS/IT project is their sole responsibility.

This practice has shown an impact on the success of IS/IT projects and generating business value from such IS/IT projects for the hospital. Apart from very few cases, the participants in this research found it difficult to identify a failed IT project since this approach was introduced.

All stakeholders at the selected case recognise the importance of a good IT governance for successful IS/IT investments in clinical and business domains:

“Good governance structure has been something we’ve worked on in the last couple of years, and I feel it absolutely necessary to actually work in this environment”.

[IT 4]

Besides the matching the nature of IT projects with experienced sponsors, the strong governance process gives the business the ability to predict possible failures and prevent it:

“If something was going to fail, you’d see it coming a mile off. Each major project, each month, there is a one-page or a two-page update that goes to the Finance Committee. It says what the status of the project is, what are the key milestones, what are the upcoming activities the next month. There is a track, what we spent today
against the budget, what has been committed against the budget. It is really
transparent. It’s very obvious if something is going to go off track.”

[EXE 2]

Adopting robust IT governance and project management methodologies that align with
the business objectives have another role to play. This is about filtering potential projects
and proactively dealing with potential failures for IT projects as one interviewee
emphasises:

“If you’ve got good IT governance and project management, there’s no reason why
you should ever have a disaster because you should have certain gates that you go
through before you ever hit go on a project. If you don’t pass through those gates, then
you never hit go”.

[EXE 6]

Although strong IT governance and project management combined have this important
role in this regard, attaining the business value of IT is not a direct result of these practices.
Rather, they enable the best opportunity to succeed in delivering IS/IT services as many
of the interviewees agreed, especially from the executives and IT groups:

“What we certainly know is without that [governance] structure, it becomes very hard
to deliver that initial benefit of actually getting that new system in and transitioned
over in a way those benefits or that accommodates the business and the business as
usual work.”

[EXE 3]
The role of the IT department in this practice is more as an advisor and supportive than leading, as the key decision makers at Rosetta Healthcare agreed:

“We don’t want IT to say, “Here’s your new Internet,” and everyone is going, “Well, this is a pile of junk.””

When asked about the key to creating prudent IT governance practices in the healthcare, the requirements were centred on allocating enough resources, establishing collaborative atmospheres within the healthcare context, ensuring a deeper understanding of the business processes and organisational structure, the existence of adequate upfront planning for IT projects, and carefully assigning leaderships to the potential sponsors (Table 4.7).

Table 4.7 The requirements for a robust IT governance in the healthcare sector, as confirmed by selected quotes from interviewees

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Selected quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Allocating enough resources:</td>
<td>“We resource it out properly so that we have people not doing it as part of their day jobs. We actually have a dedicated project manager, business analyst, and project team. That has been a real key”.</td>
</tr>
<tr>
<td>IT governance is demanding in terms of human assets, and it needs to be well resourced. This would mean enough personnel equipped with a diverse range of skills and expertise</td>
<td></td>
</tr>
<tr>
<td>• Establishing a collaborative atmosphere within the healthcare context:</td>
<td>We expect that it’s going to be a collaborative approach, so it’s not someone just running off and doing what they want to</td>
</tr>
<tr>
<td>Successful IT governance needs to be nurtured within a collaborative atmosphere continuously</td>
<td></td>
</tr>
</tbody>
</table>
do for their site. There needs to be a collaborative approach.”

**[EXE 8]**

| **Deeper understanding of business processes and organisational structures:** |
| This understanding is key to all stakeholders, especially to clinicians |
| “It needs to be at the front end in the sense that they need to basically have a line of sight as to the processes.” |
| **[IT 7]** |

| **Upfront planning for IS/IT projects:** |
| IS/IT projects need to be well planned for up front. This will lead to a transparent project management and easy to track progress |
| “The fundamental failure up front leads to massive rework, inefficiencies and costs down the back-end and usually leads to immense frustration because it's based on, "I thought I asked for this" and there're no checkpoints along that whole journey”. |
| **[EXE 4]** |

| **Carefully assigning leadership to the potential sponsors (leaders):** |
| Although there has been increasing levels of concentration on matching the requirements of specific IS/IT projects and the unique requirements for prospective sponsors, selecting the right sponsor needs to go beyond that, to cover the organisational loyalty. During one IS/IT project, a number of cases of lack of planning and delays happened, even though the same strong IT governance was applied. Asking about the reason, we were advised that the sponsor had not been an employee at the case study. |
| “The role of the sponsor really in my view, it wouldn’t have mattered who that person was. It needs to come back to an [Rosetta] executive and someone who’s employed and has accountability back to our board for delivering that outcome”. |
| **[EXE 5]** |
4.4.2.2 Change Management

In order to enable IS/IT to generate business value, more attention needs to be paid for change management. The majority of the interviewees agreed on the importance of a prudent change management strategy to reaping the benefits of IS/IT projects:

“Really from a technology perspective, the projects are relatively easy. We can put servers in place, and we can do most things now in terms of the infrastructure that we’ve got. Some things get a bit tricky, and your new technologies are coming forward all the time. However, your development of your change management strategy is vital because you have to massively overdo it to make it successful”.

[EXE 2]

Recognising the importance of change management though has recently started to develop at Rosetta Healthcare. Prior to that, the problem was noted by the number of unfinished IS/IT projects as a senior IT officer explains:

“I still believe, even on coming on board, there were 45 projects that had not been finished off when I got here. That told me that there was something not quite right in terms of the change management piece, and in that people hadn't accepted the change or hadn't moved forward with it.”

[IT 1]

The increased level of IS/IT adoption during the last few years has created a big challenge to Rosetta Healthcare. This challenge is the “the amount of change the business can cope with” according to a senior finance officer. This challenge, in turn, has played a key role in highlighting the importance of change management to generate business value from IS/IT investments as one interviewee notes:
“I believe it's been acknowledged now that change management is inevitable, and it's a lesson that so many people have learned over a long period of time”.

[CIT 4]

As a result of this acknowledgement, funding for change management is now contemplated, and sometimes allocated, for IS/IT projects at Rosetta Healthcare.

Although there has been a recognition of the importance of change management, this recognition does not, necessarily, reflect the understanding of what change management is as a number of interviewees note:

“I don't know necessarily when it gets approved that people actually understand the word change management, what it actually means. I'm not sure people are very comfortable about what that encompasses.”

[CIT 5]

Another misunderstanding was possible to note during discussing change management with different interviewees. This relates to limiting the scope of change management to process improvement as the majority of the executives state:

“We might not call people specifically by that title that they're the change managers, but we do allocate people in particular projects. Not always but we do it to look at things like- we call them, maybe say process improvement”.

[EXE 6]

This issue is not limited to Rosetta Healthcare; rather, it is common in the healthcare industry in general, and it might reflect the immaturity of this industry in this regard as one interviewee explains:
“I think we've got a long way to go. But once again, I don't think we’re Robinson Crusoe. It's very common in the healthcare; that is probably where once again, from a maturity perspective, it's something that change management needs to be properly understood first”.

[EXE 8]

in the light of these contextual conditions, and based on the difficulties face implementing a successful change management strategy, Rosetta Healthcare has recently introduced a change management program that concentrates on people, process, and communications.

**People:**

Informing people about their roles, organisational expectations, and the implications of IS/IT investments on them and on the organisation is one aspect of the people component in this program:

“Making sure that people get the right information about what we're expecting of them so that they understand what their role is and that they understand what implications are going to be. It's almost like doing current state. This is the current state we're in. This is the future state that we want to achieve. How do we bring people along and make them go through that change”.

[EXE 7]

Furthermore, investing in people and their development is another aspect of strengthening people for change management:
“We need to invest in the people that are going to make a difference on the floor, so to speak, in the operations of the business. We almost need to second them out of what they're doing and have that as a true project cost and allow them to focus on that change whilst they bring the rest of their peers along”.

[EXE 1]

The evolution of IT in healthcare also requires revisiting the required set of skills of IT personnel who work in the healthcare context:

“They now need to learn some different skills. They can't just be a technologist. They've got to talk to people.”

[EXE 6]

In order to enable people to cope with change, proper education and coaching practices need to be in place as one interviewee suggests:

“That's about spending time, and getting them to see what you say are the benefits. That's about the individual coaching and education and training about the why, and understanding people's own abilities to change”.

[IT 2]

Process

As mentioned in 4.4.2, processes in the healthcare have not witnessed radical changes compared to other industries, which may make implementing new IS/IT difficult from the change management point of view:
“Some people have been doing some things the same way for 20 years. It’s very hard for them to change, but it goes back to making sure that those changes happen in a process. We are trying to say that it’s great to put new technology in but you have to change your processes to meet the technology”.

[IT 3]

Implementing successful change practices requires a deep understanding of the current processes and the new processes by different stakeholders as the majority of interviewees agreed.

“It is now more vital than ever to go and understand what we currently do, understand what we want to achieve, to understand what we need to change to get into that outcome we're actually looking for and to work with people to help them adapt and adopt to contribute to how the process needs to change.”

[EXE 6]

Communications

Maintaining high levels of communications with different stakeholders is a key element in implementing successful change management strategies as one interviewee emphasises:

“Understanding of your communications plan is vital because you have to massively overdo it to make it successful.”

[EXE 5]
Rosetta Healthcare’s approach to achieving this communication plan is explained below by a senior IT officer:

“One of the things I've used in a number of the projects that I've done is this thing called the Commitment Curve. It's when you start a project; you approach someone, and you give them a basic idea of what you're going to be doing. You need to keep that communication up and help them move through that change. You go from start up to information to adoption to internalising it to then institutionalising it. It's like a curve that goes up. If you don't keep communicating and keep talking to people about that change or something happens, and it drops off, and you don't address the problem, then your project will fail”.

[IT 1]

Adopting a change management strategy based on this triangle (people, process, and communications) seems to be beneficial to new IS/IT implementations at Rosetta Healthcare as a number of interviewees note:

“For example, we've had lots of examples of projects that have wandered and really been difficult and lots of rework and frustration and all of these things that you read along here but yet, in the last little period of time, we've done three or four projects where we've actually this change strategy. Interesting enough, suddenly what's happened, it went really well. Not only did it deliver a good quality outcome, but it's now just like, "Oh my God, what did we used to do last week?")

[IT 4]
“They've actually moved to the new quickly, and they've also recognised that by putting in these good processes actually enabled them to be able to get there in a much better shape and, from a project point of view, on scope, on time, and under budget”.

[EXE 7]

4.4.3 Healthcare Ecosystem

This subsection is designed to cover the healthcare ecosystem and the contextual conditions of Rosetta Healthcare as collected data revealed. The external communications with other partners seem to have played key roles in generating business value from the IS/IT investments at Rosetta Healthcare. The competition amongst different healthcare providers has also had tangible influences on the decision-making practices that relate to IT investments. Different dimensions of the political influence have also been possible to capture through the interviews.

4.4.3.1 External Communications

As mentioned before, Rosetta Healthcare has a number of strategic partnerships with different radiology, pathology, and pharmacy providers [Refer to 4.2 for more information]. In addition to these three clinical partnerships, there exist a number of non-clinical partnerships with health funds and other logistics suppliers. According to the data collected during this research, these two types of external communications seem to have very different characteristics in the sense of using IS/IT to facilitate these communications. While the external communications with different health funds and suppliers are highly facilitated by IS/IT [Refer to 4.3.4.5 for more details], the clinical partnerships with different pathology, radiology, and pharmacy providers are being
slower and less efficient by the use of IS/IT in the current national health IT structure in Australia. The problem with these partnerships takes relatively different shapes according to the service of interest i.e. radiology, pathology, and pharmacy. Nevertheless, the origin of these different types of problems is the same as one of the senior interviewees explains:

“All of those are outsourced. Now we have partnerships or agreements or co-ventures with some of those organisations, but still, that means we don’t actually have control over what systems they have in place, but it also means that those systems are not integrated into our organisational systems. They’re not integrated into our PAS, for example. So any external PAS lab has its own identifiers for patient results, which is not our UR. When we send a request on a form, it will have our UR on there, but that requires the external provider to manually transcribe it because we don’t yet have CPOE across the group, and so there are potential data quality issues, data integrity issues. We sometimes get messages back from those providers, and we can’t match them up to a patient in our system because they’ve mistyped the name, or the date of birth, or the UR, or another value”.

[CIT 5]

This problem seems to be a national issue, and not limited to Rosetta Healthcare as another interviewee notes:

“Health information exchange; at the high level between various providers, whether it be GP, VMO, hospital, third party providers of labs, radiology, pharmacy, is really in its infancy in Australia”.

[CC2]

In order to gain deeper insights into the different problems face the current three clinical partnerships, a number of interviews were conducted with key people in the clinical IT
and executives groups. The identified problems with using IS/IT to facilitate these partnerships of Rosetta Healthcare with different clinical services providers are briefly summarised in Table 4.8.

As the noted problems are beyond the control of the individual healthcare providers or external clinical services providers, a number of interviewees stated that solving this dilemma should be by adopting a national initiative to standardise clinical information sharing electronically on a macro-level rather than micro-level as one of the interviewees emphasises citing the case of radiology services in other countries than Australia:

“It should be a national initiative. Places like the UK and Sweden have an electronic method for electronically sharing any radiology across the country. Then the provider just logs into that central repository or their sharing solution and can access any film at any time, and it also provides a facility to notify the doctor where films might be, because patients forget where they had a film done”.

[CC 4]

That is something another interviewee agrees on, citing some very limited attempts to create digital repositories for radiology services:

“In Australia, there's been no national approach to this. In New South Wales, they've got an enterprise image repository for the state. Queensland is trying to do similar things for sharing, but in both those states, it's been public hospitals only. In Victoria, you can join up to a Fuji sign-up system which 16 public hospitals have to share images, but it's a very manual process still, but you can push an image electronically. Again, it's only public hospitals sharing”.

[CC5]

Creating such a national initiative, however, is subject to a set of political conditions that needs to be understood from different perspectives as the next subsection shows.
Table 4.8 Identified problems with using IS/IT by Rosetta Healthcare to facilitate the communications with external clinical services providers

<table>
<thead>
<tr>
<th>Affected Clinical Services</th>
<th>Description</th>
<th>Selected quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem 1: Data Integrity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiology</td>
<td>✓ Due to lacking clear agreements on standardising information sharing between Rosetta Healthcare and its external clinical services providers, most of the information coming on board from external clinical partners are not easy to use and have data integrity issues with the in-house IS systems at Rosetta healthcare.</td>
<td>“The fact that those external providers are not in-house, they're not using our PAS, they're not using our UR, means that there's more room for data integrity to make it harder for clinicians to access the information.” [CC1]</td>
</tr>
<tr>
<td>Pathology</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Pharmacy</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td><strong>Problem 2: Slower care delivery</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiology</td>
<td>✓ Radiology providers are reluctant to print films due to their high cost and environmental repercussions. Thus, looking up the images from electronic systems is the only way to get these images. These practices are time-consuming in the current national health IT infrastructure.</td>
<td>“It's actually harder to get access to radiology images today than it was 17 years ago when I graduated. Now, 17 years ago, we weren't digital. We were analogue, and so a patient would have a film that would be printed out, and it would be given to the patient, and the patient usually had a bag of films, and they would accumulate their radiology story,</td>
</tr>
<tr>
<td>Pathology</td>
<td>✓ Due to the data integrity issue, only limited parts of the pathology are transferred using electronic</td>
<td></td>
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</table>


solutions. Finding the other parts takes longer time, and causes delays in delivering care.

**Pharmacy**

| ✓ | When patients are admitted, their medication lists need to be validated. With the partial IT integration with the pharmacy services providers, this needs more time from the clinical staff to draw a clear picture of the current medications needs for different patients. |

“Some of the external providers don't provide us electronic results. We only get results faxed through to us, and so they don't end up in our system. What we end up with in our system is potentially an incomplete record of pathology, which creates more work for our manpower and results in slower response to the actual clinical needs”.

**Problem 3: Less efficient delivery operations**

| ✓ | As more patients are no longer provided with their hard copy images, any possible issues with accessing the digital images can be time and effort consuming by the clinicians, whose schedules are already busy most of the time. |

The patient will go and see a doctor or a specialist and say, "I had my scan done at [xyz] or wherever they've been, and the doctor then has to know where that is. They have to have the application to boot up to look in. They have to have security permissions sorted out, and if not, Monday to Friday, they need to call up, 9 to 5, and get access." |

| ✓ | Similar to the case with the radiology results, not having instant access to full pathology results in one place causes lots of wasted resources (time, effort) and tangible outcomes. |

| ✓ | their longitudinal radiology images in a bag, and they'd take it with them wherever they go”. |

[CIT 4]
As patients are usually seen by different practitioners, the lack of a comprehensive and updated medication lists requires more time for coordination between different care providers. "So even for the electronic results for [Rosetta] pathology, they're actually printed through onto the fax machine in the ICU, and we get those results an hour and a half or a couple of hours before they end up in our PAS. It's much faster to go to the fax machine to look at whether the patient's anemic than it is to load up PAS.

[CIT 5]

**Problem 4: Lacking a seamless information integration**

<table>
<thead>
<tr>
<th>Pharmacy</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem 5: Safety</strong></td>
<td></td>
</tr>
<tr>
<td>Radiology</td>
<td>✓</td>
</tr>
<tr>
<td>Pathology</td>
<td>✓</td>
</tr>
</tbody>
</table>

The move from being patient-centric to a 'provider-centric' environment has created information silos that cannot be fixed without compromising the healthcare outcomes or clinicians’ satisfaction. The onus is being pushed to the doctor to go and find those images, and it might take 5, 10, 15, 20 minutes to pull up x-rays, where it used to take five seconds, so because we're not fully digital in the sense that we don't have seamless integration of radiology and access across the country, it's actually harder than it was.

[EXE 3]
<table>
<thead>
<tr>
<th>Pathology</th>
<th>✓</th>
<th>As a result of not receiving all the pathology results electronically, a comprehensive digital repository for pathology results is missing, which implies risk factors due to not having access to the full results required to create proper treatment plans.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacy</td>
<td>✓</td>
<td>There exists a real risk implied by not possessing a clear picture of the latest validated list of medications for different patients.</td>
</tr>
</tbody>
</table>

“*If there's something missing, if they're not aware, if they didn't send that test, and for various reasons multiple clinicians might be involved in a patient's care, they may not be aware that a test is being sent or that it's come back, but it's not on electronic; it's in the history and that so that leads to a risk, either from a quality point of view because we don’t know what the result is. We don’t know where to go looking for the result or wasting time finding the result, or a safety issue for similar reasons*.”

[CC 4]

I've got a potentially inaccurate list. I've got a patient who I can't reconcile those against, and that raises potential risks from not knowing what the drugs are, having an incorrect dose, having incorrect timing, or not being aware that a patient is also on something that they hadn't written on their lists. From my point of view, it's a different problem, but that raises the issue of safety. Medication safety is dependent on having clarity of the correct list of medications.

[CIT 5]
4.4.3.2 Political Influence

Two dimensions of political influence on the business value of IT were possible to capture during this research. The first is on the macro level, where the political structure of Australia plays a key role in determining the national health IT structure, while the second is on the micro level, and covers the internal political influences of different stakeholders within healthcare providers. For both levels, securing the political will is one of the main barriers to enabling better use of information systems for clinical purposes as this interviewee emphasises:

“The technical solutions are out there to do clinical systems and to do clinical information sharing and breaking down all these information silos, from a technology point of view, there's nothing to stop that happening if there's political will and there're finances to enable it, and that's just often the difficult things to get”.

[CIT 4]

Political Influence: The Macro Level

As a solution of the fragmented healthcare system, a number of interviewees called for a national initiative to create a central digital health repository. This repository enables storing all the radiology, pathology, pharmacy, and all other clinical information, and making them accessible by different healthcare providers, rather than depending on limited attempts to create these repositories on lower levels (such as a number of hospitals, within one region, or within one state):
“I still think it needs to be state/federal driven and ideally not a third-party privatised provider.”

[CIT 3]

The need for such a repository is now recognised by the Australian Government as the following interviewee notes:

“... They [The Australian Department of Health] are looking, and they were talking to us about the nation-wide health strategy and health information exchange is now an important thing for them to be addressing, because having gone through putting in basic electronic medical record systems in a number of public hospitals, they're now realising that there's a lot of benefits to be gained from sharing information, not just radiology, all information”.

[CIT 4]

Creating such a digital strategy, though, seems to be more challenging than just recognising the importance of it. The possible reasons behind that are the contextual characteristics of Australia and the complexity of the political system in the country as a multi-level system as a number of interviewees states, citing the case of New Zealand’s national digital health strategy:

“New Zealand is coming at it from a different point of view, and they've actually hooked up the whole country, but they came at it from a different direction, and they saw the value of actually incorporating information or sharing information from GPs to hospitals. In New Zealand, being, I guess, a smaller population, with a national
health service rather than national and state based services trying to do different things or independent things, they seem to have had better success at enabling health information exchange there, so different countries have done it in different ways”.

[CIT 2]

when asked about the My Health Records, and whether it can be used as a central national repository, a number of interviewees found it useful and of potential to increase the efficiency of information sharing, but not sufficient in its current capabilities, and not backed by a set of governmental incentives to enhance its uptake as this interviewee notes:

“... The incentive would be governments trying to encourage people to use that as a central repository with the GP uploading a health summary and medication list so that any time of day, because previously I've had to wait until Monday to Friday to ring a GP and say, "Can you please fax me through this patient's current list of medications?" because what I've got doesn't fit with what they brought in, or for other reasons, I'm concerned that it's not accurate”.

[CIT 4]

Political Influence: The Micro Level

A number of interviewees noted that internal politics within healthcare organisations is an apparent phenomenon, as noted by this interviewee, who had recently come to the healthcare industry from the defence industry:
“In the medical domain, there are so many political games going on between campuses, divisions within a division; it makes it extremely difficult to talk about IT without politics”.

[IT 6]

Another interviewee agrees with that, identifying some of the features of these political games within healthcare organisations:

“Some people, you know, don’t speak to them because they’re not a super user. You shouldn’t be even if they’re capable and competent and someone we’d like to be involved; it can make a difference. No, I should be the person you speak to but hang on a sec, you’re not the right person to speak to about this. I’m telling you; you’re not the right person. Yeah, there are too many political games and posturing it for my liking to make this simple”.

[IT 5]

These two interviewees represent the perception of the IT department on the role of other stakeholders (clinicians, management, administration, etc.) on the success of IS/IT investments from purchasing to deployment and utilisation. Similar pre-cautious perceptions were possible to capture from the clinicians and executives towards the role of IT department, not only in Rosetta Healthcare but in healthcare organisations in general:

“Always the problem with IT is you’ve got a traditional IT department who wants everything to the generic. Ideally, one piece of software that does everything, and
then you’re whole of the specific needs and this tension between specificity and generality. I think it’s a feature of the BHP or any big companies; it’s not unique to us”.

[EXE 2]

“Have I told you a story about libraries? You can read in a library and never lose a book because you never lend a book. It’s just sort of missing the point. The point being the dissemination of knowledge you’re going to lend those. This is the IT department; it doesn’t lend a book. Too tightly controlled, difficult to integrate with other systems and I don’t mean to be over, this is about most of them”.

[CC 3]

This political ‘tension’ seems to limit generating business value from IS/IT and leveraging the potential benefits of marrying clinical, technical, and managerial knowledge to make better IT investments as this senior interviewee notes:

“As long we [clinicians, IT, and management], cannot come to a point where we can openly discuss, the majority of our IT projects will not deliver us value back”.

[EXE 4]

Another aspect of the internal politics relates to the political influence of VMOs in purchasing IS/IT solution. A detailed discussion of this role can be found in 4.4.1.1.
4.4.3.3 Competition

As all healthcare professionals pledge the same vow to provide the care needed for patients (Sulaiman & Wickramasinghe, 2014), the competition in healthcare should be on efficiency rather than on quality as a number of interviewees emphasise:

“Yes, that’s competition. You can compete on efficiency but just sort of shouldn’t compete on quality.”

[CC 4]

“The competition is limited somewhat controlled competition because most professional practitioners would have difficulty in compromising on the quality, they all think they’re providing to this quality product, and I would have some difficulty with the trade-off between price and quality”.

[EXE 4]

According to this conceptual framing, competition plays two key roles in determining IS/IT investments and their business value. The first role is on the people level where attending to the VMOs’ needs (Including IS/IT needs) is crucial, while the second role is on the organisational level, where IS/IT systems need to be used by successful competitors to be of interest of other private hospitals.
The Competition on the People Level

The first level of competition Rosetta Healthcare has is to attract more VMOs to refer their patients to have their care episodes at the group’s different hospitals, as well as promoting the emergency department, as one interviewee notes below:

“\textit{You want people to come [to Rosetta Healthcare] if they’re privately insured and not to other competitors. That’s urgent stuff. 95\% of all referrals are through a VMO, so what you’re trying to do is encourage referral to a practitioner who works at your hospital and then having done the initial work at your hospital refer to other doctors within your hospital. That’s the competitive challenge.}”

[EXE 3]

Attracting more VMOs starts with attending to their requirements and needs. Thus, investing in specific IS/IT systems is particularly influenced by choice of powerful VMOs (The VMOs who refer more patients to Rosetta Healthcare than others) as this interviewee explains:

“\textit{... It is important in that quite often our doctors because they are visiting medical offices, work at other private organisations as well. So they will come in and say look! We’ve got this fantastic system, or they got this fantastic system at [XYZ] we can do this we can do that and everything. So we find the Executive directors and CEO were saying to us why cannot we do that at our hospital?}”

[IT 5]
The Competition on the Organisational Level

The other impact of competition on the organisational level can, in turn, be seen in two levels, internally (within Rosetta Healthcare) and externally (with other healthcare providers).

Within Rosetta Healthcare, a number of interviewees stated that the group is structurally and organisationally set up to be in competition against itself, as it has individual divisions that are competing financially against each other and performance wise against each other, rather than adopting a collaborative approach. This structure has had its direct impact on IS/IT investments as this interviewee explains:

“I think it's a glaring hole because we've got silos of executives, and each site tends to compete against each other. We don't have the consistency of applications and system across all the sites; this would prevent us leveraging these investments”.

[IT 5]

Externally, competition seems to play a key role in determining the IS/IT investments. The successful competitors, particularly, have a clear influence on purchasing clinical IS/IT solutions. This interviewee explains the reasons of that:

“Because, like any other organisations, we've made some investments which have been less than prudent. The hard work it's generated for us, and the heartache in terms of trying to manage the system invariably leads to a decision eventually to actually migrate or transition to another system. Absolutely the history is applied
in selecting another system and looking at that system within our competitors’ context”.

[EXE 7]

While the majority of the interviewees from the executives group agreed, they emphasised that the implementation process should follow the internal organisational characteristics of Rosetta Healthcare, and genuine attention needs to be paid to domesticating IS/IT solutions to the local needs of the organisation:

“I suppose we try and look at the best of what other people have put in, but it doesn’t mean necessarily we’re going to implement it the same way. With the ERP module, we had a specific problem or an area we identified as an opportunity around prosthesis management. We already had a, I suppose, a fix that was written specifically for us, but we actually did develop that module within our ERP. It wasn’t very risky because obviously, the backbone, which you find in supply system we took, we probably modified the supply system a little bit more, and we actually did develop with the vendor the prosthesis module”.

[EXE 2]

Apart from the impact of the competition on IS/IT investments and their potential business value, IT/IS has a key role in converting the competition to a collaborative atmosphere as several interviewees believe. This senior medical practitioner explains this patient-centric enabling role:

“In the US, where they have these multidisciplinary meetings, you could get lung cancer. You could collect all your information and submit it to a multidisciplinary meeting at Stanford Hospital, and they will give you an opinion. You might choose
to take that opinion and get it implemented locally that you might go to Stanford.
The future of cancer care is to have these meeting processes where you get all the
experts, formulating a treatment plan for your disease and you might get one from
Stanford, one from the memorial hospital in New York and one from Texas, the
three best cancer centres in the world. You might decide which one you’re going
to do, so that’s the future. Patients will get these opinions from these experts
outside the normal care process”.

[CIT 3]

4.4.4 Technology

Three main factors around technology were extensively mentioned by the participants
when discussing the business value of IT in healthcare: 1) Selecting the right IS/IT
solutions that meet the organisational needs, 2) The issue of information systems
integration, and 3) Data integrity, accuracy, and usability issues.

4.4.4.1 Characteristics of IS Products

Selecting the IS/IT is one of the essential steps in managing IS/IT. Not only is it crucial
for attaining the business value of IT in healthcare, but it also needs to be made carefully
based on thorough planning and analyses. The reason why selecting the ‘right’ IS/IT
product is important is explained by this interviewee:

“... Because it is going to affect everyone in the organisation in different ways.
It's going to affect the doctors in the sense that if it's done properly, it should make
it easier for them to get the information. If it's done badly, it's going to obviously
undermine them, but it will affect the nursing workflows. It will affect the allied health workflows. It will affect the administrative staff workflows. It will affect HIS workflows. It will affect billing and coding. It will affect business development managers.

[EXE 4]

Many interviewees agreed that there is no right or wrong IS/IT solution, as determining this is dependent on factors relate to the healthcare organisations, the systems themselves, and the context in which they are used:

“There's no right or wrong solution as to whether or not you go for a monolithic solution, so there's no answer, correct answer, I should say, as to whether or not a monolithic solution or a best of breed approach is right. Some hospitals prefer best of breed approach because they want the right system for each department. Consequently, that is much more problems or work required to maintain the integration, interfacing and uptime for those systems. A monolithic solution is simpler at the back end but then comes with compromises with workflow, flexibility, and whether or not it delivers value in each of those specific departments”.

[CIT 3]

Nevertheless, this study revealed a number of requirements any successful IS must ideally have as table 4.9 summarises.
<table>
<thead>
<tr>
<th>Requirements (IS/IT should be: )</th>
<th>Selected Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Much more interactive, and intelligent.</td>
<td>I mean, IT can only give you the data that you enter into it, but IT can facilitate. For example, there are things that IT can do. Let's say, a patient's blood pressure has been 130/80 and then you enter 180/90, a system could alert and say, &quot;Is this accurate?&quot; Or &quot;Is this deterioration?&quot; I think that there are things that an interactive system can do that a paper record can't do.&quot;</td>
</tr>
<tr>
<td>Easy, intuitive, and reliable especially in the clinical domain</td>
<td>Robust IT systems that are a bit like turning on your heating or your lighting. It's just assumed that it will work</td>
</tr>
<tr>
<td>Not expensive, usable</td>
<td>I think that there would be a commitment if it wasn't so expensive and I think if there wasn't the perception that only very few clinicians would actually engage with it. I think they see it as a big risk.</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Used successfully by other big healthcare organisations</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>We don’t want to be bleeding edge. We want to be leading edge. Generally, the approach we take with systems is it needs to be definitely proven, and it has to be proven in Australia, and it has to be ideally proven in health care and private health care. We don’t want to be the first generally to do anything along these lines.</em></td>
</tr>
<tr>
<td>[EXE 1]</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Problem focused, not solution focused</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Healthcare industry is being solution focused not problem focused: When I look externally, we don’t choose a system necessarily based on what solves the problem we have. It was very solution focused, not problem focused so they come in solutions and then look for the problem that it’s solving as opposed to what problem do I need, what actual things do I need to resolve.</em></td>
</tr>
<tr>
<td>[IT 4]</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Adaptable</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>You've got to have some adaptability within your system, and IT systems aren't built to be adaptable. They are built still, assuming a linear process and care. You're asking people to do even more difficult manoeuvres than they would have been given a finance system where they can process an invoice linearly or deal with financial information linearly.</em></td>
</tr>
<tr>
<td>[CIT 4]</td>
</tr>
</tbody>
</table>

### 4.4.4.2 Systems Integration

During the interviews, many of the participants discussed the problem of systems integration. This hurdle seems to have played key roles in limiting the business value of IT in the selected case. This is particularly relevant to Rosetta Healthcare as it is continuously witnessing expansions and acquiring more hospitals to join the group. These hospitals come equipped with their own IS/IT platforms, which creates systems integration issues with the group’s existing systems as described below:
“We have a lot of systems in place; we have between 260 and 300 applications across the board. A lot of those as we acquire businesses we bring those in. What we have been trying to do is standardise and consolidate, and we are still sort of struggling to do that.

[EXE 5]

“You got systems that don't talk to each other; there's already been a lot of investment in one system, and then they don't want to then have to modify”.

[IT 3]

Another reason for this problem in the clinical domain is the way clinical IS/IT systems are designed as another interviewee explains:

“IS products are designed in a way to serve the needs of specific craft groups. I always ask when I look at an IT system what was the professional background of the person who developed it, and I can reasonably predict whose needs it will serve best. Pharmacy information systems do a whole lot of things for pharmacists that make their life much easier. They don’t do much for doctors. A system developed for doctors does nothing for pharmacists or nurses, but it achieves the efficiency objectives of the person who developed it”.

[CC 2]

As a result of these issues, IS/IT can be a barrier to enhancing the organisational performance rather than an enabler:
“Well, IT should be a facilitator [of integration between different stakeholders in the healthcare], but if you build the IT, you could make it a barrier. For instance, if I build the IT system we’re implementing is fairly weak surgically. It’s good for radiotherapy, good for chemo. If we introduce that to the surgeons that will become a barrier because it doesn’t address their needs. We’ve got to develop a project going on to try to make it better for them so that’s an issue. It can be a barrier if it doesn’t deal with the interest of all the stakeholders”.

[CIT 3]

Not only does this reflect a technical problem that limits the business value of IT in healthcare, but it also mirrors an organisational-human dysfunction in this industry as another interviewee explains:

“The concept is that being a team made out of a number of craft groups is relatively new to the consciousness of healthcare professionals.”

[CC 3]

4.4.4.3 Data Issues

The problem around systems integration caused another issue around data, especially in the clinical domain. As discussed in 4.3.4.5, Rosetta Healthcare had standardised all its business operations by using one integrative BIS, which has helped to solve inconsistency problems. In the clinical domain, this problem is yet to be solved. Today, there exist a number of clinical information systems that are neither fully compatible nor interfaced. As a result, Rosetta Healthcare has more than one dataset in the clinical space. These
datasets are not standardised and don’t follow any agreed data dictionary, which raises concerns about data accessibility and usability, quality, and accuracy.

This issue is increasingly recognised by the clinicians at Rosetta Healthcare, and its impact is summarised as:

“Without the granular data, decisions are being made less informed way than they could be with a good system”.

[CIT 2]

“Lacking such good sets will affect executive directors and reporting. It will affect the executive by virtue of the fact that they’re the ones who are consuming the information that’s going into this system in order to make decisions not only about day to day activity, but strategic decisions about is this part of the business actually viable? Should we be trying to do ophthalmology at [Rosetta]? Should we concentrate on our core skills like oncology, cardiac, neuro and so on and so forth?”

[CC 4]

It will also limit the business value of the IS/IT that generate and/ or use these datasets:

If the data going in is rubbish, if it’s not standardised according to a common agreement or definition, if it’s not available in a usable, reliable, robust, valid form, in a timely manner, so I don’t get the information, if I get rubbish, if it doesn’t come in a manner that, or a time that allows me to deal with it, and I can’t
put it into a format that meets my audiences’ needs, then all of those things would prevent it; any of those things”.

[CIT 4]

In addition, it reduces the trust by clinicians in these systems, which negatively affects their uptake as explained by this interviewee:

I don't think they understand that if you deliver rubbish, the audience well... it takes a very long time to win their trust back. They give you trust to start with; if you if you get it wrong once, they tolerate it, if you get it wrong twice, then it’s a long road back. Clinical people don't have the information they need and just carry on doing things as they always did, or ignoring the information they get because it doesn’t meet their needs. Or they don't trust it.

[CC 2]

The approach followed by Rosetta Healthcare was to implement ‘better systems’ to create ‘better data sets’. Adopting this approach has resulted in additional information systems in the clinical space, and consequently additional data sets. This pain has encouraged decision-makers to follow a different approach as explained by this interviewee:

“Should we spend more money?” Money might be a side benefit, a side effect of it, but I think we should be looking at how we could maximise or optimise our current systems by getting the information where it needs to be, by altering it, by cleaning it up”.

[CIT 3]
This mission of standardising different data sets though has not been easy. Not only due to issues with systems, but also due to cultural barriers as described by this interviewee:

“It was hard. Getting people to accept the standard definitions was a challenge in the first place. That’s much less of a problem now, but certainly, 3, 4 years ago, that was a real problem. Everyone believes their definition was exactly the same. I took a group of people who were responsible for interpreting this information, and I told them, “We needed to write a definitions’ manual so that we’re all doing the same thing.” They assured me that we’re all doing the same thing. I said, “Well, then this meeting we’re very quick won’t it?” After 45 minutes, we’d agreed on one indicator. At that point, they realised that I had a problem, and that was, agreeing on what a complement is. So a very comfortable thing because it’s a good news story; trying to get them to agree was very interesting, but it was a great lesson for them”.

[CIT 1]

4.5 Findings

The findings of this study revealed a number of aspects that were not covered in the conceptual model presented in Chapter 2. These aspects are the factors affect attaining business value from IS/IT in both business and clinical domains. This, which is a finding in itself, required a second round of analysis to classify the findings into three categories as described below:

- **Expected Findings (EF):** The findings were discussed in the literature and contributed to building the conceptual model,
- **Emerging Themes (ET):** The extensively discussed points during the data collection and found to have played key roles in generating business value from IS/IT in healthcare,

- **Significant Findings (SF):** The findings that relate to the context of this study, *i.e.* the Australian healthcare system, and have impacts on the business value of IT. These findings are considered significant in the context of the study as the literature on the Australian healthcare system does not mention the impact of these conditions/factors on the business value of IT. This pertains mainly to VMOs (people), inter-organisational communications (healthcare ecosystem), and the underlying data issues and information systems that have both transactional and informational nature (technology).

Based on the data analysis performed in this study, the expected role of systems usability and the intention to use IS/IT was confirmed.

From a people perspective, the findings confirmed the need to establish prudent accounts management to manage the relationships with different IS/IT vendors in both clinical and business domains. The role of VMOs was found to be a significant finding and an emerging theme as it was discussed extensively during the interviews, especially in the clinical domain.

From a process perspective, the role of IT governance to attain the business value of IT investments was shown to be crucial (Peter Haddad et al., 2015; Weill & Ross, 2004). The findings of this study confirm that in the context of healthcare. Two other aspects around processes were discussed in details during the interviews: change management
and project management. The impacts of these two practices were not noted in formulating the original conceptual model.

From a healthcare ecosystem perspective, the findings confirm the impact of the political influence of different stakeholders on different macro, meso, and micro levels on IT investments in healthcare organisations. This is particularly apparent in implementing clinical IS/IT. Although the impact of competition on the business value of IT in healthcare was expected, the findings revealed unexpected dimensions of this impact. The significant finding in the healthcare ecosystem was the impact of external communications of the selected case with external providers of medical providers (pathology, pharmacy, and radiology). More specifically, the semi-digitised, outsources, not standardised nature of these communications appeared to have had crucial impacts on the business value of IS/IT investments.

From a technological point of view, the roles of infrastructural IT, information IT, and transactional IT were also confirmed almost as expected with some unique attributes of these types of IT in the context of healthcare. Also, the role assigned to the actual characteristics of IS products and the systems inter-operability was confirmed as expected. The significant findings were the data integrity issues as an emerging infrastructural IT required to support IS/IT in the clinical domain, and the transactional/informational IT as an emerging type of IT that was not part of the IT Portfolio (Weill & Broadbent, 1998). Table 4.1 summaries the findings of this study. Deeper discussions of these findings and their implications on theory and practice will be the core element of the next chapters.
Table 4.10 A summary of the key findings on the business value of IT in healthcare as the data

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-theme</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>People</td>
<td>VMOs</td>
<td>ET, SF</td>
</tr>
</tbody>
</table>
|               |           | • Meeting the requirements of VMOs is a key criterion to be met in any IS/IT at Rosetta Healthcare  
|               |           | • Depending on VMOs plays negative roles on the business value of IT due to:  
|               |           |   o Creating additional information silos  
|               |           |   o Security and privacy issues  
| In-house users|           | EF       |
|               |           | • Health IS/IT should target nurses as they represent the biggest medical workforce in hospitals.  
|               |           | • Internal users are not assigned significant roles in designing or investing in IS/IT.  
|               |           | • The direct impact of this is limiting the business value of IT, as well as causing massive waste of organisational resources such as time, effort, planning, and re-planning.  
|               |           | • The intention of the internal users to use IS/IT systems when they first know about them dwindles when they realise their inputs were not taken into consideration  
|               |           | • IS/IT users, especially in the clinical domain, have a low level of trust in the information they produce or receive, i.e. they don’t know how this information is used and why.  
|               |           | • Engaging users by showing the full path of the information they deal with can help generate the business value of IS/IT.  
| Vendors       |           | EF       |
|               |           | • The relationships with vendors vary from being comfortable partnerships to a source of trouble depending on the area of interest (business IT, clinical IT, and research and learning IT respectively).  
|               |           | • The level of trust between the organisation and its different vendors seems to be low due to the misalignment in the business objectives of both parties, which has played negative roles in generating the business value of IT.  
|               |           | • Vendors should have longevity in the market with sufficient resources as a start point  
|               |           | • Healthcare industry tends to use IS/IT that have been used and proven their benefits in other industries/organisations.  
|               |           | • IS/IT customisation should be avoided as this creates single points of failure for healthcare organisations.  

202
<table>
<thead>
<tr>
<th>Process</th>
<th>Change Management</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>• In order to enable IS/IT to generate business value, more attention needs to be paid for change management</td>
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<tr>
<td></td>
<td>• Lacking a prudent change management is likely to cause IS/IT projects to be incomplete and unable to deliver business value.</td>
</tr>
<tr>
<td></td>
<td>• The increased use of IS/IT has created a massive challenge to the organisation. <em>i.e.</em> the amount of change the business can cope with.</td>
</tr>
<tr>
<td></td>
<td>• As an immature industry in this regard, healthcare seems to limit the scope of change management still to process improvement.</td>
</tr>
<tr>
<td></td>
<td>• Change management should address people, process, and communications.</td>
</tr>
<tr>
<td></td>
<td>• Proper training is the enabler for any change management plan centred on the three dimensions above (people, process, and communications).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IT Governance and Project Management</th>
<th>ET, EF</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The selected case adopts a rigorous IT governance process, in which executives, IT, and senior management are involved in determining IS/IT investments.</td>
<td></td>
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<tr>
<td>• Project management is a must for delivering successful IT services.</td>
<td></td>
</tr>
<tr>
<td>• The IT governance and project management approaches adopted at the case study encourage the sense of ownership of IT projects to support clear and transparent accountability practices.</td>
<td></td>
</tr>
<tr>
<td>• Maintaining clear IT governance and project management approaches helps attain business value of IT.</td>
<td></td>
</tr>
<tr>
<td>• Generating business value of IT is not a direct result of IT governance and project management, but they enable the best opportunity to succeed in delivering IS/IT services.</td>
<td></td>
</tr>
<tr>
<td>• The role of IT department in any IT governance approach should be more as an advisor and supportive than leading. A more leading role is needed for the IT department in project management.</td>
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<table>
<thead>
<tr>
<th>Healthcare Ecosystem</th>
<th>Competition</th>
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<tbody>
<tr>
<td>• the competition in healthcare should be on efficiency rather than on quality</td>
<td></td>
</tr>
<tr>
<td>• Competition plays two key roles in determining the business value of IT in healthcare:</td>
<td></td>
</tr>
<tr>
<td>o People level: Attracting more VMOs to refer their patient to the hospital. The use of state-of-the-art IS/IT has been used as an enabler for this attraction.</td>
<td></td>
</tr>
<tr>
<td>o Organisational level:</td>
<td></td>
</tr>
<tr>
<td>• Internally: different departments have been competing against each other,</td>
<td></td>
</tr>
</tbody>
</table>
which has created silos of executives and limited the utilisation of IS/IT investments.

- Externally: successful competitors have clear influence on purchasing clinical IS/IT solutions
- IT/IS has a key role to play in converting the competition to an enabler for collaborative atmospheres to deliver patient-centric value-based healthcare delivery system.

### Political Influence

- The macro level:
  - A national initiative to create a central digital health repository is advised to address the fragmented nature of the Australian healthcare system.
  - The complexity of the political system in the country as a multi-level system creates additional roadblocks to creating such a national digital repository.
- The micro level:
  - Internal politics within healthcare organisations is an apparent phenomenon
  - The majority of internal politics in healthcare organisations seem to be centred on power dynamics.
  - The political tension between different craft groups, IT, and management is likely to limit the business value of IT.

### External communications

- While the external communications of the selected case with different health funds and suppliers are highly facilitated by IS/IT, the clinical partnerships with different pathology, radiology, and pharmacy providers are slower and less efficient by the use of IS/IT in the current national health IT structure in Australia.
- Five problems were possible to capture with using IS/IT by Rosetta Healthcare to facilitate the communications with external clinical services providers (Table 4.8):
  1. Data Integrity
  2. Slower care delivery
  3. Less efficient delivery operations
  4. Lacking a seamless information integration
  5. Safety

### Technology IS/IT Characteristics

- Selecting the ‘right’ IS/IT is one of the essential steps in managing IS/IT
There is no right or wrong IS/IT solution. Rather, there is suitable or not suitable IS/IT for each healthcare firm. Six requirements were captured for any IS/IT to deliver business value in healthcare (Table 4.9):

1. Must be much more interactive, and intelligent.
2. Easy, intuitive, and reliable especially in the clinical domain
3. Not expensive, usable
4. Used successfully by other big healthcare organisations
5. Problem focused, not solution focused
6. Adaptable

**Systems Integration**

- Lacking integration between different IS/IT has played negative roles in generating business value of IT investments in the selected case.
- Clinical IS/IT tend to be designed to serve the needs of specific craft groups, which creates multiple IS/IT that are not easy to integrate with each other.
- The lacked integration between different IS/IT reflects both technical problems and organisational/ human dysfunctionalities in the healthcare industry

**Data Issues**

- Due to the unplanned move towards adopting IS/IT in healthcare; multiple datasets have been built in the last decade. These data sets tend to be unstructured, unstandardised and not following any agreed data index/dictionary.
- Lacking an agreed data dictionary has limited the business value of IT in the selected case, and lowered the trust by clinicians in these systems.
- Technical and cultural barriers have negatively affected the efforts to standardise different clinical datasets at the selected case.

---

### 4.6 Summary

This chapter has served to present the results from the interviews and archival data collected at the selected case. Different views from clinical and non-clinical perspective were presented in this chapter around the business value of IT in healthcare. The
participants had a vast range of views on different matters pertaining to the actual impact of different IS/IT on different outputs. In general, attaining business value from clinical IT appears to be slower and harder than business IT. Different reasons for this difference were discussed. Furthermore, different IS/IT in both the clinical and business domains were also examined to evaluate their business value, and the results of these examinations were presented. The data analysis presented in this chapter revealed four main themes that found to have played key roles in generating the business value from different IS/IT. These themes are People, Process, Technology, and the Healthcare Ecosystem.

The findings were then classified into expected themes, emerging themes, and significant themes to the selected case, and the context of the Australian healthcare system.

The next two chapters are set to present an in-depth discussion of the results revealed by this study and their implications to the selected case, the healthcare system in Australia, and the contribution of this study to theory and practice.

***
Chapter 5
Discussion
Chapter 5: Discussion

The results of this research have revealed that evaluating the business value of IT in healthcare is complex and subject to several factors at micro, meso, and macro levels. These factors pertain to people, processes, technology, and the healthcare ecosystem. Table 5.1 summarises these factors and the levels at which they play roles in determining the business value of IT in healthcare. In addition, the results have shown that conceptualising the business value of clinical IT tends to be more challenging compared with that of business IT. Further, the use of the IT Portfolio concept (Weill & Broadbent, 1998) to examine different IS/IT in the healthcare context was useful to provide a deeper understanding of the potential of IS/IT to deliver business value to healthcare providers in both clinical and non-clinical domains. This theory can be further enhanced to address the uniqueness of the healthcare industry (Huppertz, Strosberg, Burns, & Chaudhri, 2014) compared with other industries such as banking, retail, and manufacturing. The results of the current research also showed the usefulness and limitations of the Enterprise of Healthcare Delivery Model (Weill & Ross, 2004), leading to possible enhancements on this model.
Table 5.1 The factors affect the business value of IT in healthcare and the level of their impacts as the results revealed

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-themes</th>
<th>Impact on Micro level</th>
<th>Impact on Meso level</th>
<th>Impact on Macro Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare Ecosystem</td>
<td>Competition</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Political Influence</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td></td>
<td>External Communications</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>People</td>
<td>VMOs</td>
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<td></td>
<td>In-house Users</td>
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<td></td>
<td>Vendors</td>
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<td>Process</td>
<td>IT Governance</td>
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<td></td>
<td>Project Management</td>
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<td>Change Management</td>
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<tr>
<td>Technology</td>
<td>IS Products</td>
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<td>Integration</td>
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<td>✓</td>
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<tr>
<td></td>
<td>Data Issues</td>
<td></td>
<td>✓</td>
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The findings gained from this research were used to enhance the initial framework presented in Section 2.6, Figure 2.9. The modified framework is simpler, yet more capable of capturing the impact of different contextual conditions (micro, meso, and macro levels) on the business value of IT in healthcare.

This chapter provides a deep understanding of the results gained from this study. In so doing, this chapter is organised into five sections. Section 5.1 summarises the results pertaining to the interviewees’ perceptions on the business value of IT in both clinical
and non-clinical domains and maps the examined IS/IT onto the four categories of IT investments (Weill & Broadbent, 1998) and the Enterprise of Healthcare Delivery Model (W. B. Rouse & Cortese, 2010). Section 5.2 discusses the conceptual components of the research framework, and Section 5.3 discusses the barriers and facilitators to generating business value from IT investments based on the four identified themes (People, Process, Technology, and Healthcare Ecosystem). Section 5.4 presents the revised Business Value of IT in Healthcare Model based on the findings from this study. Finally, Section 5.5 provides a summary of the elements discussed.

5.1 The Business Value of IT in Healthcare: Discussion

In order to understand the business value of IT in healthcare, defining measures for the organisational performance in healthcare is crucial. The interviews with different participants acknowledged the urgent need to develop clinical performance measures, which agrees with previous studies such as (McGlynn & Asch, 1998; Peterson et al., 2010). Defining the organisational performance in healthcare seems to be problematic, especially in the clinical domain. The non-linearity of care, the non-monetised nature of clinical outcomes, and the uniqueness of the healthcare industry are the most consistent reasons why defining healthcare performance has been limited to process measures, and difficult to capture the actual achieved clinical outcomes. This agrees with findings by R. S. Kaplan and Porter (2011), who criticise the approach used by healthcare providers to define the relationship between cost and quality of care based on specialty or service department levels, rather than on the actual cost and quality of outcomes achieved.
Despite the difficulty defining measures to evaluate the organisational performance in healthcare, the interviews revealed several useful clinical and non-clinical measures of the organisational performance in healthcare (refer to 4.3.2). Seven non-clinical measures were identified with these measures can be monetised and quantified. However, five of the seven clinical measures are qualitative and cannot be monetised. This partially agrees with Nerenz and Neil (2001), and further expands their findings to cover additional clinical measures including patient centeredness, and three different aspects of care, namely equity, continuity, and consistency. Most recently, these aspects are becoming more important and of interest to care providers and patients (Chua, D'Amours, Sugrue, Caldwell, & Brown, 2009; LeRouge & Wickramasinghe, 2013; Nyweide et al., 2013).

Principally, most the interviewees were positive regarding the role IS/IT can play to enhance the aforementioned performance measures at the operational level rather than at the strategic level, as can be understood from the following interviewees:

“I think the IT should facilitate that continuity of care so that certainly, it should facilitate outreach because people don't just want an acute event that has usually got out of the practitioners involved in their care outside the hospitals, a particular service, and then they'll go back to that care. I think IT has a big role in giving those other practitioners access to information about the patients with the patient's permission, of course, but about their care, I think IT has the potential to reduce that repetitive questioning that patients often go through”.

[CC2]
“If I look at the business, and I'll start with putting the patient at the centre of the business. If I draw a map around the patient, you have what I call core services. Let's say they have an appendectomy. There's value add in their post-operative care, and there's value add in terms of their actual discharge and their level of functional improvement outside. That's what I call core. Inside that, there's basically the clinical services that actually go with it. IT in that area, can play a significant role in basically making sure you minimise what I call the non-value add activities; the repetition of information, trying to find have you got the right patient, the near real-time transfer of information, the single point of entry of information so that once operation notes are put in, then you might want to say out of that comes a summary that goes into a discharge summary, etcetera. For me, that's a core bit”.

[CIT 2]

“We see that there is a huge benefit for all three things of financial, patient outcomes, and efficiency with the use of IS/IT. Because of the way the world is today, if we don't jump on board, we're going to get left behind. There is certainly a view that we need to jump on. The board have made a significant investment over the next five years additional to what we normally would spend in this space, so it's quite a big... it's quite a significant investment”.

[IT 1]
The role of IT in the expected services, [such as] the patient's admission process in terms of their ability to find their way through the hospital, their ability to be able to do for example their financial and their billing stuff, there are services that they require here, such as cleaning, domestic services, meals, pharmacy, allied health, all the other things that actually go around that core service. Value add proposition for me is IT actually reduces the amount of non-value add activity and gives better patient experience.

Comparing the clinical IS/IT to business IS/IT revealed that generating business value from the former is slower, and harder to realise compared with the latter. The reasons behind this difference were centred on the limited ability to measure clinical outcomes, which agrees in part with K. Cresswell and Sheikh (2013) and expands their work by identifying three reasons that limit the ability to define clinical outcomes (refer to 4.3.3). Specifically, four clinical information systems and one business information system were examined in this study (refer to 4.3.4). The results showed that most the studied clinical IS have, 1) helped enhance patient safety by adhering to care protocols and standards, and reducing medical errors and clinical incidents, which potentially reduces cost; and, 2) had less impacts on the efficiency of care delivery operations given the clinical domain is partially digitised and partially paper-based. This agrees with the findings of several studies (Middleton et al., 2013; Sue Bowman & RHIA, 2013). The results also showed that the examined integrated business IS/IT solution had shown positive impacts on the
efficiency of operations and running cost of the hospital. This agrees with Weill and Broadbent (1998) that information systems can be used to reduce the cost of operations and substitute significant workforce resources by using IS/IT that are capable of a higher volume of transactions in a given time compared with human resources. Figure 5.1 illustrates the different impacts of the studied IS/IT in both the clinical and business domains.

![Image of Figure 5.1](image-url)

**Figure 5.1** The impacts of the examined IS/IT on clinical and non-clinical performance measures in the healthcare sector
Table 5.2 and Table 5.3 map the studied clinical systems onto the IT Portfolio (Weill & Broadbent, 1998) and the Enterprise of Healthcare Delivery Model (W. B. Rouse & Cortese, 2010) to better understand the business value of infrastructural, transactional, informational, and strategic IT in the different levels of healthcare delivery.

**Table 5.2 Mapping the studied CPOE and IRS systems onto IT Portfolio (Weill & Broadbent, 1998) and the Enterprise of Healthcare Delivery (Rouse & Cortese, 2010) models**

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Components</th>
<th>CPOE</th>
<th>IRS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IT Portfolio</strong></td>
<td>Infrastructure</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Internet, intranet, computers, servers, databases</td>
<td></td>
<td>Internet, intranet, computers, servers, databases</td>
</tr>
<tr>
<td></td>
<td>Transactional</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Data entry/ input, like • Identification • Progress notes • Medication scheduling • Discharge checklist • Treatment plans</td>
<td></td>
<td>Data entry/ input, like • Incident details • Level of reporting • Actions required • Destination of information</td>
</tr>
<tr>
<td></td>
<td><strong>Informational</strong></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Facilitating information sharing within different craft groups rather than using paper records</td>
<td>Facilitating real-time information exchange among different departments and personnel</td>
<td></td>
</tr>
<tr>
<td>Strategic</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>Healthcare Delivery</strong></td>
<td>Healthcare Ecosystem</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>All of the systems work in the Australian healthcare ecosystem. The only difference is that CPOE is American made and is used campus-wide, while IRS is Australian made and is used group wide.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Structure</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Both systems require re-engineering healthcare processes to help generate business value. This includes both internal and inter-organisational processes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery Operations</td>
<td>X</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Detection</td>
<td>Detection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diagnosis</td>
<td>Diagnosis</td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>Treatment</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Recovery</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Clinical practices</td>
<td>CPOE</td>
<td>IRS</td>
<td></td>
</tr>
</tbody>
</table>
Table 5.3 Mapping the studied DCCS and SMR systems onto the IT Portfolio (Weill & Broadbent, 1998) and the Enterprise of Healthcare Delivery (Rouse & Cortese, 2010)

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Components</th>
<th>DCCS</th>
<th>SMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT Portfolio</td>
<td>Infrastructure</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>✓ Internet, Intranet, computers, servers, databases</td>
<td>Internet, Intranet, computers, servers, databases</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transactional</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>✓ Data entry/ input, like Identification, Progress notes, Medication scheduling, Discharge checklist, Treatment plans</td>
<td>Data entry/ input, like Patient personal details, Medical results, Care plans, Clinicians involved in care delivery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Informational</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>✓ Enabling access to unified information about different diseases and best practices to manage them based on different clinical conditions</td>
<td>Facilitating real-time information exchange among different departments and personnel based on specific protocols</td>
<td></td>
</tr>
<tr>
<td>Strategic</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Healthcare Delivery</td>
<td>Healthcare Ecosystem</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>All of the systems work in the Australian healthcare ecosystem. The functional difference between these two systems is that DCCS utilises an international database of diseases that is customised to fit the Australian context, while SMR is used to digitise patients’ medical records.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Structure</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Both systems require re-engineering healthcare processes to help generate business value. This includes both internal and inter-organisational processes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery Operations</td>
<td>✓ Detection</td>
<td>✓ Detection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Diagnosis</td>
<td>✓ Diagnosis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Treatment</td>
<td>✓ Treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Recovery</td>
<td>✓ Recovery</td>
<td></td>
</tr>
<tr>
<td>Clinical Practices</td>
<td>CDSS</td>
<td>EMR(^{10})</td>
<td></td>
</tr>
</tbody>
</table>

\(^{10}\) SMR was considered as an introductory system to fully electronic medical records at the selected case.
As can be noted from Table 5.2 and Table 5.3, all of the clinical IS/IT share the same infrastructure (Internet, intranet, computers, servers, and databases), and facilitate transactional processes such as data entry, data processing. Two major points can be taken from these two tables:

1. **Informational IT solutions are the most implemented systems:** The four examined clinical information systems are of informational nature, *i.e.* they provide information for managing and controlling the care delivery, and they support clinical decision making, communication and accounting. This agrees with the definition and functionality of informational IT as stated by Weill and Broadbent (1998). It also shows that the healthcare industry tends to invest in clinical information systems that are capable of facilitating information sharing between different stakeholders and craft groups.

2. **Strategic IT solutions are almost absent from the clinical domain:** The four examined systems are of informational nature with some transactional functionalities. None of the examined clinical information systems had a clear strategic component/ nature. This may indicate that healthcare industry is not ready yet to create a new use of IT in care delivery, and IT is not a strategic enabler for healthcare organisations. Rather, it is heavily used to manage different processes to run smoothly at lower costs and higher productivity. This is supported by findings from the interviews as presented throughout Chapter 4. When the interviewees were asked about the main reason for investing in IS/IT, the vast majority of the participants in the study thought reducing the cost was the
primary reason, while enabling or finding new business strategies was not cited as one of the main reasons.

The above suggests that the business value of clinical IT is currently limited to, 1) facilitating information sharing within and among healthcare organisations, and 2) supporting care delivery at the operational level, not at the strategic level.

Similarly, the studied business information system (BIS) can be mapped onto the models used in this study (Table 5.4).

Table 5.4 Mapping the studied BIS onto IT Portfolio (Weill & Broadbent, 1998) and the Enterprise of Healthcare Delivery Model (W. B. Rouse & Cortese, 2010)

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Components</th>
<th>BIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT Portfolio</td>
<td>Infrastructure</td>
<td>Internet, Intranet, Computers, Servers, Databases</td>
</tr>
<tr>
<td></td>
<td>Transactional</td>
<td>Data entry/ input, like</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Invoices</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• account receivable accounts payable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Managing human resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Purchase orders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Managing cash flow and tracking different processes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Maintenance and engineering jobs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Interfacing health fund and other partners</td>
</tr>
<tr>
<td>Healthcare Delivery</td>
<td>Informational</td>
<td>Enabling access to unified information about different diseases and best practices to manage them based on different clinical conditions</td>
</tr>
<tr>
<td></td>
<td>Strategic</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Healthcare Ecosystem</td>
<td>The system interfaces the organisation with different players in its healthcare ecosystem. This includes payers (patient and insurers), suppliers, and other healthcare organisations.</td>
</tr>
<tr>
<td></td>
<td>System Structure</td>
<td>The system integrates the operations in a number of departments and helps increase the efficiency and productivity at a lower cost.</td>
</tr>
</tbody>
</table>
As noted in Table 5.4, the selected case uses an integrated business information system that can facilitate different processes and operations. This system is predominantly transactional, as it processes and automates the basic, repetitive transactions of the selected case. The findings from the interviews showed that this system had helped reduce the cost by substituting capital for labour and handling higher volumes of transactions with greater speed and less unit cost, which agrees with the definition and functionality of such systems as stated by Weill and Broadbent (1998). It also expands their work to show that transactional IT in healthcare have other informational functionality/nature, as interfacing different suppliers and payers has helped the decision makers at the selected case to better manage different operations at the business level. This is achievable by having access to real-time data on the business performance and the dynamically changing market conditions.

For example, the BIS system allowed decision makers to track the demand on specific clinical specialties by monitoring the transactions with different health funds. Thus, this transactional system has actually provided valuable information to direct the business towards new emerging clinical specialities, as stated by this interviewee:
“It [BIS] is not just a system that we feed with data; it has been feeding us with a wide range of information on our business and where we should head”.

Hence, with the increased use of business analytics and business intelligence, Transactional IT are not merely transactional anymore, they have both transactional and informational components/natures.

Based on the findings from the interviews, the studied information systems played no roles to make healthcare delivery patient-centric, or to enhance the accessibility to care, nor equity of care. Additionally, none of the examined information systems (both in the clinical and non-clinical domains) had direct impacts on the bottom line and net gain of the organisation. As a result, the business value of transactional IS/IT with informational components can be realised by the enhanced operating gain, cost efficiency, better resources utilisation, and higher efficiency of operations. Similarly, the business value of informational IT in the clinical domain can be realised by the enhanced patient safety, and better care in two dimensions, namely continuity and consistency as Figure 5.2 summarises.
Figure 5.2 The business value of informational and transactional IT in healthcare as the results of this study revealed

Attaining the business value from IT investments, however, is subject to the availability of a robust IT infrastructure (Weill and Broadbent, 1998). As summarised in Table 2.11, IT infrastructure is the foundation of information technology capacity, which is delivered as reliable services shared throughout the firm and coordinated centrally, usually by the information technology group (IT Department). By definition, it includes both the technical and the managerial expertise required to provide reliable services. According to this framework, IT infrastructure includes both hardware and software from a technical perspective, and the human infrastructure to manage the IT portfolio in general (Weill and Broadbent, 1998). Having the required infrastructure services in place significantly increases the speed with which new applications can be implemented to meet new strategies, thus increasing the firm’s strategic agility and flexibility (Weill and Broadbent, 1998).

The findings gained from this study showed that the IT infrastructure at the selected case had both the technical capabilities and managerial skills required to manage the IT
portfolio. This was discussed in details in Section 4.3.1. The majority of the interviewees agreed that the IT infrastructure was robust, flexible, and supportive of any prospect information system that meets the group’s information technology architecture. The human component of the IT infrastructure was also found robust and equipped with a wide range of managerial and technical skills. This can be seen from the diversity of roles different IT personnel had, and the long years of experience the majority of the IT department possessed. Upon the availability of these two requirements, the move towards implementing new information systems, and attaining business value from them, should be smooth and faced with fewer hurdles. This was not the case with most of the newly implemented systems, especially within the clinical domain. Upon following up on the possible reasons behind this, the majority of the participants in this study explained that lacking robust, usable, and agreeable data sets had played a negative role in generating business value from the clinical IT investments. This issue was discussed in detail in Section 4.4.4.3 (Data Issues). Hence, the findings of this study expand the concept of IT infrastructure to include data in addition to the other components, namely technical and managerial capabilities. This expansion is particularly crucial given the increased recognition and use of business intelligence and business analytics in the healthcare as expounded previously (Boonstra & Broekhuis, 2010), which supports the findings of this study.

Despite the role of IT infrastructure in generating business value from IT investments, other contextual conditions appear to have played key roles in determining the business value of the examined IS/IT in healthcare, as discussed below.
5.2 The Contextual Components of the Research Framework

The initial Business Value of IT in Healthcare Model presented in Section 2.6 and illustrated in Figure 2.9 identified the main themes under which the business value of different types of IT are examined in this study. Table 5.5 revisits the elements from the initial framework.

Table 5.5 The identified elements from the conceptual model based on the literature

<table>
<thead>
<tr>
<th>Context</th>
<th>Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare ecosystem (Society)</td>
<td>Payer</td>
</tr>
<tr>
<td></td>
<td>Regulators</td>
</tr>
<tr>
<td></td>
<td>Competitors</td>
</tr>
<tr>
<td></td>
<td>Healthcare providers</td>
</tr>
<tr>
<td></td>
<td>Patient</td>
</tr>
<tr>
<td>System Structure (Organisation)</td>
<td>Collaboration</td>
</tr>
<tr>
<td></td>
<td>Integration</td>
</tr>
<tr>
<td></td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>External</td>
</tr>
<tr>
<td>Delivery operation (Processes)</td>
<td>Detection</td>
</tr>
<tr>
<td></td>
<td>Diagnosis</td>
</tr>
<tr>
<td></td>
<td>Treatment</td>
</tr>
<tr>
<td></td>
<td>Recovery</td>
</tr>
<tr>
<td>Clinical Processes</td>
<td>Clinical Data Repository (CDR)</td>
</tr>
<tr>
<td></td>
<td>Clinical Decision Support Systems (CDSS)</td>
</tr>
<tr>
<td></td>
<td>Computerised Practitioner Order Entry (CPOE)</td>
</tr>
<tr>
<td></td>
<td>Laboratory Information Systems (LIS)</td>
</tr>
<tr>
<td></td>
<td>Nursing Documentation (ND)</td>
</tr>
<tr>
<td></td>
<td>Order Entry (OE)</td>
</tr>
<tr>
<td></td>
<td>Pharmacy Management System (PMS)</td>
</tr>
<tr>
<td></td>
<td>Physician Documentation (PD)</td>
</tr>
<tr>
<td></td>
<td>Radiology Information System (RIS)</td>
</tr>
</tbody>
</table>
The findings from this study, however, enabled a better categorisation of different aspects around the business value of IT in healthcare. Also, additional factors that had not been noted in the initial framework were found to have played key roles in determining the business value of IT in the context of healthcare. Table 5.6 presents the elements that were identified as key factors that impact the generation of the business value of IT in healthcare, and illustrates their consistencies with the initial Business Value of IT Model.

Table 5.6 Identified elements from the conceptual model based on the study findings

<table>
<thead>
<tr>
<th>Context</th>
<th>Elements</th>
<th>Consistency with initial framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare ecosystem</td>
<td>External Communication</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Competition</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Political Influence</td>
<td>No</td>
</tr>
<tr>
<td>System Structure (Organisation)</td>
<td>Change management</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Project Management</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>IT Governance</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Collaboration</td>
<td>Yes</td>
</tr>
<tr>
<td>People</td>
<td>Visiting Medical Officers (VMOs)</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>In-house users</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Vendors</td>
<td>No</td>
</tr>
<tr>
<td>Technology</td>
<td>Characteristics of IS Products</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Data issues</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Integration</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The findings from the study manifested that only five elements of the initial framework elements were consistent with the revised conceptual model. These are competition, collaboration, characteristics of IS products, underlying issues centred around the
existence of robust and agreeable digitised clinical data repositories, and the integration and interfacing between different IS/IT platforms used by healthcare organisations.

The following sections discuss these different contextual factors and their impacts on the business value of IT investments.

5.2.1 The Healthcare Ecosystem Context

Three aspects of the healthcare ecosystem were found to have played significant roles in determining the business value of IT in healthcare; namely external communications, political influence, and competition.

5.2.1.1 External Communications

The results revealed that lacking a national initiative to handle the communications between different organisations in the context of healthcare had limited the value added by IT investments in healthcare. Although most of the today’s healthcare organisations in Australia have some advanced IS/IT platforms, inter-organisational information sharing practices do not appear to have been well established. This confirms findings by Wickramasinghe, Fadlalla, Geisler, and Schaffer (2005) that the healthcare industry has yet to realise the full potential of the e-business revolution in the form of e-health. The findings also support the components of the framework proposed by Wickramasinghe et al. (2005) to help countries and healthcare organisations to establish an accepted level of readiness to fully adopt different aspects of e-health, especially the urgent need to create national architectures of IS/IT, and standardising policies, protocols and procedures.
around the use of e-health as prerequisites. It was also possible to differentiate two levels of information sharing, namely clinical data and administrative data (Wickramasinghe et al., 2005). In this regard, the findings from this study, 1) confirm that these two categories of data are comprehensive and cover all aspects of information sharing between healthcare organisations and their external partners; and, 2) support and expand the findings of this model further that sharing clinical information between healthcare organisations and their external medical services providers (pathology, radiology, and pharmacy) is much more complex and lags behind sharing administrative information (with partners such as health funds and suppliers).

The results also showed that lacking an initiative to create national digital repositories had played a negative role in limiting the potential value of adopting IS/IT for both healthcare organisations and their partners. This also caused all interfacing organisations to lose the competitive advantage IS/IT can potentially provide. This confirms the theory of Relational View of Competitive Advantage (Dyer & Singh, 1998) that a single firm cannot achieve competitive advantages by itself as when it enters full partnerships with other stakeholders (partners, suppliers, and other healthcare organisations in the context of healthcare). This appears to be the case with today’s healthcare organisations in the Australian context, which not only limits their benefit from IS/IT investments as complementary resources and capabilities (Farley et al., 2013; Grover & Kohli, 2012), but also causes five problems as discussed in Chapter 4 (refer to 4.4.3.1).
5.2.1.2 Political Influence

Two aspects of political influence were revealed by the findings of this study. The first is on the macro level, where the political structure of Australia plays a key role in determining the national health IT structure, while the second is on the micro level, and covers the internal political influences within healthcare providers.

Creating a national digital health repository that can be accessed seamlessly by all healthcare organisations in Australia was the solution many interviewees called for to solve the fragmented nature of the Australian healthcare system. However, the complexity of the political hierarchy of the country (Kellermann & Jones, 2013; Papastergiadis, 2004) compared with other countries appears to have played significant roles delaying such a national project. This also supports the argument by (Wickramasinghe et al., 2005) that the availability of governmental regulations and rules are key prerequisites for e-health. Given such a national repository is currently missing in the Australian healthcare ecosystem, information sharing on a macro level between healthcare organisations and their clinical partners still lags behind. Thus, realising the business value of clinical IS/IT is limited to meso/ micro levels. This, in turn, is limited due to internal political influences that have significantly contributed to the actual decision making processes regarding IS/IT investments as the findings of this study revealed.

It was identified by the results of this study that building the IT portfolio at the selected case and assigning leadership roles around managing this portfolio were subject to a
continuous organisational debate and sometimes ‘tension’. This is particularly acute in managing new information systems in the clinical domain, and the role of IT department in this regard. The participants from the clinician’s group explicitly called for, 1) limiting the role of IT department to providing technical support to other stakeholders, and, 2) assigning the leadership to clinicians with sound technical knowledge in the clinical domain, and to the management and executives teams in administrative space. IT personnel who came from different backgrounds than healthcare agreed on this, while other IT personnel who had worked the majority of the time in the context of healthcare refused to delegate their authorities to others regarding building and managing the organisation’s IT portfolio. This confirms the recommendations made by Weill and Broadbent (1998) that decisions around IT investments should not be taken at the technical level. Rather, it should be one of the responsibilities of the top management. It also expands their findings by identifying to whom the decision-making authority should be assigned in both the clinical and non-clinical domain regarding clinical IT and business IS/IT investments respectively.

5.2.1.3 Competition

The results of this study revealed that competition plays two key roles in determining IS/IT investments and their potential business value on two levels: people, and organisations.

On the people level, the results of this study revealed that attending to the VMOs’ needs and requirements plays a key role in selecting clinical IS/IT to invest in. Thus, investing
in clinical IS/IT had been shown as an enabler to attract more VMOs to refer their patients to the selected case. This alignment with the VMOs had repeatedly caused misalignment with the business objectives of the hospital itself despite the robust governance procedures adopted by the selected case, which in turn limited the benefits from specific IS/IT investments as discussed in Chapter 4. This supports the argument of Weill and Broadbent (1998) that maintaining an alignment between a firm’s business objectives, and their IT portfolio is crucial. It also extends our understanding of this required alignment in the context of healthcare.

The impact of competition on the organisational level appears to be more complex than that on the people level. Based on the findings from the study, there existed an internal competition among different individual divisions that were competing financially against each other and performance wise against each other, rather than adopting a collaborative approach. The direct result of this internal competition was creating silos of executives and sets of IS/IT that are not easy to talk to each other. The indirect result that contributed significantly to limiting the business value of IS/IT (especially the clinical systems) was creating different clinical databases that neither standardised nor used universally on the meso level. This also contributes to the IT Portfolio Model (Weill and Broadbent, 1998) and further expands our understanding of the consequences of internal competition in healthcare organisations on managing a firm’s IT portfolios and attaining business value from them.

Further, competition appears to have played a confirmatory role in the decision making in regard with investing in IS/IT. According to the results of this study, looking at
different successful competitors and their IS/IT platforms had played key roles in
determining the IT portfolio of the selected case.

All of the aforementioned aspects of competition are not aligned with the value of patients
as noted by M Porter and Teisberg (2014). Rather, they all are centred on the interest of
healthcare organisations and their VMOs. The only aspect of competition that aligned
with value for patients was the aspect of using IS/IT to convert competition to an enabler
to creating collaborative atmospheres in the context of healthcare. This patient-centric
enabling role, as explained in Chapter 4, is achieved by using multidisciplinary meetings
between different competitors to give patients the best possible medical experience. The
IS/IT used to facilitate this type of meetings can be classified as informational IT (Weill
and Broadbent, 1998). Thus, this study confirms the findings of (M Porter & Teisberg,
2014; Michael E. Porter & Teisberg, 2006) that competition has mainly been at wrong
levels for the wrong objectives apart from the role of IS/IT in supporting multidisciplinary
meetings. It also supports their proposed reform models in the sense that future
competition (today’s competition) must be value-based and patient-centric competition.

5.2.1.4 Recommendations for the Healthcare Ecosystem Context

Based on the discussion above, this study recommends the following for the healthcare
ecosystem context:

1. While neutralising the political influence of different stakeholders may not be
   possible, Rosetta Healthcare and healthcare organisations in general need to
minimise that by better aligning to their information technology architectures and business objectives.

2. Rosetta Healthcare and healthcare organisations in general can benefit from others’ success or failure stories in the area of IS/IT investments. The unique characteristics of individual firms, however, must be taken into consideration.

3. Rosetta Healthcare and other healthcare providers need to adopt collaborative approaches rather than competition-based approaches, as the value of adopting such approaches is not limited to inter-organisational benefits, but it also enables generating business value from the internal IS/IT investments/ portfolios by building patient-centric healthcare systems.

4. The Australian Government needs to consider building a national repository to host medical records (medical history, pathology, pharmacy, and radiology) that can be accessed seamlessly by different healthcare providers. This repository is quite different from My Health Records (previously PCEHR) in capacities, policies and rules, and access requirements.

5.2.2 The Process Context

Within the process context, this study revealed three aspects that need to be addressed in order to attain business value from IS/IT in healthcare. These are IT governance, project management, and change management. In addition, the study revealed that new IS/IT are not revolutionising processes in the healthcare. Rather, their contributions are limited to facilitating current processes to increase efficiency levels and reduce cost. The majority of interviewees, especially in the clinical domain had similar perceptions about this point:
“Most business processes in health are traditional and structured around organisational roles that are 100 years old, like the doctor, the nurse, etc.”

[CC 3]

As a result, most of the investments in the selected case had one or two of these objectives: reducing the cost and/or increasing the efficiency of healthcare delivery operations. Even with this limited role assigned to IS/IT, the following practices need to be addressed by healthcare organisations in general.

5.2.2.1 IT Governance and Project Management

The findings from this study also showed that IS/IT implementations comprise both up-front investments to cover the initial cost of purchasing and implementing IS/IT solutions, and ongoing investments to support the utilisation of the system and its use in the context of the selected case. These investments need to follow precise and strict IT governance procedures; this supports the argument of Weill and Ross (2004) that IT governance both empowers and controls firms’ IS/IT investments.

The findings from this study showed that the selected case is following strict and robust sets of IT governance practices to ensure that IS/IT investments are aligned with the business objectives and the organisation’s interest. This is in support of numerous studies that urge the importance of adopting IT governance and aligning to its procedures in order to improve the value of IS/IT investments. See for example (Cater-Steel & Tan, 2005;
Sulaiman & Wickramasinghe, 2014). IT governance practices go hand in hand with project management aspects as the findings from this study revealed.

The findings also revealed that the current set of IT governance had two rigid strength points:

1. Matching the skills and experiences of the sponsors (the leaders in IT implementations) to the business objectives of IS/IT systems,

2. The IT governance committee comprises senior personnel from management, IT, and clinical domains. This shows that the selected case takes IT governance seriously.

These practices though had two weaknesses as the findings of this study revealed:

1. They are not guided by an agreed framework that is tested, validated, and continuously nourished. This can be understood from the informal start of these practices and the way they have evolved. Although these practices have had shown reasonable success rates with current systems, they might not be capable of managing more complex implementations in the near and far futures.

2. They are vulnerable to political influence and the power levels of different stakeholders. A number of interviewees reported cases where the political influence defeated the IT governance practices and resulted in incompatible and/or incapable systems.
To address these weaknesses, this study also revealed a number of requirements that are needed to ensure the robustness of IT governance, and to empower it further in the selected case and healthcare in general (refer to 4.4.2.1, Table 4.7).

Furthermore, the products of these systems (data, information) also require advanced levels of accountability, especially due to the fact that they are being used for clinical and business decision support and decision making. Hence, this study revealed that IT governance procedures need to be extended to cover the product of IS/IT systems i.e. data/information and the way this product is used and should be managed.

5.2.2.2 Change Management

The findings of this study revealed that the selected case had started to realise the importance of implementing a dynamic change management strategy to ensure that IS/IT implementations are successful and generating business value. A senior executive officer confirmed this by putting “the amount of change the business can cope with” as one of the organisation’s biggest challenges. This confirms findings of (Boonstra & Broekhuis, 2010; Lorenzi & Riley, 2013) that managing the organisational change around IS/IT implementations is crucial to the success of these implementations.

In order to respond to this challenge, the selected case adopted a triangular plan to manage change centred on people, processes, and communications. The journey of the selected case and its similar healthcare organisations is still in its infancy as revealed by the findings of this study. Although this plan was in place during the data collection and
analysis phases, it did not seem to have been reinforced in the organisation, which caused processes and the culture around them to be conducted without taking change requirements into consideration. Further, the actions needed to align with this plan were not clearly articulated, which also caused many projects to struggle to follow the change management plan successfully. This supports two of the seven factors of successful change stated by McManus and Cacioppe (2011) around the importance of reinforcing and solidifying change and ensuring the first steps towards managing change are actionable, and confirm their roles in the context of healthcare.

5.2.2.3 Recommendations for the Process Context

Based on the discussion above, this study recommends the following for the healthcare ecosystem context:

1. Rosetta Healthcare and healthcare organisations in general are advised to conduct deep analyses for their current processes and work on re-engineering the processes that potentially prevent enhancing the overall performance. These analyses are expected to identify better ways to embedding IS/IT into different organisational processes.

2. In order for healthcare organisations to have robust IT governance structures, impromptu approaches should be avoided in favour of visionary, systematic, and well-planned structures. This is needed to meet the ever-sophisticated transitions to fully adopting EMRs in the near and far futures.
3. IT governance practices need to be well resourced, nourished in a collaborative atmosphere, based on a deeper understanding of organisational processes, well-planned upfront, and equipped with the right leadership.

4. Rosetta Healthcare and other healthcare organisations should systematically work to neutralise the political influence of different players on IT governance by better aligning with the business objectives and the universal information technology architecture of the organisation. If such an architecture is not available, healthcare organisations are strongly encouraged to articulate it.

5. Rosetta Healthcare and other healthcare providers should make the move from recognising the importance of managing change to constitutionalising and integrating them into their management practices. This includes reinforcing change policies and drawing a roadmap for the practical steps to handle change resulting from digitising healthcare processes through the use of IS/IT.

6. Due to the fact that healthcare industry is still immature in respect with managing the change resulting from IS/IT investments, external bodies from other industries that established best practices around change management can be used in the interim, with a vision to domesticate this experience to be an integral part of the organisational contemporary assets.

5.2.3 The People Context

The findings from this study highlighted three main people factors around the business value of IT in healthcare, namely the current arrangements between the hospital and its
VMOs, in-house users’ satisfaction and engagement in both designing and using IS/IT investments, and the relationship between the hospital and its vendors.

5.2.3.1 The Hospital’s Visiting Medical Officers

As described in 4.1.2, the selected case received more patients through referrals by and to its VMOs than patients through its Emergency Department. These arrangements have mutuality benefitted the hospital and its VMOs during the last few years; the hospital has benefitted from the experience of the VMOs and built a good reputation in the Australian market, and the VMOs have utilised some state-of-the-art equipment and facilities and other assets owned by the group. This mutually agreed and beneficial alignment, though, does not seem to imply a similar alignment in the area of IS/IT. The findings from this study revealed a conceptual misunderstanding between the hospital and its VMOs in regard to IS/IT investments. The problem faced by both parties is multifaceted as the participants remarked. First, the VMOs invested heavily, both financially and emotionally, in their own IS/IT to facilitate their operations. These solutions lack the capability and the potential to interface with the complex IS/IT platforms implemented by bigger hospitals. This supports the argument made by Wickramasinghe et al. (2015) that these arrangements play a key role in determining the success of implementing and attaining benefits from clinical information systems such as CDSS and CPOE. It also expands their work (Wickramasinghe et al., 2015) by identifying two directs results of these arrangements: creating additional information silos, and causing security and privacy concerns.
Notably, lacking the mutual interest in unifying IS/IT platforms and enabling smoother interfacing between these solutions at both ends have not affected the smooth business relationship between the hospital and its VMOs. Table 4.1 and Figure 4.1b and 4.1c illustrated the increasing numbers of admissions and operations performed in the selected case and decreased numbers of admissions through the Emergency Department. This supports the tenet of this thesis that IS/IT have not been looked at as a strategic enabler of the selected case. Rather, it has been portrayed as a facilitator at the operational level. It also supports and confirms the theory of Relational View of Competitive Advantage (Dyer & Singh, 1998) as this relationship is giving both parties better advantages than if they work separately. It also expands its scope to organisations’ strategic partnerships to cover individuals, i.e. VMOs, not only other organisations.

5.2.3.2 In House Users

Because of the complications of adopting this outsourced model to manage the relationships with physical doctors (VMOs), the majority of clinical information systems implemented or considered for investment at the selected case have been targeting nursing processes. Nurses are the largest group of health-care professionals in hospitals providing 24 hour care to patients (Nguyen, Bakewell, et al., 2015; Nguyen, Haddad, et al., 2015). Thus, their satisfaction and intention to use IS/IT to facilitate their processes play key roles in attaining the business value of IS/IT. However, the results revealed by this study showed that their inputs tended to be taken in theory during the initial discussions on investing in specific IS/IT, but not in the actual decision making on these investments. In
comparison to satisfying its VMOs, the hospital appeared to have not paid enough attention to the nurses’ requirements. This is in support to Paynton (2009) that the power nurses have is less and tends to be informal compared to the doctors’ as a group. This appears to have played negative roles in maintaining nurses’ intention to use these systems when they are introduced, which has limited their motivation to use these systems and benefit from them. This applies on both business IT and clinical IT levels. As a direct result, the hoped business value of these investments has not been generated, and the hospital has been exposed to a massive waste of organisational resources such as time, effort, planning, and re-planning. Further, the IS/IT investments, especially in the clinical domain, have not been successful as planned. This partially supports (K. Lee et al., 2013) who argue that the intention of using IS/IT helps predict the success of these systems, and extends it in the sense that the initial intention of use is a must, but not sufficient to make such a prediction. Further, the bigger the difference between the initial and the final intention of use, the longer the journey between the ‘intention to use’ and the ‘habit of using’ IS/IT in healthcare.

The findings also revealed another reason that may explain the low uptake of clinical IS/IT. This is the lack of visibility of the pathway of the data/information procured by the nurses and junior medical workforce. Unlike the business domain, the participants from the clinicians and clinical IT groups urged the need by those who entered the information for understanding the purpose of entering this information. This is in support of many studies that urge improving communications between different craft groups including nurses, for example (De Meester, Verspuy, Monsieurs, & Van Bogaert, 2013; Lingard et
al., 2004; Yoder-Wise, 2014), but it also expands these studies to identify another dimension of improving these communications by enabling them to track the use of the information they create using their IS/IT platforms.

5.2.3.3 Vendors

The findings also revealed that the selected case had strong relationships with business IT vendors, followed by clinical IT vendors, and lastly with vendors of IS/IT around research and education. This supports the argumentation of studies such as (Ajami & Bagheri-Tadi, 2013, p. 132; Boonstra & Broekhuis, 2010) that healthcare lacks suitable IT vendors, which may reflect an immature industry, without sufficient viable products or competitors able to offer better services, and without enough information on vendors to enable an informed decision. This is particularly acute in Australia where the sophisticated clinical information systems tend to be American or European made and accessing technical support and after sales services are harder due to being in two different time zones. Also, the findings revealed the clinical systems work better in the country they were designed. Thus, the need of domesticating the systems to fit the Australian context makes realising their business value harder and slower.

In general, the relationships with IS/IT vendors did not seem to be an enabler to generating business value from these systems. The lack of trust in different vendors was extensively discussed during the interviews. Many of the interviewees called for being very precise on what to ask vendors to do, very cautious about what they say, and very protective of the hospital business objectives against the vendors’ objectives. This agrees
with recommendations by Weill and Broadbent (1998) that vendors should not take part in making decisions around investing in IS/IT for their clients.

In addition, many interviewees expressed their concerns about having single points of failure by over relying on vendors, or even on local IT personnel to manage the relationships with these vendors. This is particularly relevant when healthcare organisations go down the track of customising IS/IT to fit their needs. These personnel may move to other organisations and all their skills and knowledge in managing their allocated IS/IT systems will be lost. This dilemma is even more apparent with the culture this study found at the selected case, and summarised below:

“They [vendors] are software developers. They are IT shops. We are healthcare. We just want to make their systems work in our environment”.

[CIT 2]

This does not seem to be an issue in the health IS/IT literature in other parts of the world like the US, where big healthcare providers have their own IS/IT development teams to domesticate local experiences in designing, implementing, and managing EMRs. However, it has been a barrier in Australia, where the journey to adopting EMRs is still in its infancy, which supports the findings by Pearce and Haikerwal (2010) even six years after publishing their work on e-health in Australia.
5.2.3.3 Recommendations for the People Context

Based on the discussion above, this study recommends the following for the people context:

1. Rosetta Healthcare and other healthcare organisations should seriously consider feedback and inputs from in-house users about their requirements and what makes them adopt different IS/IT solutions.

2. Rosetta Healthcare will need to continue to adopt their current cautious attitude towards their IS/IT vendors, especially in the clinical domain.

3. Rosetta Healthcare is advised to start domesticating IS/IT development skills and experiences to meet the digital needs of the near and far futures independently from external vendors.

4. Private healthcare organisations will need to encourage their VMOs to use the hospitals’ IS/IT platforms. This is needed to enable these hospitals to build and standardise their digital assets comprising electronic medical records for both inpatients and outpatients. Hospitals may need to design schemes or plans to incentivise the adoption of their IS/IT solutions by its VMOs, at least at the beginning of using such IS/IT solutions.

5. Healthcare organisations will need to work on designing plans and visions around enabling the users of their clinical IS/IT to track the information they produce in order to see the benefits of entering them into IS/IT systems.
5.2.4 The Technology Context

The findings from this study revealed three technology factors that appeared to have played key roles in determining the business value of IT in healthcare. These are: the characteristics of IS/IT products, IS/IT integration, and data integrity issues as discussed below.

5.2.4.1 Characteristics of IS/IT Products

The findings of this study confirmed the importance of making prudent selection of IS/IT to be invested in. This importance is explained by the complex relationships between the different divisions within healthcare organisations. Thus, any IS/IT may have both direct and/or indirect impacts organisation-wide irrespective of which department/division or the purpose they are implemented for. Selecting the right system for the clinical environment seemed much more complex than for the business environment, which supports findings of Abbott, Foster, Marin, and Dykes (2014) that clinical domains are challenging environments for selecting and implementing IS/IT. Nevertheless, this study revealed a number of requirements that must be available in prospective systems in order to generate business value. Some of these requirements support the current literature on the technical factors associated with effective implementation of health IS/IT. System usability, system integration and interoperability, stability and reliability, adaptability and flexibility, cost, accessibility and adaptability of hardware are extensively discussed in the literature, see for example (Adler, 2007; Ammenwerth, Iller, & Mahler, 2006; K. M. Cresswell, Bates, & Sheikh, 2013). Ease of use and intuitiveness are also discussed in the
literature (Nguyen, Bakewell, et al., 2015; Nguyen, Haddad, et al., 2015; Wickramasinghe et al., 2014). Two emerging aspects were revealed by this study regarding selecting health IS/IT solutions in the Australian context:

1. **IS/IT systems need to be more interactive and of higher intelligence:** The capability of current systems is far more advanced than the current level of readiness of average Australian healthcare organisations. In addition, due to lacking supportive datasets, particularly in the clinical environment, the applicability of this requirement is not foreseeable in the near future in this context. However, such systems can be supported by machine learning and are expected to be of high importance for tomorrow’s healthcare delivery.

2. **IS/IT systems need to be used successfully by other big healthcare providers:** This requirement explains the approach used by some healthcare providers to investing in IS/IT. Such hospitals lack sufficient in-house expertise to manage complex health IS/IT implementations and tend to be ‘second-movers’ to adopting such systems as explained by this senior interviewee:

   “We don’t want to be bleeding edge. We want to be leading edge. Generally, the approach we take with systems is it needs to be definitely proven and it has to be proven in Australia, and it has to be ideally proven in health care and private health care. We don’t want to be the first generally to do anything along these lines.

   [EXE 1]
As such, this study revealed that the business value of simpler systems is realisable, as in the case of IRS and SMR, while realising the business value of more complex systems is harder, slower, and not guaranteed. This partially supports findings by Kamogawa and Okada (2009) that first-mover advantages are significant, as initial successes will build the trust that will enable deeper market penetration—and set in motion a virtuous cycle that potentially leads to a sustained advantage. It also expands their work (Kamogawa & Okada, 2009) by differentiating between first-movers and second-movers based on the complexity/simplicity of implemented IS/IT.

5.2.4.2 Systems Integration

The selected case appeared to have suffered from having several IS/IT that are not integrative, and cannot talk to each other in many aspects. Two sources of this problem were identified in this study: 1) the continuous expansion of the hospital and acquiring new hospitals; and, 2) the way these systems were designed to meet the actual needs of specific craft groups without putting the wider vision of the organisational needs into consideration.

The selected hospital had the same problem in the business domain. It had a number of IS/IT systems as well as the conventional paper-based systems to manage its assets around engineering, suppliers, human resources, and finance. Then it made the investment in its ERP and management control systems. Moving from those multi-systems to the current integrative system was not too challenging to achieve as the findings of this study revealed. Today, the selected hospital is benefiting from this system as a cost-efficient
system to help increase the operational gain and increase the overall efficiency. Making such a smooth move in the clinical domain has not been possible due to a number of factors as discussed in 4.3.3. This further supports the findings of this study that managing business IS/IT in healthcare and attaining the business value of them is easier than those of clinical IS/IT systems. It also supports the findings of studies such as (K. M. Cresswell et al., 2013; Huppertz et al., 2014) that achieving systems integration in the clinical domain is not easy, and requires a defined network of healthcare providers working together using proven protocols and measures to enhance the overall performance of the systems to be integrated. It also supports the findings of Frimpong et al. (2013) that integrating IS/IT solutions is key to enhancing patient outcomes, efficiency of operations, and reducing cost.

Another aspect of system integration is centred on the level of integration between the selected case and its external business partners (health funds, suppliers, engineering, etc.), and clinical partners (pathology, radiology, pharmacy, and VMOs). Even at this level, the integration with business partners appeared much more seamless than those with clinical partners. The lacked integration with the latter was discussed in detail in 5.2.1.1.

5.2.4.3 Data Issues

The findings of the study revealed that several aspects - around data quality, accuracy, validity, and usability - had a negative impact on the business value of IT in the selected case, particularly in the clinical domain. This problem was a direct result of two interrelated reasons. Firstly, there existed a number of clinical information systems that
worked independently with lower levels of interoperability, which created a number of clinical datasets that don’t follow an agreed upon standard as discussed in 4.4.4.3. Secondly, the selected case did not have a culture of constitutionalising sets of standards, dictionaries, and rules around data integrity. The main result of lacking such efforts and culture is lower levels of trust in one of the most important digital assets of the hospital, \textit{i.e.} its massive sets of clinical data. Not only has this issue limited the business value of the costly clinical IS/IT solutions, but it also has caused massive waste of organisational resources due to the need and pressure to fix the problems around these data sets. This finding supports one of the contentions of this study that clinical data should be considered as a key part of the IT infrastructure in healthcare organisations. Thus, the revised conceptual model of this study notes this, and places clinical data repositories (CDR) in the base layer of the IT portfolio of healthcare organisations, namely IT infrastructure as Section 5.4 will show.

5.2.4.4 Recommendations for the Technology Context

Based on the discussion above, this study recommends the following for the technology context:

1. Rosetta Healthcare and healthcare organisations in general will need to dedicate teams to standardise their data based on agreed frameworks. This standardisation process may be supported by establishing a centralised digital repository to host data dictionaries, and one unified dataset that is capable of feeding different IS/IT in both business and clinical domains with their data needs.
2. Purchasing new IS/IT systems to solve the data issues is not advised. Rather; directing these investments towards building the digital repository and integrating current IS/IT is more likely to help deliver more business value to the organisation.

3. Rosetta Healthcare and healthcare organisations with less expertise in managing complicated IS/IT implementations are advised to domesticate in-house expertise to gradually build their IS/IT portfolios and avoid the ‘big bang’ approaches according to which sophisticated IS/IT systems are implemented and put in service in a short period of time. This approach is likely to fail to generate business value of IS/IT in the clinical domain due to the lack of systems integration, data issues, and also due to the lack of expertise to manage this type of implementations and the resulting amount of change at the organisational level.

4. As discussed in 5.1, none of the IS/IT examined in this study helped make healthcare delivery patient-centric in the selected case. This study recommends Rosetta Healthcare to focus on IS/IT that engage patients in their care plans and help give them better patient experience. Well-designed point of care systems at the bedside are potentially helpful in this regard.

5. The Australian government should consider developing a national data dictionary that can be used by different healthcare organisations. This dictionary may utilise ICD-10-AM and build upon it to standardise the data around diseases and their treatments.
5.3 The Business Value of IT in Healthcare: Barriers and Facilitators

This study has identified six main barriers to generating the business value of IS/IT investments at Rosetta Healthcare. These barriers, which were discussed in details in previous sections, are illustrated in Figure 5.3 below and then summarised individually thereafter in Table 5.7.

Figure 5.3 Barriers to generating business value from IS/IT as found at Rosetta Healthcare
1. **Lack of engagement by in-house users:** During the data collection phase, several interviewees, especially in the clinical domain, expressed their dissatisfaction about the use of IS/IT systems, as these neither met their requirements nor were even close to what they had asked for during the initial discussions. While this barrier in the business domain is of less impact (given once a system is implemented, it will be the only system to be used), this barrier is of higher impact in the clinical domain. The reason is that while the system is implemented, the option to use the older system (paper-based) will normally be still available, and probably preferable for many of the users. This further creates a divide between digitised processes and paper-based processes.

2. **Lack of alignment with VMOs:** This barrier is of high impact in the clinical domain. While the relationships between the hospital and its VMOs have been mutually beneficial, the misalignment regarding IS/IT platforms used by the two parties limited the use of the group’s systems by VMOs. Hence, their business value cannot be easily realised.

3. **Lack of trust in vendors:** Given the immature nature of clinical IS/IT vendors in Australia, different levels of participants in this study expressed they had very low trust in vendors of clinical IS/IT. This missing trust appeared to have caused the organisation uncertainty, and sometimes scars, that in turn limited the commitment to building an integrative IS/IT portfolio, and consequently limited the IS/IT capacity organisation-wide. A better trust level could be seen in the business domain. Thus, the impact of this barrier is particularly acute in the clinical domain.
4. **Lack of integration with external clinical partners:** This barrier appears to be beyond the control of individual healthcare organisations. Nevertheless, its impact causes all these organisations to be unable to realise the potential business value of their IS/IT portfolios. Due to lacking efficiency, and the increased levels of frustration, more clinicians are abandoning the digitised systems in favour of conventional ways to receive their patients’ medical data whenever this is possible. This appears to have made the massive investments in clinical IS/IT of lesser impact and to be a waste of organisational resources.

5. **Lack of integration between IS/IT systems:** When islands of automation exist, realising the business value of IS/IT becomes problematic in healthcare organisations. These islands are created when multiple IS/IT systems are in place but unable to talk to each other, and not fully interfaced. This barrier is applicable to clinical and business domains, as integrating clinical IS/IT with business IS/IT is crucial in today’s healthcare delivery based on the results of this study, particularly in terms of decision support and decision making.

6. **Lack of standardised datasets:** This barrier is applicable to the clinical domain. Having multiple clinical systems producing different datasets that don’t follow any universally agreed upon format or structure has caused high levels of frustration and lower levels of trust by different clinicians in the quality, accuracy, and validity of clinical data and their usefulness in supporting decision making. This has resulted in massive sets of data of limited value.
Table 5.7 The barriers to attaining business value of IT in healthcare and their impact on the clinical and non-clinical domains

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Impact on Clinical IS/IT</th>
<th>Impact on Business IS/IT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Applicable?</td>
<td>High</td>
</tr>
<tr>
<td>Lack of engagement from in-house users</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>Lack of alignment with VMOs</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>Lack of trust in vendors</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>Lack of integration with external clinical partners</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>Lack of integration between IS/IT systems</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>Lack of standardised datasets</td>
<td>Yes</td>
<td>✓</td>
</tr>
</tbody>
</table>

On the other hand, this study has revealed a chain of facilitators to generating the business value of IT in healthcare as illustrated in Figure 5.4. The items of this chain are described below:
1. **Prudent selection of IS/IT products**: Selecting the IS/IT product that suits the organisation is an essential step to attaining the business value of IT in general. Yet, this is not an easy step in the context of healthcare as the results from this study revealed. Any system to be added to healthcare organisations’ current IT portfolios would need to be intelligent, interactive, adaptive to the complex nature of healthcare delivery, easy to use, intuitive, and yet powerful and reliable. Most
importantly, new IS/IT must be purchased based on three other criteria: their ability to integrate with existing IS/IT, meeting the requirements of the universal IT architecture (if any), and their capability to solve the problem(s) they are purchased to address. These systems will also need to use current datasets rather than building additional datasets. Communications between different stakeholders are also key in the process of purchasing new IS/IT solutions.

2. **Well planned change management programs:** Embedding new IS/IT in the daily processes of healthcare delivery seems to cause massive change that healthcare organisations must handle and deal with. As such, well-planned change management programs will help facilitate the generation of the business value of IS/IT in healthcare. Such programs need to be focused on providing continuous training and communications about current processes and future processes. Such programs need to be well resourced to allow their maximum benefit to be reached.

3. **Strong governance structures and project management practices:** Unlike the first two facilitators, this facilitator is not costly, as healthcare organisations can use their resources in better ways to promote higher levels of accountability, by adopting strong governance structures and project management practices. Such structures will need to constantly monitor key milestones, be driven by the business objectives rather than the political influence of different stakeholders, guided by a robust set of rules, and supported by healthy communications between different stakeholders.
4. **Post-implementation assessments:** Performing regular post-implementation assessments is key to attaining the business value of IS/IT in healthcare. These assessments are to cover both the systems and their products (data). Assessing the usability, acceptability, and fidelity of these systems, taking insights from the actual users into consideration, and domesticating skills and experiences in-house to develop and manage IS/IT are key aspects in this regard. Communications between decision makers, systems’ users, and all other parties involved in these implementations are also crucial.

5. **Well-resourced and tracked Training Programs:** Designing and delivering well-resourced training programs is one of the key enablers of generating business value of IT in healthcare. These programs are key, especially in the clinical domain, as the use of IS/IT does not yet represent a component of medical curriculums and academic programs. Not only do these programs need to be well-resourced, but also, they need to be tracked and revised systematically to ensure attaining the maximum benefit of them.

As can be noted from Figure 5.4, communications represent a key element in the chain of the business value of IS/IT in healthcare as found at Rosetta Healthcare. These communications require healthy workplaces and need to be systematically monitored and assessed. If these communications are absent due to organisational dysfunctionalities, this chain will likely be negatively affected, and similar healthcare organisations to Rosetta Healthcare will attain less business value of their IS/IT investments. Having said that, expanding the findings from this specific case to the generalised perspective would
require taking their own contextual conditions into consideration, including their business strategy and objectives, fund structures, IS/IT portfolios, and position in their healthcare ecosystem.

5.4 The Revised Business Value of IT Model

The findings of this study partially supported the IT Portfolio (Weill & Broadbent, 1998) and the Enterprise of Healthcare Delivery (W. B. Rouse & Cortese, 2010). Further discussions of the implications of this study on these two works will be presented in Chapter 6. In addition, the findings of this study revealed the impacts of different components of the IT portfolio of the selected case, and consequently the business value of these systems. Furthermore, the study revealed several barriers and facilitators to generating the business value of IT in healthcare. Taking these into consideration, the initial conceptual model presented in Section 2.6 (Chapter 2) was revised to enhance its coverage to the contextual conditions surrounding healthcare organisations and affecting the business value of different IS/IT. Figure 5.5 illustrates the revised conceptual model of this study based on the findings from Rosetta Healthcare.
Figure 5.5 The Revised Business Value of IT in Healthcare Model
5.5 Summary and Next Steps for Rosetta Healthcare

This chapter has served to discuss the findings of this study with respect to the business value of IT in healthcare, the factors affecting this business value, and both facilitators and barriers to attaining business value from IS/IT investments in the context of healthcare.

The results from this study showed that there existed a positive perception on the business value of IT in healthcare. The business value of clinical IS/IT is slower (and harder to realise) than the business value of business IS/IT, due to a number of reasons were discussed in details in Chapter 4 and in this chapter.

The findings of this study were also used to further improve the capability of the Business Value of IT Model initially posed in this study. The insights gained from the selected case were useful to revise this model and produce a simpler, yet more powerful conceptual model.

In order for the selected case to generate higher levels of business value from its IS/IT investments, a list of 19 recommendations were outlined in 5.2.1.4, 5.2.2.3, 5.2.3.3, and 5.2.4.4 based on the results of this study. These recommendations address the urgent needs of the contexts of People, Process, Technology, and Healthcare Ecosystem.

The next chapter is set out to summarise this study and discuss its limitations, implications, lessons learnt, and future research directions.

* * *

258
Chapter 6
Conclusion
Chapter 6: Conclusion

Today, IS/IT are widely seen as enablers to improve different outcomes of care delivery. Thus, significant investments have been made to embed these platforms into different healthcare systems, from micro to meso and macro levels. This research is set out to examine the business value of these IS/IT in the context of healthcare.

To answer the research question, this study followed a qualitative approach and thoroughly examined different IS/IT in both the clinical and business domains at a large Australian private not-for-profit healthcare group. The contextual conditions of this selected case were also examined.

The findings revealed by this study were classified around 1) the business value of different IS/IT in both the clinical and business domains, and 2) different factors affect the business value of IT in healthcare, around people, process, the healthcare ecosystem, and technology. All of these findings were presented and discussed in details in the previous two chapters.
This chapter presents a summary of this research. It starts with Section 6.1 which discusses how the research question has been answered. Section 6.2 then highlights the implications of this research on theory, and Section 6.3 presents the implications on practice. Section 6.4 is a summary of the limitations of this research. Finally, Section 6.5 presents future research directions in the area of the business value of IT in healthcare.

6.1 Answering the Research Question

This study has answered the research question “How can information systems/information technology facilitate the generation of business value in healthcare?” by answering three sub-questions:

- Which IS/IT does healthcare need to invest in to generate business value?
- How can these IS/IT help generate business value in healthcare?
- Under which conditions are these IS/IT likely to generate business value in the healthcare industry?

To answer all of these questions, a systematic approach was taken, structured around taking the conceptual framework and the adopted theories into consideration, as well as constantly maintaining openness throughout the data collection and data analysis phases. The results of this study have answered these three questions thoroughly as Table 6.1 summarises.
Table 6.1 Answering the research question by addressing three sub-questions

<table>
<thead>
<tr>
<th>Sub-question</th>
<th>The answer</th>
<th>Reference(s) in this thesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which IS/IT does healthcare need to invest in to generate business value?</td>
<td>Answering this question depends on the area IS/IT solutions are used for:</td>
<td>4.3.3 4.3.4 5.1</td>
</tr>
<tr>
<td></td>
<td>In the clinical domain, the healthcare industry seems to benefit from IS/IT of informational nature, while transactional/ informational IS/IT are beneficial in the business domain.</td>
<td></td>
</tr>
<tr>
<td>How can these IS/IT help generate business value in healthcare</td>
<td>Based on answering the first sub-question, the answer to this question also depends on the settings:</td>
<td>4.3.3 4.3.4.1 through to 4.3.4.4 5.1</td>
</tr>
<tr>
<td></td>
<td>• <strong>In the clinical domain:</strong> Informational IT can generate business value by enhancing patient safety, continuity of care and consistency of care. This is achievable by 1) better adhering to the care protocols and standards, and 2) facilitating better information sharing and access between different craft groups. This information sharing is one of the core business objectives of informational IT as stated by Weill and Broadbent (1998) and supported by the findings of this study.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <strong>In the business domain:</strong> Informational/ Transactional IS/IT can generate business value by enhancing the operating gain, cost efficiency, resource utilisation, and the efficiency of operations. This is achievable by enabling both information sharing and faster processing and handling of repetitive transactions with less manpower needed.</td>
<td>4.3.3.2 4.3.4.5 5.1</td>
</tr>
<tr>
<td>Under which conditions are these IS/IT likely to generate business value in the healthcare industry?</td>
<td>The results of this study showed that evaluating the business value of IT in healthcare without taking the contextual conditions into consideration is not realistic. Thus, answering this question is key in the context of this study. These conditions pertain to people, processes, the healthcare ecosystem, and technology. In order for IS/IT to generate business value of IT the following aspects need to be available:</td>
<td></td>
</tr>
</tbody>
</table>
### 1. Healthcare Ecosystem:
- A national initiative to support inter-organisational communication in the context of healthcare in Australia, especially in the clinical domain
- A flexible national political system that enables building national clinical data repositories
- A systematic organisational effort to neutralise the political influence of different stakeholders in building different IS/IT portfolios and managing them by better aligning with the organisational business objectives and IT architecture

### 2. Process
- A well-designed change management plan centred on people, process, and communications
- Continuous training
- Engaging different stakeholders in the decision making in regard to IS/IT investments
- Strong governance structures and project management practices:
  - Consistent monitoring of milestones
  - Driven by rules and clear frameworks of accountability
  - Business oriented, not politically driven
  - Supported by healthy communications between different stakeholders.
### 3. People

- Higher alignment between hospitals and their VMOs by encouraging them to use their hospitals’ IS/IT platforms

- A better engagement by the in-house users by taking their inputs and needs into consideration, and providing proper training programs for them

- Better management of the relationships with IS/IT vendors by adopting precise account management practices

### 4. Technology

- Prudent selection of IS/IT products, as they need to be:
  - Interactive, adaptable, intelligent
  - Easy, intuitive, robust, not expensive
  - Problem-focused
  - Integrated with other IS/IT already in use
  - Meeting the IT architecture
  - Supported by valid standardised data
  - Supported by a set of healthy communications between different stakeholders
  - Supported by proper digital data repositories on both meso and macro levels

- Assessing the usability, acceptability and fidelity of different IS/IT on a regular basis

- Taking insights from the actual users into consideration in regard to any improvements needed

- Domesticating skills and experience in-house to develop and manage IS/IT portfolios


6.2 Contribution to Theory

Evaluating the business value of IT in healthcare in this study has served to explore the benefits of adopting the Enterprise of Healthcare Delivery Model (Rouse and Cortese, 2010) and IT Portfolio Model (Weill and Broadbent, 1998) in healthcare. While the former is designed to be used in the context of healthcare, the latter is more generic and targets other sectors across manufacturing and service industries such as banking and retail. Thus, this research is one of the first to examine this work in the context of healthcare and explore possible enhancements needed for this model to further cover the unique needs of healthcare delivery.

6.2.1 Contribution to the IT Portfolio Model

This study shows that the IT Portfolio Model (Weill and Broadbent, 1998) presents a robust framing for different IS/IT. It also confirms that different business objectives lead to different IS/IT investments, which in turn need to have powerful governance and project management practices to leverage their possibilities. This study adds to this model a better categorisation of IS/IT investments in the context of healthcare. This study shows that most of the transactional IS/IT platforms today are serving informational purposes in the business domain. This is achievable by providing the business analytics and business intelligence tools with rich information to better manage the healthcare firms’ operations and shape the business strategies. Thus, this study suggests that the generic IT Portfolio of healthcare organisations in the business domain comprises three layers (Infrastructure, Transactional/Informational, Strategic), while it is the same IT Portfolio Model as stated by (Weill and Broadbent, 1998) in the clinical domain, i.e. four layers (Infrastructure,
Transactional, Informational, Strategic) as the revised Business Value of IT in Healthcare Model depicts in Chapter 5 (Figure 5.5).

The other enhancement to this model as a result of this study is the need to extend the concept of IT infrastructure beyond IT hardware and software and the human expertise to manage these resources, especially in the clinical space. The addition in this regard is the need to include clinical data repositories into the IT infrastructure. Today, healthcare organisations are producing and having to deal with massive data sets. The problem with these data sets (especially in the context of this study) is that they are neither standardised nor agreed upon by different craft groups. Thus, building such clinical data repositories is key to ensuring the robustness of the IT infrastructure of healthcare organisations to support the move to adopting more sophisticated IS/IT platforms such as EMRs.

It is also worth mentioning that the IT Portfolio Model lacks the tools to cover the socio-technical aspects of the healthcare industry as mentioned previously. Thus, the use of the Enterprise of Healthcare Delivery (Rouse and Cortese, 2010) has been beneficial for this study around this point.

### 6.2.2 Contribution to the Enterprise of Healthcare Delivery

The use of the Enterprise of Healthcare Delivery model (Rouse and Cortese, 2010) was useful in two dimensions. The first is providing the socio-technical framing for healthcare delivery through four levels, namely healthcare ecosystem, system structure (healthcare organisations), delivery operations (processes), and clinical practices (people). This maps well with both the original (Figure 2.9) and revised Business Value of IT Model (Figure 5.5) designed in this study and centred on healthcare ecosystem, process, people and
technology. The second dimension is the need to study the interactions between these different layers. Although this model suggests there exist direct impacts of each of these layers on the layer above and below, the results revealed by this study do not support these interactions as stated in Subsection 2.5.2. For example, we did not find evidence that better system structures can affect the healthcare ecosystem by improving human productivity and less healthcare cost. Similarly, the delivery operations did not show a direct impact on the clinical practices in terms of providing better care capabilities and health information. Although most of these impacts are intuitively understood and acceptable, this study did not find any supporting evidence in the context of the selected case.

6.3 Contribution to Practice

This study has contributed to the practice by identifying the likelihood of different IS/IT to generate more business value for Rosetta Healthcare. As Table 6.1 above shows, answering the research questions presents a set of recommendations - for the selected case, healthcare providers whose characteristics in general are similar to those of Rosetta Healthcare, and the Australian Government - to better leverage the expensive IS/IT portfolios and enhance healthcare outcomes within their limited resources. These recommendations cover the four contexts of this study, i.e. the healthcare ecosystem, people, processes, and technology. Table 6.2 summarises the contribution of this study to practice as a set of recommendations and their scopes as found in this research.
Table 6.2 The contribution of this study to practice as a set of recommendations

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Context</th>
<th>For</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>The selected case</td>
</tr>
</tbody>
</table>
| Minimising the political influence of different stakeholders on IS/IT investments by better aligning to the firm’s IT architecture and business objectives | • Healthcare Ecosystem  
• People | ✓ | ✓ |
| Adopting collaborative approaches rather than competition-based approaches to creating patient-centric healthcare systems | • Healthcare Ecosystem | ✓ | ✓ | ✓ |
| Building local (at the organisational level) and national repositories to host medical records (medical history, pathology, pharmacy, and radiology) that can be accessed seamlessly by different healthcare providers | • Healthcare Ecosystem  
• Technology | ✓ | ✓ | ✓ |
| Working on a better understanding of the current processes and future processes of healthcare delivery | • Process | ✓ | ✓ |
| Impromptu approaches to managing IT portfolios should be avoided in favour of visionary, systematic, and well-planned structures | • Ecosystem  
• Process | ✓ | ✓ | ✓ |
| Establishing well-resourced IT governance practices that are nourished in a collaborative atmosphere | • Process | ✓ | ✓ |
| Taking the change management a level up from recognising its importance to constitutionalising and integrating it into different management practices | • Process | ✓ | ✓ |
| Enhancing the engagement of in-house users by taking the actual needs of them into consideration when making the decision on IS/IT investments and enabling them to track the information they produce | • People  
• Technology | ✓ | ✓ |
Adopting prudent and well-structured account management practices to manage the relationships with different IS/IT vendors

- People
- Technology

Encouraging VMOs to use the hospitals’ IS/IT platforms, possibly by designing schemes or plans to incentivise that

- People
- Technology

Standardising clinical data sets

- Technology

Domesticating in-house expertise to gradually build the clinical and business IS/IT portfolios independently from the vendors.

- Technology
- People

Adopting point of care systems to create patient-centric healthcare delivery and enhance patient experience

- Technology
- People

 Developing a national data dictionary that can be used by different healthcare organisations

- Healthcare Ecosystem
- Technology

6.4 Research Limitations

This research has four key limitations:

1. Since examining the business value of IT in healthcare is a relatively new evolving area, the literature is limited to the impact of limited IS/IT on narrow sets of outputs as discussed earlier in this thesis. Not only does this limit the usefulness of the literature, but it also highlights the importance of this research, as designing a robust framework to evaluate the business value of IT in healthcare is crucial to today’s healthcare delivery.

2. The examined IS/IT were at different stages of implementation and utilisation. Some of them were relatively new (less than one year in service), thus, evaluating their business value requires longer timeframes than those were available during...
the data collection phase.

3. Since the selected case is a private not-for-profit hospital, many of the participants were not comfortable to share information on cost and/or revenue. Thus, this study covers other aspects of business value than these two elements (cost and revenue).

4. As the topic was of interest to most of the participants, they tended to be open about different issues around the organisation and its IS/IT platforms. Thus, it was difficult to align to the designed protocol for the interview. Although this has enriched the study with unexpected themes and thoughts, the amount of the textual data the researcher had to deal with was massive, which required extended time and extra effort for data coding and analysis.

5. Since the research adopts a single case study, the ability to generalise the findings to other healthcare organisations is limited. These organisations may not have similar characteristics to Rosetta Healthcare in terms of funding, use of IS/IT, and organisational objectives/strategies. This limitation is addressed in the next section (Future Research Directions).

### 6.5 Future Research Directions

Even though the healthcare industry has been investing heavily in IS/IT (Gartner, 2015; OECD, 2013c), investigating the business value of these expensive investments is still in its early stages, as this research has shown. For future research, several directions can be taken to leverage the findings of this study. Firstly, the developed conceptual framework based on a qualitative approach can now be used as a model to develop a set of research instruments to investigate the business value of IT in the healthcare quantitatively. Even
though this is a challenging undertaking, especially in the clinical space, it is possible to work on designing a new protocol for interviews and a questionnaire to quantify the business value of IT in healthcare based on the results of this study.

Secondly, this research recognises the importance of improving the generalisation of the finding by adopting multiple case studies. This research has used multiple units of analysis within the selected case, from which valuable insights were captured on the business value of IT in healthcare. However, they all align, to different extents, to the business objectives of Rosetta Healthcare as a private not-for-profit organisation. Thus, examining the framework developed in this study in different contexts/ settings will further improve the validity and robustness of this framework and the findings of this study in general. One option in this regard is to compare private hospitals to public hospitals in the Australian context. This is of paramount importance due to the fact that VMOs represent a significant difference between private and public healthcare settings in Australia. Thirdly, while the developed framework was useful to examine the business value of different IS/IT designed in different countries for various craft groups, it is noted that examining the robustness of the framework requires investigating different healthcare ecosystems. Thus, comparing the Australian healthcare system with the healthcare systems of other countries is another future research direction. This is particularly important to confirm the roles of differences in the regulatory frameworks and national political structures in generating the business value of IT in healthcare.

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271
References
References


References


References


CMS. (2013). Roadmap for implementing value driven healthcare in the traditional Medicare fee-for-service program: Centers for Medicare & Medicaid Services.


Dahlgren, J. W., & Cokus, M. S. (2007). Real Options and Flexibility in Organizational Design (pp. 1-7).


References


HIMSS. (Ed.) (2013). HIMSS.


References


OECD. *OECD Health Data: Health status.*


References


Appendices
Appendix A: Ethics Approval from Deakin University

Memorandum

To: Prof Nilmini Wickramasinghe
VPC's Office - Health

B  o:c: Mr Peter Haddad

From: Deakin University Human Research Ethics Committee (DUHREC)

Date: 18 August, 2016

Subject: 2016-062
The Business Value of IT in Healthcare: An Analysis

Please quote this project number in all future communications.

Approval for this project was granted by the Deakin University Human Research Ethics Committee Executive on 18/08/2016.

Approval has been given for Mr Peter Haddad, under the supervision of Prof Nilmini Wickramasinghe, VPC’s Office - Health, to undertake this project for four years from 18/08/2016.

The approval given by the Deakin University Human Research Ethics Committee is given only for the project and for the period as stated in the approval. It is your responsibility to contact the Human Research Ethics Unit immediately should any of the following occur:

- Serious or unexpected adverse effects on the participants
- Any proposed changes in the protocol, including extensions of time.
- Any events which might affect the continuing ethical acceptability of the project.
- The project is discontinued before the expected date of completion.
- Modifications are requested by other HRECs.

In addition you will be required to report on the progress of your project at least once every year and at the conclusion of the project. Failure to report as required will result in suspension of your approval to proceed with the project.

DUHREC may need to audit this project as part of the requirements for monitoring set out in the National Statement on Ethical Conduct in Human Research (2007).

Human Research Ethics Unit
research-ethics@deakin.edu.au
Telephone: 03 9251 7123

296
Appendix B: Participant Information and Consent Form

Project Title: The Business Value of IT in Healthcare: An Analysis

Investigators:

1. **Mr Peter Haddad**
   PhD. Candidate, MEng, BEng.

2. **Professor Nilmini Wickramasinghe, PhD MBA**
   Professor Health Informatics Management | Office of the Pro Vice-Chancellor
   Faculty of Health | Deakin University

3. **Dr Lemai Nguyen**
   Senior Lecturer | Department of Information Systems and Business Analytics |
   Deakin Business School | Deakin University

4. **Honorary Professor David Phillips**
   Faculty of Health | Deakin University

**Dear participant,**

You are invited to participate in a research project being conducted by Deakin University. Please read this invitation carefully and be confident that you understand its contents before deciding whether to participate. If you have any questions about the project, please ask one of the investigators.
Who is involved in this research project? Why is it being conducted?

This research is being conducted by a research team consisting of Prof Nilmini Wickramasinghe, Dr Lemai Nguyen, Honorary Professor David Phillips, and Mr Peter Haddad. This research forms part of a PhD program at being taken by Mr Haddad at Deakin University, Faculty of Health.

Why have you been approached?

You have been approached due to your position at [Rosetta Healthcare], where your role would enable you to provide knowledge and information that will contribute towards finding outcomes for the research question.

What is the project about? What are the questions being addressed?

The aim of this research is to identify how information technology can improve organisational performance in healthcare firms. The key research question, therefore, is: “How can information systems/ information technology facilitate the generation of business value in healthcare firms”?

The key question is very important for healthcare organisations because, as the literature review has shown, there has been a trend to increase the IT capital investments with little to show in return. It is vital to measure the business value being generated by information technology in healthcare organisations. Another factor affecting this research is that healthcare service providers attempt to balance the costs (the input) and the quality of service (output). This study will attempt to develop a roadmap to achieving improved quality of service at reduced costs by highlighting the most value-generating areas in IT investments and recommending best by considering four interrelated levels: people, processes, organisations, and ecosystem.

If I agree to participate, what will I be required to do?

Investigators will contact you to organise an interview(s) at a location and time that is convenient for you. During the interview, you will be asked questions in four interrelated areas: organisational characteristics, information technology, investments in information technology and returns on investments in information technology. The interview will be audio recorded if you agree. Investigators do not expect any unpleasant or inconvenient aspects of taking part in this research.
What are the possible risks or disadvantages?

This research does not envisage any risk to either the participants or their organisations due to the nature of this research and questions put to participants. The reasons are as follows:

- Participation in the research is entirely voluntary.
- The questions in interviews are about information systems/ information technology at [Rosetta Healthcare], and should not cause any personal stress or anxiety to respondents
- Unless agreed otherwise, the data will be analysed and the results published without including information that can potentially identify either the respondents or [Rosetta Healthcare].

If you are unduly concerned about your responses to any of the interview items or if you find participation in the project distressing, you should contact Prof. Nilmini Wickramasinghe as soon as convenient. Prof. Wickramasinghe will discuss your concerns with you confidentially and suggest an appropriate follow-up, if necessary.

What are the benefits associated with participation?

The research project is expected to contribute to the current body of knowledge in terms of improving healthcare quality within the limited available resources. Thus, participation in the research project may result in improved healthcare services being provided.

What will happen to the information I provide?

This research project will be strictly confined to the ethical research conduct practices recognised by [Rosetta Healthcare] and Deakin University.

As for the confidentiality, the data collected will be treated as strictly confidential and used for academic research purposes only. Confidentiality of the information provided will be protected subject to any legal limitations. Access to information will be restricted to only the investigators: Prof Nilmini Wickramasinghe, Dr Lemai Nguyen, Honorary Professor David Phillips, and Mr Peter Haddad. Data will be destroyed using confidential waste disposal techniques after five years following last publication. Paper records will be shredded and disposed of using the disposal of confidential waste processes.
Electronic records will be deleted and erased. All data and information will be de-identifiable. Even in the case of specific positions like CEO, CFO, etc. as the organisation will not be named or identified, thus these individuals will not be identified.

**What are my rights as a participant?**

- The right to withdraw at any time
- The right to request that any electronic recording ceases immediately
- The right to have any unprocessed data withdrawn and destroyed, provided it can be reliably identified, and provided that so doing does not increase the risk for the participant.
- The right to have any questions answered at any time.

**Whom should I contact if I have any questions?**

For any questions, enquiries or further information you should contact Prof Nilmini Wickramasinghe.

Yours sincerely

Professor Nilmini Wickramasinghe Dr Lemai Nguyen
Honorary Professor David Phillips Mr Peter Haddad
Consent Form

1. I have had the project titled “Business Value of IT in Healthcare: An Analysis” explained to me, and I have read the information sheet

2. I agree to participate in the research project as described

3. I agree:
   
   (a) to be interviewed and/or complete a questionnaire and/or survey
   (b) that my voice will be audio recorded and stored electronically

4. I acknowledge that:
   
   (a) I understand that my participation is voluntary and that I am free to withdraw from the project at any time and to withdraw any unprocessed data previously supplied (unless follow-up is needed for safety).

   (b) The project is for the purpose of research. It may not be of direct benefit to me.

   (c) The privacy of the personal information I provide will be safeguarded and only disclosed where I have consented to the disclosure or as required by law.

   (d) The security of the research data will be protected during and after completion of the study. The aggregated data collected during the study may be published, and a report of the project outcomes will be provided to me upon a written request. Any information which will identify me will not be used.

Participant’s Consent

Participant: __________________________ Date: __________________________

(Signature)
Appendix C: The Protocol of the Interviews

I. Firm characteristics:

1. What is the approximate size of your firm?
   1. Locations
   2. Employees:
      i. Doctors (On staff and VMOs)
      ii. Non-medical

2. Where does your firm position in the current marketplace?

3. Can you explain the decision-making process regarding new investments, for example, is it made according to:
   1. Raising problems?
   2. New products from vendors?
   3. Other?

4. Do you evaluate the top management commitment to IT?

II. Structure of information technology:

1. How is IT handled in your firm, and is there a separate IT department, if yes where does it sit in the organisation chart?

2. Is there any collaboration and/or coordination between clinicians, IT personnel, and top management level management to optimise the level of IT in your level?

III. Investments in Information technology:

1. Can you explain the decision-making process regarding IT investments, for example, is it made according to:
   1. Rising problems?
   2. New products from vendors?
   3. Other?
2. What is the percentage of your total budget is set aside for similar IT systems?

   1. Is it increasing?

   2. How is it determined?

   3. What are the main areas of IT investments?

      i. Clinical

         1. Cardiology

         2. Oncology

         3. Other

      ii. Admin

         1. Billing

         2. Compliance

         3. Other

      iii. Other

3. Is there any collaboration and/or coordination between clinicians, IT personnel, and top management level management to invest in specific IT solution?

4. In choosing to invest in a particular IT solution, how important is it that another hospital has such a system?

IV. Returns of Investments in Information Technology:

   1. Have you heard about “business value of IT”, and do you think about this with regards to your IT investments?

   2. Do you think of IS/IT solutions like other capital investments? i.e. Do you measure when they have paid off the investment?

   3. In your view, do you think IT capital investment will:

      1. Decrease costs? Why? How?

      2. Enhance healthcare quality? Why? How?


5. Improve efficacy? Why? How?

4. Do you use any indicators to measure the returns on your IT investments on:

1. Enhancing the organisational structure?
2. Improving the healthcare delivery operations?
3. Clinical practices?
4. Other?

* * * *
Appendix D: List of Publications Produced from this Research


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