THE ADOPTION OF THE NATIONAL PROGRAMME FOR INFORMATION TECHNOLOGY IN THE NHS: THE CASE OF LORENZO

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DECLARATION

I hereby certify that this thesis has been realised under normal supervision and all sources used have been acknowledged.

I declare that this work has not already been accepted in substance, not is it currently being submitted in candidature for any other degree.

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ABSTRACT

This thesis is concerned with the aspect of Health Informatics that relates to IT adoption in the NHS. It focuses on the identification of the factors that influence significantly the implementation of LORENZO, the Electronic Health Record system that is being implemented in the Strategic Health Authorities (SHAs) in the North, Midlands, and East of England (NME) region as part of the National Programme for Information Technology (NPfIT) in the NHS.

As a result of a review of the literature it was concluded that the study should be based on the underlying ideas of the Technology Acceptance Model (TAM). However, rather than the quantitative approach usually associated with the TAM, a qualitative research methodology was used to approach this area. The data was obtained by conducting face-to-face semi-structured interviews with people who represented the end users in the NHS and the designing company (the LSP). By contrast with most academic studies, the research, therefore, studied the NPfIT from the bottom up (i.e. the end user perspective).

NVivo was used to aid the analysis of the interview data. This analysis was used to develop an extended TAM model and to suggest a theoretical model of the relationship between LORENZO development methodology and users' acceptance.

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DEDICATION

This thesis is dedicated to my parents, my brother Nabeel, my sisters Sahar, and Dima, and my soul mate Jumana (juju).

It is also dedicated to my Fiancée Fay with love...

TABLE OF CONTENTS

DECLARATION i

ABSTRACT ii

ACKNOWLEDGMENT iii

DEDICATION iv

LIST OF FIGURES xii

LIST OF TABLES xiv

LIST OF ABBREVIATIONS xvi

CHAPTER ONE

1 INTRODUCTION 1
1.1 BACKGROUND 1
1.2 RESEARCH PROBLEM 7
1.3 RESEARCH OBJECTIVES 8
1.4 RESEARCH QUESTIONS 9
1.5 SIGNIFICANCE OF THE RESEARCH 9
1.6 RESEARCH ORGANISATION AND SUMMARY 11

CHAPTER TWO

2 INFORMATION TECHNOLOGY IN THE HEALTHCARE SECTOR 15
2.1 INTRODUCTION 15
2.2 INFORMATION TECHNOLOGY AND INFORMATION SYSTEMS: A THEORETICAL OVERVIEW 17
2.2.1 Information Systems and Information Technology 17
2.2.2 The Concept of "Fit" 19
2.2.3 Socio-technical Theory 19
2.2.4 Information Systems Development Methods (ISDMs) 22
2.2.4.1 System Development Life Cycle (SDLC) 22
2.2.4.2 Prototyping 24
2.2.4.2.1 Rapid Application Development (RAD) 26

2.2.4.3 Application Software Packages 27
2.2.4.4 Outsourcing 28
2.3 INFORMATION SYSTEMS IN HEALTHCARE 29
2.3.1 E-health, Telehealth and Telemedicine 29
2.3.2 Health Care Information Systems (HCIS) 31
2.3.3 Electronic Medical, Patient and Health Records 35
2.3.3.1 The Essence of EMR, EPR and EHR 35
2.3.3.2 Benefits of EMR 37
2.3.3.3 Barriers to Implementation of EHR Systems 38
2.3.3.3.1 Barriers to HCIS Adoption in the Healthcare Sector 39
2.3.3.3.1.1 Complexity of Healthcare Information and Procedures 39
2.3.3.3.1.2 Complexity of Healthcare Organisations 40
2.3.3.3.1.3 Difficulty of Integrating Healthcare Systems 40
2.3.3.3.1.4 Cultural Barriers 40
2.3.3.3.1.5 Financial Barriers 41
2.3.3.3.2 Barriers to EHR Adoption 41
2.3.3.3.2.1 Financial Barriers 41
2.3.3.3.2.2 Organisational or Behavioural Barriers 42
2.3.3.3.2.3 Technical Barriers 44
2.4 CONCLUSION 47

CHAPTER THREE

3 SUCCESSFUL IMPLEMENTATION OF IT PROJECTS 50
3.1 INTRODUCTION 50
3.2 IS SUCCESS 51
3.2.1 DeLone and McLean Model of IS Success 52
3.2.1.1 D&M Model Components 53
3.2.1.2 Critiquing the D&M Model 55
3.3 IS FAILURE 57
3.3.1 IS Failure: A Serious Dilemma 57
3.3.2 IS Failure Categories 58
3.3.3 IS Failure and User Resistance 59
3.3.4 Symptoms of IS Failure 60
3.3.5 Critical Failure Factors (CFFs) 61
3.4 USERS' ACCEPTANCE OF IT 63
3.4.1 Intra-organisational IT Acceptance 64
3.4.2 IT Adoption/Acceptance Theories 64
3.4.3 Technology Acceptance Model (TAM) 67
3.5 CRITICAL SUCCESS FACTORS (CSFS) OF IT IMPLEMENTATION 69
3.5.1 Top Management Support 71
3.5.2 User Involvement 72
3.5.3 User Support 73
3.5.4 User Training 73
3.5.5 Availability of Resources 74
3.5.6 Championship 74
3.6 CONCLUSION 75

CHAPTER FOUR

4 THE NPFIT IN THE NHS IN ENGLAND 77
4.1 COMPONENTS OF THE NPFIT 77
4.1.1 The NHS Care Records Service (NHS CRS) 78
4.1.2 Electronic Booking System (Choose and Book) 79
4.1.3 Electronic Transmission of Prescriptions (ETP) 79
4.1.4 NHS National Network (N3) 80
4.2 DELIVERY OF THE NPFIT PRODUCTS 80
4.2.1 National Application Service Providers (NASPs) 81
4.2.2 Local Service Providers (LSPs) 81
4.2.3 Existing System Providers (ESPs) 83
4.3 LORENZO: THE NHS CRS IN THE NMEPFIT 83
4.3.1 Deployment Units Approach 84
4.3.2 Deployment Process of LORENZO 87
4.4 CRITIQUE TO THE NPFIT IMPLEMENTATION 90
4.5 CONCLUSION 93

CHAPTER FIVE

5 QUALITATIVE RESEARCH: NATURE, TYPES AND LIMITATIONS 95
5.1 INTRODUCTION 95
5.2 NATURE OF THE RESEARCH 96
5.2.1 Research Approach (Methodology) 98
5.2.1.1 Quantitative vs. Qualitative Approaches 98
5.2.1.2 Choosing the Qualitative Approach 99
5.2.1.3 Research Paradigm: Positivism vs. Interpretivism 101
5.2.1.4 Ontological Foundation of Research Paradigm 102
5.2.1.5 Epistemological Foundation of Research Paradigm 104
5.2.2 Deductive vs. Inductive Research 106
5.2.3 Exploratory, Descriptive and Explanatory Studies 106
5.2.4 Cross-sectional vs. Longitudinal Studies 108
5.3 DISADVANTAGES OF QUALITATIVE RESEARCH 108
5.3.1 Subjectivity of Qualitative Research 109
5.3.2 Lack of Credibility 109
5.3.3 Lack of Transparency 110
5.3.4 Lack of Generalisation 111
5.4 ASSESSING QUALITATIVE RESEARCH QUALITY 113
5.4.1 Reliability of Qualitative Research (Dependability) 114
5.4.2 Internal Validity of Qualitative Research (Credibility) 115
5.4.3 External Validity of Qualitative Research (Transferability) 117
5.4.4 Objectivity of Qualitative Research (Confirmability) 117
5.5 CONCLUSION 118

CHAPTER SIX

6 CASE STUDY DESIGN 119
6.1 INTRODUCTION 119

6.2 RESEARCH DESIGN 119
6.2.1 Design Strategy 121
6.2.2 Case-Study: The Selected Design Strategy 122
6.2.2.1 What is Case-Study 123
6.2.2.2 Why Select a Case Study Strategy 125
6.2.2.3 Types of Case Studies 127
6.2.2.4 Single vs. Multiple Case Studies 128
6.2.2.5 Level and Units of Analysis 130
6.2.2.6 Writing Good Case Based Research Report 133
6.2.3 Data Collection Methods 134
6.2.3.1 Typologies of Data Collection Methods 134
6.2.3.2 Types of the Data Collected 134
6.2.3.3 Types of Qualitative Interviewing 135
6.2.3.4 Semi-structured Interviewing: the Main Research Method 136
6.2.4 Sampling Design 138
6.2.4.1 Types of Samples 138
6.2.4.2 Snowball Sample: The Selected Sampling Technique 139
6.2.4.3 Selection Criterion of the Sample Subjects 140
6.2.4.4 Theoretical Sampling 140
6.3 DEVELOPING THE INTERVIEW GUIDE 141
6.4 INTERVIEWS CONDUCTED 144
6.5 IMPLEMENTATION OF INTERVIEWS 145
6.6 CONCLUSION 146

CHAPTER SEVEN

7 QUALITATIVE DATA ANALYSIS DESIGN 148
7.1 INTRODUCTION 148
7.2 QDA STRATEGIES (APPROACHES) 149
7.2.1 Heterogeneity in QDA Approaches 149
7.2.2 Common Features of QDA Approaches 151
7.2.3 The Nature of the QDA Process 152
7.3 GROUNDED THEORY (GT) 153
7.3.1 What is Grounded Theory? 154
7.3.2 When Can Researchers Use GT? 155
7.3.3 The Outcome of Using GT 157
7.4 CODING PROCEDURES 159
7.4.1 Open (initial) Coding 163
7.4.2 Focused Coding 165
7.4.3 Theoretical Coding 165
7.4.4 Selective Coding 168
7.5 WHAT DOES GT SUFFER FROM? 170
7.6 CONCLUSION 171

CHAPTER EIGHT

8 ANALYSIS OF THE COLLECTED DATA 172
8.1 INTRODUCTION 172

8.2 USING COMPUTERS IN QUALITATIVE DATA ANALYSIS 172
8.3 THE STAGES OF DATA ANALYSIS 174
8.3.1 Transcription of Interviews 174
8.3.2 Creating NVivo Projects 175
8.3.3 Coding the Transcripts 175
8.3.4 Writing Memos 182
8.3.5 Creating Tree Nodes 184
8.3.6 Bringing all the Projects Together 189
8.3.6.1 The First Category: Clinicians' Attributes 190
8.3.6.1.1 Difficulty in Reaching Consensus 192
8.3.6.1.2 End Users' Autonomy and Power 192
8.3.6.1.3 Lack of End Users' Informatics Experience 193
8.3.6.1.4 Busy Clinicians (Lack of Time) 193
8.3.6.1.5 Anxiety in Using the System 194
8.3.6.1.6 Generational Gap 196
8.3.6.1.7 End Users' Training (inappropriate) 196
8.3.6.2 The Second Category: Departmental Factors (nature of working environment) 197
8.3.6.2.1 Diversity of IT Applications 199
8.3.6.2.2 Individualistic Nature of the Practise 199
8.3.6.2.3 Lack of Benefits Realisation 199
8.3.6.2.4 Various User Groups and Specialties 201
8.3.6.2.5 Tension within and between End User Groups 201
8.3.6.2.6 Non-Practising Clinicians 202
8.3.6.2.7 Work Pressure 202
8.3.6.2.8 Lack of Clinical Input 203
8.3.6.2.9 Various System Deployment Environments 203
8.3.6.3 The Third Category: Organisational Factors 205
8.3.6.3.1 Focus on Single Organisations for Deployment (Absence of Critical Mass Factors 208
8.3.6.3.2 Lack of Clinical Input 208
8.3.6.3.3 Lack of NHS Trusts' Involvement 208
8.3.6.3.4 Lack of Organisational Readiness 211
8.3.6.3.5 Lack of Senior Level Awareness of the Project 212
8.3.6.3.6 Lack of Senior Level Management Medical Expertise 212
8.3.6.3.7 Lack of Top Management (NHS) Support 212
8.3.6.3.8 Legal Implementation of Procedures vs. Guidance 213
8.3.6.3.9 NHS Organisational Structure 213
8.3.6.3.10 Non-Supportive NHS organisational Culture 214
8.3.6.3.11 Political Influence on System Deployment 215
8.3.6.3.12 Rewards for Adopting the System 215
8.3.6.3.13 Stakeholders and Communications Management 216
8.3.6.3.14 Undocumented Tacit Knowledge - Absence of Externalization 217
8.3.6.4 The Fourth Category: LSP Related Factors 217
8.3.6.4.1 Lack of Clinical Input 218
8.3.6.4.2 Lack of Interaction between the LSP and the Local NHS 218
8.3.6.4.3 Lack of LSP's HIS Development Expertise 219
8.3.6.4.4 Lack of Technical Support 219
8.3.6.4.5 Limited Influence to Facilitate Software Usage 220
8.3.6.4.6 Reliance on LSPs to Standardise Clinical Processes 220

8.3.6.5 The Fifth Category: System Related Factors 220
8.3.6.5.1 The Newness of the System 222
8.3.6.5.2 Complexity of the Software 223
8.3.6.5.3 Changing (Creeping) Requirements 223
8.3.6.5.4 Compatibility of the System 224
8.3.6.5.5 Large Scale of the Project 224
8.3.6.5.6 Limited Completion Time 225
8.3.6.5.7 System Development Methodology 225
8.3.6.5.8 System's limited Functionality 227
8.3.6.5.9 Determination of system's Strategic Objectives 227
8.3.6.5.10 Problem Recognition and Definition 228
8.3.6.5.11 Integration and Information Sharing 228
8.3.6.5.12 Highly Configurable System 228
8.3.6.5.13 The Technological Nature of the Programme 229
8.3.6.6 The Sixth Category: The Nature of Clinical Processes 229
8.3.6.6.1 Ambiguous, ill-defined Business Processes 230
8.3.6.6.2 Lack of Understanding of Clinical Processes 231
8.3.6.6.3 Variation in (Unstandardized) Clinical Process between and within NHS Organisations 231
8.3.6.6.4 Lack of Task-Technology Fit 232
8.3.6.7 The Seventh Category: Clinical Safety 232
8.3.6.7.1 Lack of Importance Placed on Clinical Safety 234
8.3.6.7.2 Risk Assessment 235
8.3.6.7.3 Local Ownership of Risk 235
8.3.6.7.4 Reporting System of Safety Issues 236
8.4 CONCLUSION 237

CHAPTER NINE

9 THEORY BUILDING 239
9.1 INTRODUCTION 239
9.2 WHAT MADE IPM FAIL? 240
9.2.1 iPM (the Old PAS) 240
9.2.1.1 The iPM PAS Category 241
9.2.1.1.1 Negative Perceptions about iPM 241
9.2.1.1.2 Existence of Workarounds 244
9.2.1.1.3 Threats to System Security 244
9.3 DETERMINING RELATIONSHIPS IN THE MAJOR CATEGORIES 248
9.3.1 Clinicians' Attributes 249
9.3.2 Departmental Factors (nature of working environment) 254
9.3.3 Organisational Factors 261
9.3.4 LSP Related Factors 271
9.3.5 System Related Factors 275
9.3.6 The Nature of Clinical Processes 280
9.3.7 Clinical Safety 283
9.4 CONCLUSION 286

CHAPTER TEN

10 RESEARCH FINDINGS AND RECOMMENDATIONS 290
10.1 INTRODUCTION 290
10.2 MAJOR FINDINGS AND CONCLUSIONS 291
10.2.1 Extensions to the TAM 291
10.2.2 Perceiving the Benefits of LORENZO 298
10.2.3 Barriers to Successful Implementation of LORENZO 299
10.3 CONTRIBUTIONS OF THE RESEARCH 302
10.4 RESEARCH LIMITATIONS AND ETHICAL CONSIDERATIONS 303
10.5 RESEARCH RECOMMENDATIONS 305
10.5.1 How should we perceive the development methodology? 305
10.5.1.1 Adopting multi-staged and iterative development methodology 305
10.5.2 How can we improve clinicians' attributes? 307
10.5.2.1 Enhancing end users' IT experience 307
10.5.2.2 Encouraging clinicians' involvement 307
10.5.2.3 Providing proper training programmes 308
10.5.2.4 Encouraging a teamwork philosophy in NHS local organisations 308
10.5.2.5 Emphasising the importance of health informatics departments in the NHS trusts 309
10.5.3 Fostering the NHS Organisational Context 309
10.5.3.1 Focusing on the bottom level of the NHS organisations 309
10.5.3.2 Fostering open, bottom-up communication channels 309
10.5.3.3 Obtaining top management support and championship 310
10.5.3.4 Emphasising seniors' clinical/technical expertise 310
10.5.3.5 Ensuring the NHS responsibilities toward LORENZO implementation 310
10.5.4 How the LSP can boost users' acceptance of LORENZO 310
10.5.4.1 Adjusting contractual arrangements 310
10.5.4.2 Allowing part time contracts 311
10.6 FUTURE RESEARCH 311

REFERENCES 313

APPENDICES

LIST OF FIGURES

CHAPTER ONE

FIGURE 1-1: THE GOVERNANCE SYSTEM OF THE DoH 2
FIGURE 1-2: MAP OF THE SHAs IN ENGLAND 3
FIGURE 1-3: THE RESEARCH STRUCTURE 12

CHAPTER TWO

FIGURE 2-1: SYSTEM PERSPECTIVE OF INFORMATION SYSTEM 17
FIGURE 2-2: SDLC PHASES 23
FIGURE 2-3: PROTOTYPING METHOD 25
FIGURE 2-4: E-HEALTH, TELEHEALTH, AND TELEMEDICINE 30
FIGURE 2-5: THE FIVE LEVELS OF MEDICAL RECORDS COMPUTERISATION 35

CHAPTER THREE

FIGURE 3-1: D&M's TAXONOMY OF IS SUCCESS 53
FIGURE 3-2: FAILURE RATES OF IT PROJECTS – CHAOS REPORT 58
FIGURE 3-3: CAUSES OF IS FAILURE 61
FIGURE 3-4: THE TECHNOLOGY ACCEPTANCE MODEL (TAM) 67

CHAPTER FOUR

FIGURE 4-3: STRATEGIC COMPONENTS OF THE NPfIT 78
FIGURE 4-4: ELEMENTS OF THE NHS CRS 79
FIGURE 4-5: LSPs OF THE NPFIT 82
FIGURE 4-6: LORENZO's DEPLOYMENT UNITS 84
FIGURE 4-7: NATIONAL STANDARD FOR IMPLEMENTATION 87

CHAPTER FIVE

FIGURE 5-1: THE PHILOSOPHICAL FOUNDATION OF THE RESEARCH 105

CHAPTER SIX

FIGURE 6-1: THE ROLE OF RESEARCH DESIGN 121
FIGURE 6-2: TECHNOLOGIES AND LEVELS OF ANALYSIS 131
FIGURE 6-3: LEVELS (UNITS) OF ANALYSIS 131
FIGURE 6-4: THE STAGES OF THE CURRENT RESEARCH 141

CHAPTER SEVEN

FIGURE 7-1: THE PROCESS OF CODING 169

CHAPTER EIGHT

FIGURE 8-1: CLINICIANS' ATTRIBUTES CATEGORY 191
FIGURE 8-2: ANXIETY IN USING THE SYSTEM SUBCATEGORY 195
FIGURE 8-3: DEPARTMENTAL FACTORS (THE NATURE OF WORKING ENVIRONMENTS) CATEGORY 197
FIGURE 8-4: LACK OF BENEFITS REALISATION CATEGORY 200
FIGURE 8-5: VARIOUS SYSTEM DEPLOYMENT ENVIRONMENTS SUBCATEGORY 204
FIGURE 8-6: ORGANISATIONAL FACTORS CATEGORY 206
FIGURE 8-7: TEAMWORK SUBCATEGORY 210

FIGURE 8-8: LSP RELATED FACTORS CATEGORY 217
FIGURE 8-9: SYSTEM RELATED FACTORS CATEGORY 221
FIGURE 8-10: LORENZO SOLUTION ROADMAP 226
FIGURE 8-11: THE NATURE OF CLINICAL PROCESSES CATEGORY 229
FIGURE 8-12: CLINICAL SAFETY CATEGORY 232

CHAPTER NINE

FIGURE 9-1: THE IPM PAS CATEGORY 241
FIGURE 9-2: THE IPM PAS CATEGORY WITH LINKS 246
FIGURE 9-3: THE CAUSES OF IPM FAILURE 247
FIGURE 9-4: CLINICIAN'S ATTRIBUTES CATEGORY WITH LINKAGES 250
FIGURE 9-5: THE LINKAGE BETWEEN ANXIETY IN USING THE SYSTEM, THE NEWNESS OF THE PROJECT, AND RESISTANCE TO USAGE 251
FIGURE 9-6: DEPARTMENTAL FACTORS (NATURE OF WORKING ENVIRONMENT) MAJOR CATEGORY WITH LINKAGES 255
FIGURE 9-7: THE LINKAGE BETWEEN END USERS' AUTONOMY & POWER, TENSION WITHIN AND BETWEEN END USERS GROUPS, AND VARIOUS USER GROUPS AND SPECIALITIES 260
FIGURE 9-8: EXTERNAL RELATIONSHIPS WITH DIFFICULTY IN REACHING CONSENSUS 263
FIGURE 9-9: EXTERNAL RELATIONSHIPS WITH LEGAL IMPLEMENTATION OF PROCEDURES VS. GUIDANCE 264
FIGURE 9-10: ORGANISATIONAL FACTORS MAJOR CATEGORY WITH LINKAGES 265
FIGURE 9-11: THE CAUSES OF THE LACK OF TOP MANAGEMENT (NHS) SUPPORT 269
FIGURE 9-12: LSP RELATED FACTORS MAJOR CATEGORY WITH LINKAGES 272
FIGURE 9-13: SYSTEM RELATED FACTORS MAJOR CATEGORY WITH LINKAGES 276
FIGURE 9-14: THE NATURE OF CLINICAL PROCESSES MAJOR CATEGORY WITH LINKAGES 281
FIGURE 9-15: CLINICAL SAFETY MAJOR CATEGORY WITH LINKAGES 284

CHAPTER TEN

FIGURE 10-1: THE ORIGINAL TAM 292
FIGURE 10-2: FACTORS AFFECTING END USERS' ATTITUDES IN A MODIFIED TAM. 293
FIGURE 10-3: INFLUENCING FACTORS ON CLINICAL SAFETY 294
FIGURE 10-4: CLINICAL SAFETY 295
FIGURE 10-5: THE IMPACT OF DEVELOPMENT METHODOLOGY ON SYSTEM'S FEATURES 296
FIGURE 10-6: EXTERNAL VARIABLES IN MODIFIED TAM 298
FIGURE 10-7: THE IMPACT OF VARIOUS USER GROUPS ON CLINICAL INPUT 300
FIGURE 10-8: SEQUENTIAL STAGES OF SYSTEM'S DEVELOPMENT 306
FIGURE 10-9: ITERATIVE STAGES OF SYSTEM'S DEVELOPMENT 307

LIST OF TABLES

CHAPTER ONE
TABLE 1-1: WANLESS REPORT AND DELIVERING THE NHS PLAN 5

CHAPTER TWO
TABLE 2-1: CLASSIFICATION OF HCIS 32
TABLE 2-2: TYPES OF AIS 33
TABLE 2-3: TYPES OF CIS 34
TABLE 2-4: SECURITY PRECAUTIONS 47

CHAPTER THREE
TABLE 3-1: EWSs OF IS FAILURE 60
TABLE 3-2: CFFs BASED ON THE TRIPLE S FRAMEWORK 63
TABLE 3-3: SUCCESS FACTORS OF IS DEVELOPMENT PROJECTS-CHAOS STUDY 71

CHAPTER FIVE
TABLE 5-1: TYPES OF RESEARCH 97
TABLE 5-2: GOALS OF QUALITATIVE AND QUANTITATIVE STRATEGIES 99
TABLE 5-3: ALTERNATIVE TERMS FOR RESEARCH PARADIGMS 102

CHAPTER SIX
TABLE 6-1: RESEARCH PURPOSES AND TYPES OF INTERVIEWS 136
TABLE 6-2: CONDUCTED INTERVIEWS IN THE NME REGION 144

CHAPTER EIGHT
TABLE 8-1: THE CONCEPTS IN PROJECT 1 (R1) 177
TABLE 8-2: THE CONCEPTS IN PROJECT 2 (R2) 178
TABLE 8-3: THE CONCEPTS IN PROJECT 3 (R3) 179
TABLE 8-4: THE CONCEPTS IN PROJECT 4 (R4) 180
TABLE 8-5: THE CONCEPTS IN PROJECT 5 (R5) 181
TABLE 8-6: THE CONCEPTS IN PROJECT 6 (R6) 182
TABLE 8-7: THE CATEGORIES IN PROJECT 1 (R1) 184
TABLE 8-8: THE CATEGORIES IN PROJECT 2 (R2) 185
TABLE 8-9: THE CATEGORIES IN PROJECT 3 (R3) 186
TABLE 8-10: THE CATEGORIES IN PROJECT 4 (R4) 187
TABLE 8-11: THE CATEGORIES IN PROJECT 5 (R5) 188
TABLE 8-12: THE CATEGORIES IN PROJECT 6 (R6) 189
TABLE 8-13: THE SOURCES OF THE CONCEPTS IN CLINICIANS' ATTRIBUTES CATEGORY 192
TABLE 8-14: THE SOURCES OF THE CONCEPTS IN THE DEPARTMENTAL FACTORS CATEGORY 198
TABLE 8-15: THE SOURCES OF THE CONCEPTS IN THE ORGANISATIONAL FACTORS CATEGORY 207
TABLE 8-16: THE SOURCES OF THE CONCEPTS IN THE LSP RELATED FACTORS CATEGORY 218
TABLE 8-17: THE SOURCES OF THE CONCEPTS IN THE SYSTEM RELATED FACTORS CATEGORY 222

TABLE 8-18: THE SOURCES OF THE CONCEPTS IN THE NATURE OF CLINICAL PROCESSES CATEGORY 230
TABLE 8-19 THE SOURCES OF THE CONCEPTS IN CLINICAL SAFETY CATEGORY 233

CHAPTER NINE

TABLE 9-1: THE TYPES OF RELATIONSHIPS USED IN THE NVIVO PROJECTS 249

LIST OF ABBREVIATIONS

AIS: Administrative Information System	**ALBs**: Arm Length Bodies
ASP: Application Service Providers	**BT**: British Telecom
CAQDAS: Computer-Assisted Qualitative Data Analysis Software	**CASE**: Computer-Aided Software Engineering
CBHIS: Computer Based Health Information System	**CBIS**: Computer-Based Information System
CDSS: Clinical Decision Support System	**CFFs**: Critical Failure Factors
CfH: Connecting for Health	**CIS**: Clinical Information System
CPOE: Computerized Provider/Physician Order Entry	**CRS**: Care Records Service
CSC: Computer Sciences Corporation	**CSFs**: Critical Success Factors
D&M: DeLone and McLane	**DBMS**: Database Management Systems
DoH: Department of Health	**DOI**: Diffusion of Innovations
EE: Effort Expectancy	**E-Health**: Electronic Health
EHR: Electronic Health Record	**EMR**: Electronic Medical Record
EPR: Electronic Patient Record	**EPS**: Electronic Prescription Service
ERDIP: Electronic Record Development and Implementation Programme	**ESP**: Existing System Provider
ETP: Electronic Transmission of Prescriptions	**EWSs**: Early Warning Signs

FC: Facilitating Conditions

FITT: Fit between Individual, Task, and Technology

GP: General Practitioner

GT: Grounded Theory

GTM: Grounded Theory Method

GUI: Graphical User Interface

HCIS: Health Care Information System

HIS: Health Information System

HRM: Human Resource Management

ICT: Information & Communication Technology

IfH: Information for Health

IS: Information System

ISDMs: Information Systems Development Methods

IT: Information Technology

JAD: Joint Application Design

LAS: London Ambulance Service

LHC: Local Health Community

LIS: Library Information System

LPfIT: London Programme for Information Technology

LSP: Local Service Provider

MPCU: Model of Personal Computer Utilization

N3: NHS National Network

NAO: National Audit Office

NASP: National Application Service Provider

NHS: National Health Service

NME: North, Midlands, and East of England

NMEPfIT: North, Midlands and East Programme for Information Technology

NPfIT: National Programme for Information Technology

NSI: National Standard for Implementation

PACS: Picture Archiving and Communications System

PAS: Patient Administration System

PCI: Perceived Characteristics of Innovation

PCs: Personal Computers

PCT: Primary Care Trust

PE: Performance Expectancy

PEOU: Perceived Ease of Use

POC: Provision of Care

PSIS: Personal Spine Information Service

PU: Perceived Usefulness

QDA: Qualitative Data Analysis

RA: Relative Advantage

RAD: Rapid Application Development

SCR: Summary Care Record

SDLC: System Development Life Cycle

SHA: Strategic Health Authority

SI: Social Influence

SME: Small and Mid-sized Enterprise

SN: Subjective Norms

SOGI: Societies, Organisations, Groups, and Individuals

SOPs: Standard Operating Procedures

SPfIT: Southern Programme for Information Technology

SUS: Secondary Uses System

TAM: Technology Acceptance Model

TTF: Task-Technology Fit

TTM: Time to Market

UIS: User Information Satisfaction

UTAUT: Unified Theory of Acceptance and Use of Technology

Chapter One

1. INTRODUCTION

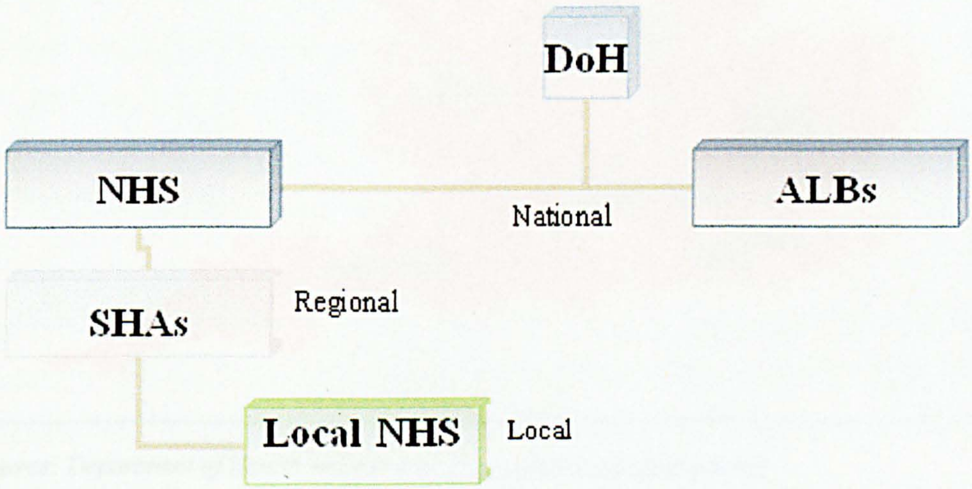
1.1 BACKGROUND

Information technologies have been infused in almost all aspects of our professional and personal lives. The tremendous capabilities of Information Technology (IT) in processing, storing, and retrieving information has resulted in fast growth in computer usage. Growth in computer usage represents the fastest diffusion of technology in human history (Igbaria, Zinatelli & Cavaye 1998). Kelcun-Dabrowska (2003) postulates that the use of Information systems (i.e. computer based systems) contributes to enhancing efficiency, effectiveness, and quality of care in the healthcare industry.

It has been one of the UK government's top priorities to modernise healthcare. Tony Blair declared his ambition to do so, "*Giving the people of this country the best system of healthcare in the world*" (Department of Health 1998). Since then, the UK government has concentrated its efforts on utilising Information and Communication Technology (ICT) as a key enabler of numerous reform and/or modernisation plans (Beynon-Davies & Williams 2003). These plans aim at reengineering the organisational processes and services in the healthcare sector to enhance patient care (Currie & Guah 2006). Currie & Guah (2006) state that the healthcare sector in the UK has received large financial investment to implement modernisation schemes.

The Department of Health (DoH) provides health care through the National Health Service (NHS), supported at a regional level by the Strategic Health Authorities (SHAs), and at a local level through local NHS organisations, as shown in Figure 1-1 (Department of Health 2008).

Figure 1-1: The Governance System of the DoH



As shown in Figure 1-1, the NHS provides health care to patients regionally through 28 SHAs that were established in 2002. In July 2006, the number of SHAs was reduced to 10 covering the whole of England. Figure 1-2 illustrates these SHAs. Nowadays, SHAs are accountable for implementation and benefits realisation from the NPfIT, and making sure that local NHS has the capability and resources to deliver their plans (NHS Connecting for Health 2007).

Figure 1-2: Map of the SHAs in England

Source: Department of Health website http://www.dh.gov.uk/en/index.htm

Primary Care Trusts (PCTs) are the frontline and cornerstone of the NHS in providing health services at a local level. The main functions of PCTs are: improving the health of the local population, commissioning services, which refers to the process of identifying the best services needed by local population, acquiring them and ensuring that they are being offered to local inhabitants in the desired way, and finally developing staff skills to improve the quality of services provided (The NHS Confederation 2008). Furthermore, The NHS is considered Europe's largest employer. Worldwide, the NHS is the third largest employer after the Chinese Army (2.3 million) and Indian Rail (1.5 million) (NHS Employers 2008). The number of NHS staff as of 30 September 2007 reached 1,331,109 people.

During the past years, successive governments have tried with varying success to introduce different developments aimed at enhancing the quality and reducing the cost of providing health services. Information and Communication Technologies (ICT) in the NHS context have been perceived as crucial element in achieving these goals, by making health information available electronically at local and national level. The introduction of IT started from the 1960s illustrated by computer systems for Patient

Administration Systems (PAS), followed by laboratory and radiology systems in the 1970s. Hospital information support systems and resource management systems were introduced in 1980s. In 1990s, the NHS developed an IT strategy that resulted in the introduction of Electronic Patient Record (EPR) and later an Electronic Record Development and Implementation Programme (ERDIP) (Currie & Guah 2007).

Modernising the NHS began in July 2000 as a 10-year reform programme. Since 2000, the NHS has initiated a series of reform programme that aimed at improving the quality of health services and providing healthy lives for the people of the UK. The author discusses some reform plans that explicitly emphasised the pivotal role of IT as an enabler of modernisation process. These reform plans are:

- ***Information for Health: An Information Strategy for Modern NHS 1998-2005***

In September 1998, the DoH published the Information for Health (IfH) document. IfH was a seven-year strategy that stressed the importance of developing information strategy with the aim of providing accessible and updated information for both patients and health professionals. The DoH announced its goal to develop an Electronic Health Record (EHR), which collects health-related data about patients regarding their contacts and the types of treatment they get from GPs and primary care. EHR was to be implemented as a network of local individual Electronic Patient Records (EPR) (Department of Health 1998). The IfH strategy emphasised the pivotal role of IT in developing and applying Telemedicine or Telecare for providing various health services to patients.

- ***The NHS Plan: A Plan for Investment A Plan for Reform***

The NHS plan was published in 2000 to reveal a holistic view of what the reform programme should be in the coming 10 years to modernise the NHS and provider better health care (Department of Health 2000).

In April 2002, the *"Wanless Report"* (Department of Health 2002a) and *"Delivering the NHS Plan"* (Department of Health 2002b) were published to translate the NHS plan into deliverable reform actions enabled by Information ICT. Table 1-1 summarises these two documents.

Table 1-1: Wanless Report and Delivering the NHS Plan

(April 17th 2002)	(April118th 2002)
Wanless report	***Delivering the NHS plan***
➢ Double ICT investment ➢ Protection of ICT investment to ensure their direction toward building modern IT in the NHS ➢ Rigorous standards for data and IT ➢ Better IT implementation management	➢ Increased share of the NHS budget to be devoted to training, capital expenditure, and modern IT. These assure qualified staff who are able to provide better quality care with enhanced capacity

After the publication of the Wanless report, Delivering the NHS plan, and the increased interest in applying modern IT, the DoH published the "Delivering 21st Century IT Support for the NHS - a National Strategic Programme" in June 2002 (NHS Connecting for Health 2007, Department of Health 2002c). The DoH took some steps to put the national strategic programme into practice, such as the recruitment of a director general for the **N**ational **P**rogramme **f**or **I**nformation **T**echnology (hereafter, the NPfIT) and the creation of a clinical care advisory group (NHS Connecting for Health 2007). The advisory group comprised representatives from many NHS organisations, which suggested the creation of a NHS care record for each citizen. The NPfIT was created officially in October 2002 (Department of Health 2002d).

The NPfIT is the World's largest IT upgrading project (Brennan 2007, Clegg & Shepherd 2007). The NPfIT is a 10-year programme for creating a national and integrated IT infrastructure. The NPfIT is centrally controlled by the NHS **C**onnecting **f**or **H**ealth (CfH) agency to procure various IT applications with a total expected expenditure of £12.4 billion over the ten years until 2013/2014 (House of Commons 2007). The NHS CfH is seen as the single national IT provider for the NHS, and is responsible for delivering the NPfIT (NHS Connecting for Health 2007). Once the national systems are installed, they will connect 110,000 doctors, 390,000 nurses, and 120,000 other health professionals (The NHS Confederation 2008). Moreover, patients will have access to their personal health information.

The main objective of the NPfIT is giving health professionals access to patient-related information safely, securely, and easily whenever and wherever it is needed (NHS Connecting for Health 2007). Providing health services to people entails producing massive volume of paperwork. Paperwork is vulnerable to misplacement, occupies massive space, and consumes time. Thus, implementing the various IT applications in the NPfIT is expected to save the processing time, consume less space, and overcome other problems that have been in the NHS such as, lost records, delays in appointments and prescriptions (The NHS Confederation 2008).

Moreover, previous hospitals purchased and used their own IT systems without national sharing of medical records with other NHS organisations. Thus, the NPfIT aims at linking computer systems of NHS organisations to enable electronic sharing of information easily and securely (Eason 2006, National Audit Office 2006). To establish electronic sharing of information, the NPfIT aims to build a national network that connects all NHS organisations together with a high-speed, safe, and secure internet connection. Based on this network, prescriptions will be sent electronically to the closest pharmacies, appointments will be fixed at times, and locations convenient to patients, and all primary and crucial medical information about each British citizen will be kept electronically accessible at both national and local level (NHS Connecting for Health 2007).

The NPfIT consists of four main components; the first component is the NHS Care Records Service (CRS). CRS, which is the ultimate output of the NPfIT, is concerned with creating a single electronic health record to which all health providers can have access to and add health-related information (The NHS Confederation 2008). To implement the CRS, England was divided into 10 Strategic Health Authorities (SHAs). Local Service Providers (LSPs) were assigned to deliver local systems and services. Six out of the 10 SHAs constituted the NME region (North, Midlands, and East of England). In the NME region, LORENZO, designed by Computer Science Corporation (CSC), is the CRS to be installed.

The second component is the electronic booking system (Choose and Book) that enables patients to choose their appointments. The third component is Electronic Transmission of Prescriptions (ETP) for generating and transmitting prescriptions electronically. The fourth component is the NHS National Network (N3) that provides the NHS with the IT infrastructure and networking services. The NPfIT has increased in scope and complexity since its beginning in 2002 as more IT applications were added for improved performance.

The reading of the IT/IS literature revealed two main levels of adoption, the organisational and the individual (intra-organisational) levels. In addition, reviewing the official documents published by the UK parliamentary select committee, the UK National Audit Office, NHS reports, and the special issues in the academic journals (e.g. the NHS special issue in the Journal of Information Technology in September 2007), revealed that in spite of the benefits the NPfIT offers, it suffers from shortcomings. End users' resistance to adopting the new systems was one of the main aspects that needed looking at. Chief Clinical Officer, Professor Michael Thick stressed the importance of end users' attitudes and behaviours in enhancing better usage of the new systems (Connecting for Health 2007). Accordingly, the author focused his interest on studying the NPfIT in the NHS at an intra-organisational level (i.e. looking at the implementation of LORENZO from the bottom up).

To understand how the NHS users' behaviour toward the use of technology affected the implementation of LORENZO, the author relied on the Technology Acceptance Model (TAM) discussed in depth in section 3.4.3 of the Successful Implementation of IT Projects chapter (Technology Acceptance Model (TAM)). However, the author adopted a qualitative approach to research this area instead of the quantitative methods that are usually applied to extend the TAM. The extended TAM resulting from analysis of the interview data is shown in Figure 10-9, External Variables in the Modified TAM, in the Research Findings and Recommendations chapter.

1.2 RESEARCH PROBLEM

Currie & Guah (2006) claim that the failure rate in healthcare IT projects is high and may reach around 80%. Moreover, unlike the small or mid sized projects, large scale projects (NPfIT is an example) encounter implementation problems such as delays (Currie & Guah 2006). One can notice that implementing IT initiatives in healthcare organisations incorporates challenges. Thus, the UK Government funded NPfIT as the biggest IT project in the world ever, needs special attention to be paid from the decision makers in the Department of Health (DoH), the NHS CfH, as well as researchers in order to sustain the resources that have been invested in it since its inception in 2002.

In addition, the author noticed that most research has focused on delays, budget overruns in the NPfIT of its individual components, and no or little research has investigated the relationship between the development methodology of information systems and end users' acceptance. Therefore, this research presents an exploratory study from the perspective of end users and developers of LORENZO to identify the significant factors that influence its implementation.

1.3 RESEARCH OBJECTIVES

LORENZO was an appropriate IT application to be researched within the NPfIT context. This is because an opportunity arose for the author to study LORENZO in Morecambe Bay NHS Trust. Moreover, the implementation of LORENZO covers 60% of the SHAs in England. This was thought to be helpful in conducting the present study in a wide area, and consequently, the findings could be useful to more NHS organisations and other stakeholders.

Accordingly, the broad aim of the present study is to investigate the status of LORENZO implementation in the NME region at the local level (bottom-up approach). To achieve the broad aim, the present study focuses on end users' attitudes toward the use of LORENZO through the qualitative inquiry lens. The TAM is the theoretical model to be used in the present study.

The specific objectives of the current study are summarised below:

1. On the basis of analysis of findings from the implementation of LORENZO to suggest extensions to the TAM.

2. Identify the benefits and barriers to the implementation of LORENZO in the NME region.

3. Obtain a variety of relevant perspectives on the implementation of LORENZO in the NME region.

1.4 RESEARCH QUESTIONS

There is a set of questions the author seeks to answer in order that the specific objectives are met. One point to bear in mind is that the author's interest in answering these questions reflects the gap(s) he has found after reviewing the literature. These gaps summarised in lack of studying LORENZO from a user perspective, lack of studies that examined the impact of the development methodology on users' acceptance, and the relative lack of studies that focused on the LSP side of LORENZO implementation. The research questions of the current study are as follows:

1 What extensions to the TAM are suggested by examining the implementation of LORENZO?

2 What are the benefits of LORENZO at the local level?

3 What are the barriers to achieving the successful implementation of LORENZO at the local level?

1.5 SIGNIFICANCE OF THE RESEARCH

The importance of the study stems from the fact that in spite of the various theories that instruct organisations and people in the best practices in IS implementation, system failure continues to occur in large IT projects. In addition, successful uptake of IT is dependent on the nature of the organisational context as well as the nature of the sector. Thus, the study investigates the uptake of LORENZO and looks to the aspects that should be taken into account in order to obtain end users' acceptance. In the same manner, this research presents potential academic, societal, and personal benefits. These are:

Academic benefits

- The current research provides an opportunity to look at a relatively unexplored area in the IS literature, i.e. the relationship between the development methodology and intra-organisational IT usage/acceptance.

- This research proposes an extended TAM model based on the data collected, which reflect user views. This also presents a relatively unexplored area of end users' perceptions of the NPfIT in practice.

Societal benefits

- Applying the research findings in healthcare organisations in the UK or other countries is based on the notion that scientific research and practice are in a continuously interactive relationship. This means that healthcare organisations encounter problems like any other organisations, which constrain their success and accordingly need tackling. Scientific research plays an important role in solving these problems. Assisting healthcare organisations to solve their problems and guiding them to obtain successful uptake of their IT projects should enable technologically advanced societies' heath organisations, to provide better quality health services.

- The current research presents an opportunity for companies working on developing and installing computer hardware and software to gain comprehension and awareness of the importance of designing computer-based information systems that minimise end user resistance.

Personal benefits

- Conducting the current research equips the author with up-to-date knowledge and enhances his level of comprehension and scholarship. The increased level of scholarship would assist the author in applying the research findings in real-life health organisations in Jordan (the author's home country). Furthermore, the author will build on this research to conduct a series of other research projects. Entering this line of research is pivotal as it allows the author to become a consultant in health informatics in the future.

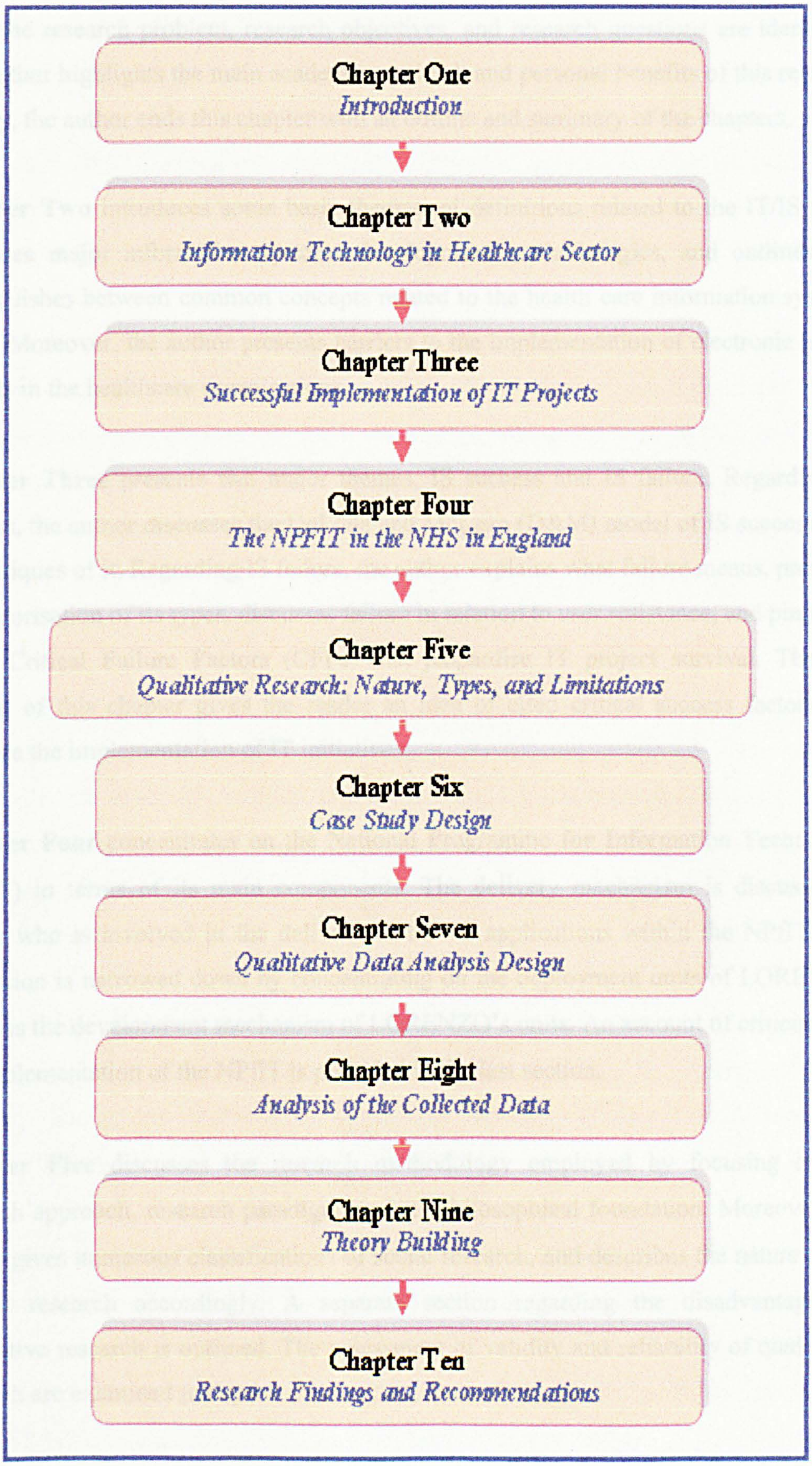
- Good teaching and good research lead to superior learning outcome. The author's intention is to utilise his research-based knowledge in his teaching at one of the Jordanian universities. The author perceives his teaching as a communication tool for transferring the fieldwork-based knowledge to his students. In this way, students can enrich their comprehension and have the chance to look at the western experience in utilising IT.

- Because the current research is conducted in the NHS, which is the largest healthcare, public-sector organisation in Europe, it provides an opportunity to transfer the British experience in computerising the health sector and apply it in Jordan. Knowledge transfer from one of the most technologically developed countries to one of the promising developing countries stimulated the author to conduct this research.

1.6 RESEARCH ORGANISATION AND SUMMARY

This thesis encompasses ten chapters, their sequence is intended to make it easier for the reader to understand how the research objectives were met, what were the various activities accomplished throughout the thesis, and how the findings of this research were inductively derived based on the various research stages. Figure 1-3 shows the arrangement of the chapters.

Figure 1-3: The Research Structure



Chapter One is an introductory chapter that gives an overview of the present research. Then the research problem, research objectives, and research questions are identified. The author highlights the main academic, societal, and personal benefits of this research. Finally, the author ends this chapter with an outline and summary of the chapters.

Chapter Two introduces some basic theoretical definitions related to the IT/IS field, discusses major information systems development methodologies, and outlines and distinguishes between common concepts related to the health care information systems arena. Moreover, the author presents barriers to the implementation of electronic health records in the healthcare organisations.

Chapter Three presents two major themes, IS success and IS failure. Regarding IS success, the author discusses the DeLone and McLean (D&M) model of IS success, and the critiques of it. Regarding IS failure, the author explains what failure means, provides a categorisation of its types, discusses failure in relation to user resistance, and pinpoints some Critical Failure Factors (CFFs) that jeopardise IT project survival. The last section of this chapter gives the reader an idea of cited critical success factors that enhance the implementation of IT initiatives.

Chapter Four concentrates on the National Programme for Information Technology (NPfIT) in terms of its main components. The delivery mechanism is discussed to clarify who is involved in the delivery of the IT applications within the NPfIT. The discussion is narrowed down by concentrating on the deployment units of LORENZO, which is the development mechanism of LORENZO's units. An account of criticisms of the implementation of the NPfIT is provided in the last section.

Chapter Five discusses the research methodology employed by focusing on the research approach, research paradigm, and its philosophical foundation. Moreover, the author gives numerous classifications of social research, and describes the nature of the current research accordingly. A separate section regarding the disadvantages of qualitative research is outlined. The assessment of validity and reliability of qualitative research are examined in depth.

Chapter Six justifies the research design strategy adopted in this study. More specifically, the author discusses the reasons for selecting the case study approach, outlines the various types of case study, and puts emphasis on single versus multiple case studies. The selected data collection tool and sampling strategy are also explained in this chapter. The author explains all the stages he has gone through to conduct the interviews from developing the interview guide to the actual face-to-face interaction with the participants.

Chapter Seven shows the heterogeneity in the strategies used for analysing qualitative data, and their common features. In addition, this chapter discusses grounded theory techniques and principles as the main data analysis technique used in this thesis. The discussion focuses on the definition of grounded theory, when it can be used, and the resulting theory generated. A separate section is assigned to explain the various coding procedures employed in this study. The last section of this chapter mentions the disadvantages of using grounded theory as a technique for analyzing qualitative data.

Chapter Eight starts with an introductory account of the use, and role of computers in analysing qualitative data. The NVivo computer-assisted qualitative data analysis software is presented by explaining its features, and the reasons for choosing it. The author moves on to list the stages of the data analysis. This chapter is dedicated to demonstrate the analysis of the interview transcripts, and highlight the seven major categories of variables drawn from the analysis.

Chapter Nine discusses iPM, the old Patient Administration System (PAS), as a real example of system failure in the NHS to understand its causes. The other part of this chapter explains the relationships within and between the seven major categories resulting from analysis of the collected data.

Chapter Ten presents the findings of this study and suggests a framework that encompasses the system's features (i.e. LORENZO) and the main factors that affect end users' attitudes toward the use of LORENZO in the NHS, based on the TAM. The limitations of this study are discussed in this chapter. Suggestions for future research are also outlined before discussing the most relevant recommendations.

Chapter Two

2. INFORMATION TECHNOLOGY IN THE HEALTHCARE SECTOR

2.1. INTRODUCTION

The rapid growth in the use of Information Technology (IT) has resulted in changing the way, by which products and services are provided to end customers (Hussein, Abdul Karim & Selamat 2007). This change has not been confined to only private sector, but to the public sector. This has directed governments in both developed and developing countries to invest in IT projects in order to improve the provision of public services.

Using IT in organisations and reaping its benefits has a perquisite, which is successful development and implementation of IT schemes. Successful implementation of IT projects has become the primary concern within the Information Systems (IS) discipline (Coombs 1999). Unfortunately, successful implementation of IT is not an easy task to accomplish in spite of the technological advancement in software engineering and the various methodologies used to develop information systems.

Implementation of IS projects has witnessed a high failure rate in comparison with other high-tech projects (Yeo 2002, Mahaney & Lederer 1999). Laudon & Laudon (2006) state that the most common reason for failure of large IS projects is organisational resistance to change. Moreover, Laudon & Laudon (2006) postulate that introducing IT must be incorporated with simultaneous change in structure, people, and tasks. Correspondingly, managers must be able to deal with people and organisations to reach the intended objectives of IT.

At an individual level, adopting IT in organisations does not occur without challenges that may jeopardise the organisational survival. Because numerous IS innovations are rejected by end users or under-utilised (Sharma & Yetton 2003), end users' acceptance of using IT is the most important factor, which helps decision makers and systems developers in preventing failure of health information systems (Kijsanayotin, Pannarunothai & Speedie 2009).

Consequently, implementing the IT applications that compose the structure of the NPfIT needs special attention to be paid from the decision makers in the Department of Health (DoH), the NHS Connecting for Health (CfH) agency, and researchers as well, in order to be aware of the potential problems associated with introducing IT into the NHS world. Such attention is vital because it helps the leadership in the NHS sustain the resources that have been invested in the NPfIT since its inception in 2002.

Since the IT applications of the NPfIT are designed and developed by commercial IT companies, those companies might not have been able to either deal with the people and the organisational arrangements in the NHS, or consider those factors which enhance the success of the technologically advanced programs within the NPfIT. Furthermore, given that CSC outsources LORENZO, which is the fundamental outcome of the NPfIT, the designers might not have taken into account the requirements of the intended users during the design and operation of the system.

In this chapter, the author reviews the existing literature to present a theoretical background and definitions of information systems (IS) and information technology (IT). In addition, the author explains the concept of fit and socio-technical theory, and discusses the various development methodologies used in building information systems. The author moves on to define health information systems, telemedicine, telehealth, and e-health, and to present a typology of the various clinical and administrative information systems used in health care organisations. The last part of this chapter focuses on the electronic records and the distinction between medical, patient, and health records with an emphasis on the hindering factors that obstruct successful implementation of electronic records.

2.2. INFORMATION TECHNOLOGY AND INFORMATION SYSTEMS: A THEORETICAL OVERVIEW

Technological advancements in the fields of medicine and communication technologies have resulted in dramatic change in the way health care is provided to patients (Maheu, Whitten & Allen 2001). In the healthcare sector, information technology (IT) has become a necessity for developing an integrated healthcare IT infrastructure that improves health services and reduces medical errors (LeRouge, Mantzana & Wilson 2007). The strategic role of IT in healthcare has encouraged researchers and academics to work on establishing a new field that is concerned with the provision of health services to patients electronically, or so-called Electronic Health (E-Health) (Maheu, Whitten & Allen 2001). Thus, this section intends to discuss e-health with emphasis on clarifying some theoretical terms (definitions) that are frequently used throughout the thesis.

2.2.1. Information Systems and Information Technology

In the IS field, there is a plethora of (IS) definitions. For instance, O'Brien (1996: 10) defines IS as "*An organised combination of people, hardware, software, communication networks and data resources that collects, transforms and disseminates information in an organisation*". O'Brien's definition denotes the fact that any IS includes technical (i.e. computer hardware and software) as well as social side that is represented in the people who are meant to use it. Moreover, Gupta (1996: 8) defines an IS as "A *system that creates, processes, stores and retrieve information*". This denotes to system perspective to look at information system as a tool, by which data processed and converted into useful information.

Figure 2-1: System Perspective of Information System

Data → **Processing** → **Information**

Laudon & Laudon (2005: 7) define IS as "*interrelated components working together to collect, process, store and disseminate information to support decision making, coordination, control, analysis, and visualization in an organisation*".

Even though there are plenty of IS definitions, there is no agreed upon definition for IS (Alter 2008). Thus, Alter (2008: 451) defines an IS as:

> *"A system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce informational products and/or services for internal or external customers".*

Alter (2008) states that his definition of IS, is useful for academics and researchers, as it differentiates IS from IT and includes manual and computer-based systems. To gain greater understanding about the difference between IS and IT from one side and the difference between manual and Computer-Based Information Systems (CBIS) from the other side, the definitions of IT and CBIS are presented.

Information Technology (IT) refers to any object whose technological base encompasses computer or communication hardware or software (Cooper & Zmud 1990). Gupta (Gupta 1996: 8) defines IT as "*tools and techniques that support the design and development of information systems; these include hardware, software, telecommunications, databases and client servers*". In addition, Laudon & Laudon (2006) describe IT as all CBIS that are used by organisations and the underlying technologies. Thus, when IT tools are used to design an IS in order to collect, analyse and disseminate information, it is termed a Computer-based IS (CBIS) (Kamal 2006). From this point on, the author uses IS to denote a CBIS.

Even though the term technology, in the context of IT, usually allied to the use of computers and automation, its enormous influence on organisational operations, structure, and employees has made it difficult to confine technology just to computer hardware and software. Instead, technology is a broad concept, which encompasses social, procedural, and equipment aspects (Martin 2001). However, most systems development projects focus on the technical side of implementing IT projects (Eason 2001, Clegg 2000). In addition, the IS literature reveals that the failure rate is still high for IT projects because of the lack of emphasis on the organisational impact of IT (Doherty & King 2005). Therefore, the author mentions some models, which stress the significance of the social side of IT implementation. These models are Socio-technical theory, Task-Technology Fit (TTF), and Fit between Individual, Task, and Technology (FITT).

2.2.2. The Concept of "Fit"

For any technology to have a positive impact on performance, it must be utilised and have good fit with the task it supposed to support (Goodhue & Thompson 1995). Goodhue and Thompson (1995) developed the Task-Technology Fit (**TTF**) framework, which stresses the importance of matching task characteristics with technology characteristics.

Ammenwerth et al (2006) criticised the TFF model as it takes into account the fit between task and technology, and the fit between user and technology with no emphasis on the fit between the user and the task. Ammenwerth et al (2006) argue that the nature of the clinical environment, in which IT is applied, necessitates that systems developers and decision makers focus on matching users' attributes with the task's attributes. For instance, in the NHS doctors may not be motivated to fill in prescription forms as a consequence of the extra time required, which can be invested in seeing more patients instead. Thus, Ammenwerth et al (2006) developed a framework called FITT (Fit between Individual, Task, and Technology), which focuses on achieving fit between technology, task, and individuals. They concluded that realising fit between the three components is a key driver for effective IT adoption within the clinical environment in health care.

In conclusion, human and organisational factors are as vital as technical issues and achieving mutual alignment or fit between users, task, and technology is an important factor for successful implementation of IT (Yusof, Kuljis et al. 2008). This implies that users must be motivated, well trained, and able to use a given technology. Technology, in turn, must offer a satisfactory level of functionality for users to perform a certain clinical task that is adequate and clear to them.

2.2.3. Socio-technical Theory

IT is considered as a tool for organisational change/Transformation (Laudon & Laudon 2005). For instance, E-business, where key organisational functions take place in the internet is “technochange” or technology-driven organisational change (Laudon & Traver 2003). IT-enabled change programmes require rethinking of the social and technical systems of the organisation (Chu & Smithson 2007).

Although the rate of technological change has been dominated by the development of new information and communication technologies (Clegg 2000), most IT-enabled organisational change projects face resistance from users, and in some cases these projects encounter system rejection (Doherty & King 2005). The adoption of a techno-centric approach in designing IT projects is one possible factor, which contributes to the failure of IT projects (Eason 2001). Doherty & King (2005) stressed the danger of adopting a techno-centric approach because it encourages systems developers to give most of their attention to implementing IT systems, with not enough emphasis on adapting these systems to the organisational context.

The principal drawback of the techno-centric approach is that it does not give users enough influence on the design process of the technical system. This approach forces organisations to take technology as it is, and adapt their social systems around it (Clegg 2000). In addition, Clegg (2000) claims that adopting a socio-technical approach can improve the design and performance of the IT systems.

The Tavistock Institute founded Socio-technical theory in 1946, since then socio-technical theory has been developed, and tested, to enhance the quality of working life, with technical change (Mumford 2006). Mumford (2006) states that technical system is represented by the technology introduced and its associated work structure, whereas, the social system covers the people in the organisation, and the structure that coordinates and controls the groups of people inside the organisation.

The main principle of socio-technical theory is to pay equal attention to both the human and technical subsystems of the organisation. This means that employees who are meant to use the technology or supposed to be affected by the introduction of the new technology, should be involved, and participate in defining their needs, so that they can be incorporated into the design of the new IS (Mumford 2006). Since technical and social systems are brought together and treated equally, the needs and rights of employees are seen as having as high priority as the technical (non-human) aspects of

IT projects (Mumford 2006). Adopting the socio-technical approach has a prerequisite, which is creating participative, open, and democratic communications that enable employees to convey their needs (Mumford 2006).

In healthcare organisations, implementing IS projects leads to a great deal of change, which affects profoundly the organisation, the people, and the patients as well (Wager, Lee & Glaser 2005). Thus, it is important for healthcare providers to consider strategies that boost organisational acceptance. Wager et al (2005) suggest four main strategies that enable top management in healthcare organisations to better manage the change process associated with introducing IT, these are:

1. Define and manage the expectations of end users

Because people are different, they have different expectations about the new system. Thus, executives in healthcare organisations should not only focus on communicating the objectives of the new systems to users, but also take into account and listen to the needs, and the expectations of the intended users.

2. Do not underestimate the user resistance

It is crucial to keep in mind that change, which results from the adoption of new IT affects people inside organisations. Consequently, decision makers in healthcare organisations should work on conveying clearly the value of the new system to the intended users, rather than forcing them to use it. Wager et al (2005) pinpoint that if end users realise the value or the benefits of the new system, they become more inclined to use the new system. However, the fact that users realise the value of the new system, it does not give executive teams in healthcare organisations an excuse to make the use of the new system mandatory, unless users have confidence in the overall performance of the new system, and sufficient buy-in from the staff is gained.

3. Provide technical support staff and IT infrastructure

Providing timely, accurate, and complete medical information relies on secure and reliable IT infrastructure, which enables medical/clinical staff to share and transfer information among each other. In addition, implementing IT projects in the healthcare sector needs enough resources to be invested during, and after the implementation phase. Resources are not confined to financial resources; they include sufficient technical expertise and knowledge represented by a technically professional team that can offer assistance and guidance to users.

4. Provide sufficient training

Providing training programmes to the intended user groups is pivotal. Training programmes should take place prior to the implementation of the new system (before go-live date), as well as ongoing training since potential problems or changes to the system's functionality may arise, which need updated skills.

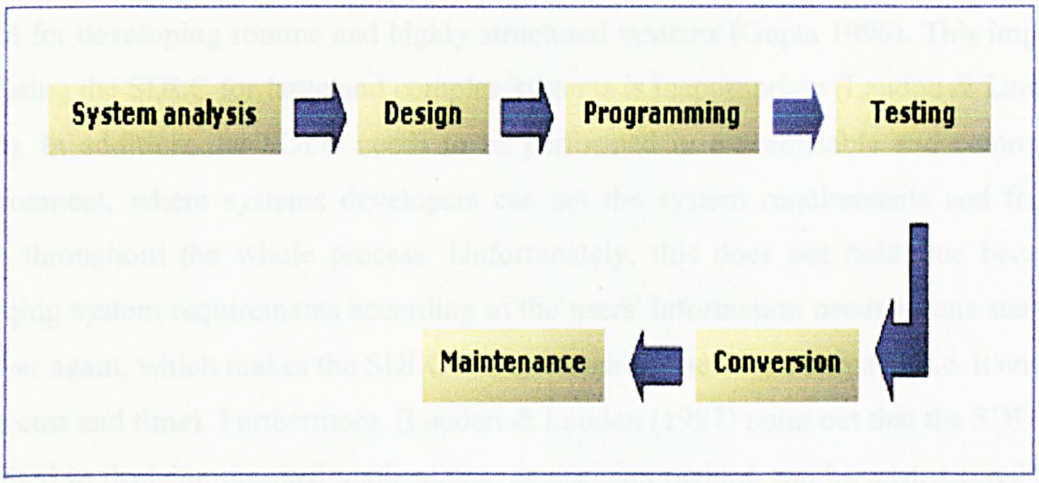
2.2.4. Information Systems Development Methods (ISDMs)

Even though information systems are built for a common purpose, which is solving organisational problems, they are different in terms of their size and technological complexities. Consequently, numerous building approaches have been developed to accommodate the differences in information systems (Laudon & Laudon 2005). Laudon & Laudon (2005) and Gupta (1996) pinpoint five major IS development methods: the System Development Life Cycle (SDLC), prototyping, application software packages, end-user development, and outsourcing. The author discusses just four of these ISDMs because of their relevance to the topic of the current study, and highlights the main principles of Rapid Application Development (RAD) method, as an advanced version of prototyping.

2.2.4.1. System Development Life Cycle (SDLC)

The SDLC is the oldest and the most traditional and popular system development methodology (Laudon & Laudon 2006). SDLC is composed of stages, or phases that are performed sequentially. SDLC consists of system analysis, design, programming, testing, implementation, and maintenance stage (Gupta 1996). Figure 2-2 shows these stages.

Figure 2-2: SDLC Phases



In system analysis stage, functional/business/information requirements of the system are determined. The requirements are specified by finding out who the end users are, and what they need from the system, in terms of information, and how, when, and where they need information. The design and programming stages follow to convert the functional requirements into design or technical specifications (Gupta 1996).

Testing systems aims at ensuring that the information system performs in its intended way, to match the system requirements, and satisfy end users' information needs. (Laudon and Laudon (1997) specify three main types of testing: Unit, System, and, Acceptance testing. Although testing is considered as a separate phase in the SDLC, it is imperative that the (IS) is tested throughout the whole process of developing the IS. Conversion refers to the strategies used to replace the old system with the new one. Parallel, Direct Cutover, Pilot, and Phased approaches are the most commonly used strategies for converting to the new systems. Conversion strategies have drawbacks and advantages, for instance, direct cutover is considered risky but less costly, whereas, phased and pilot strategies are less risky but take longer to convert to the new system.

Installing the designed (IS) is not the final stage of the development process because the environment in which these systems operate is dynamic, and end users' needs are changing. This necessitates that system developers and IS professionals be aware of the fact that these systems must be continuously maintained by revising, adding, and omitting functionalities to cope with these changes.

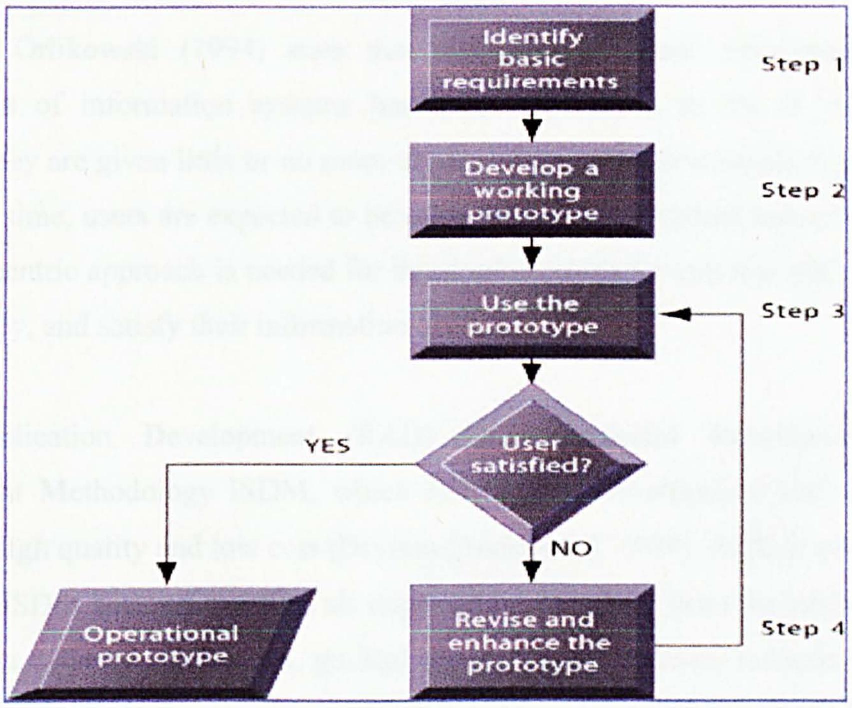
The SDLC has some limitations; SDLC is a set of highly planned sequential stages suited for developing routine and highly structured systems (Gupta 1996). This implies that using the SDLC for large and complex systems is inappropriate (Laudon & Laudon 2006). In addition, the SDLC needs to be performed in a predictable and controlled environment, where systems developers can set the system requirements and freeze them throughout the whole process. Unfortunately, this does not hold true because changing system requirements according to the users' information needs means starting all over again, which makes the SDLC a very resource intensive approach (i.e. it entails more cost and time). Furthermore, (Laudon & Laudon (1997) point out that the SDLC is ill suited to decision-oriented applications, as decision making can be unstructured and accordingly, determining information needs in advance is not viable.

Moreover, the SDLC encourages the "Creeping" requirements that Gupta (1996) mentioned. Creeping requirements refers to the emerging requirements that evolve during the process of system development. Creeping requirements have a negative impact on the functionality of the IS. The inflexibility of the SDLC approach does not allow the system to accommodate these changes.

2.2.4.2. Prototyping

Prototyping is one of the systems development methods by which the computer system is developed iteratively by building a prototype in a quick and inexpensive manner (Gupta 1996). The prototype is "*A preliminary working version of an information system for demonstration and evaluation purposes*" (Laudon & Laudon 1997: 433). Based on prototyping, the information system is built gradually after iterations of development. Each of these iterations encompasses certain activities as depicted in Figure 2-3.

Figure 2-3: Prototyping Method



Source: (Laudon & Laudon 2006)

The prototyping method encourages more user involvement throughout the process of development (Laudon & Laudon 1997). In addition, Alavi (1984) and Doke & Swanson (1995) state that prototyping is useful when users' system requirements are uncertain, and both designers and users are well informed. Thus, one can conclude that prototyping is a valuable development method for decision-oriented applications and end-user interface part of computer applications as systems designers need to interact directly with end users and get their feedback (Laudon & Laudon 1997).

The prototyping method is a user-orientated development approach that necessitates full co-operation and involvement of end users (Gupta 1996). Due to the intensive participation of end users in developing computer systems, users become more responsible for the success of the system. In addition, due to the direct interaction between end users and system designers, new system features may emerge during iterations and subsequently, systems that are more reliable evolve (Gupta 1996).

2.2.4.2.1. Rapid Application Development (RAD)

Beath and Orlikowski (1994) state that even though users' involvement in the development of information systems has been emphasised in the IS development literature, they are given little or no room to participate in the development process, and at the same time, users are expected to be responsible for the system outcomes. Thus, a more user-centric approach is needed for developing computer systems that engage end users actively, and satisfy their information needs.

Rapid Application Development (RAD) is a powerful Information System Development Methodology ISDM, which aims at fast development and delivery of systems at high quality and low cost (Beynon-Davies et al. 1999). RAD is considered as a complete ISDM because it covers all stages of the life cycle from the initiation of the system to its delivery. Teamwork, gradual delivery of the system, reduced waste, and achievable goals are four main pillars on which RAD is based (Gupta 1996). The author discusses briefly the principles of RAD.

1. Teamwork

The Teamwork component is analogous to Joint Application Design (JAD) where system developers and the intended users work together in teams. Each team is composed of four to eight people who discuss various design and development decisions (Beynon-Davies et al. 1999, Gupta 1996). System developers must be socially skilled, and able to use advanced tools, users on the other hand must be knowledgeable in the application being designed. By using RAD, systems developers rely on advanced tools that support rapid developmental change. For instance, Computer-Aided Software Engineering (CASE), Graphical User Interface (GUI), and Database Management Systems (DBMS), are advanced tools used to construct the required prototype *in situ* where system designers and users meet (Beynon-Davies et al. 1999).

2. Phased deliverables

According to the RAD, systems are developed in terms of incremental prototypes and phased delivery (Beynon-Davies et al. 1999). This means that systems are delivered in modules not all at the same time (Gupta 1996). Systems developers construct an initial working prototype that is demonstrated and discussed with representative user groups to amend it. The process of amending and modifying the prototype continues until end users are satisfied.

3. Achievable goals

In RAD, system's requirements/goals are determined mainly by the users not by the management. This leads to more successful systems as their objectives are set up by the intended users themselves.

4. Reduced waste

RAD aims at a frequent delivery of application products. Each deliverable, which constitutes a segment of the entire system, should be completed in three to four months, with no delivery date more than six months after the last release (Gupta 1996). This strategy leads to less time wasted, and greater allocation efficiency of resources needed to build the system or modify it. For instance, if an error is detected in the system, system developers can detect and fix the error in only a particular module, instead of inspecting and rebuilding the whole system.

One can notice that prototyping and RAD allow end users to be active players in developing computer systems. However, applying these methods requires that decision makers and IS professionals be aware of the fact that end users must be empowered, and have the power to make key decisions regarding the development process. Furthermore, they must be able to work with technical staff, and understand the application being developed. For instance, applying prototyping or RAD for building clinical information systems under the NPfIT in the NHS requires the leadership in the NHS to ensure that its users are well informed. Yet, the notion that end users must be well informed is misleading because it is not meant that clinicians should only possess clinical knowledge, but technical knowledge as well. Thus, investigating the level of technical experience, knowledge, and familiarity in the use of IT are important issues to consider when using prototyping.

2.2.4.3. Application Software Packages

Buying or leasing software packages or so-called off-the-shelf packages (Gupta 1996) from external commercial sources (vendors) has been widely used in developing systems (Laudon & Laudon 2006). Software packages are built for specific and non-critical tasks that range in complexity from very simple to extremely complex (Gupta 1996).

Commercial companies take the responsibility for providing predesigned and pretested software, and offer ongoing support to sustain the system. Although software packages are predetermined and prewritten software, many of them offer customisation capabilities, which allow the software to be modified to meet the unique requirements of the organisations (Laudon & Laudon 2006).

There are advantages that organisations can reap from adopting the applications software packages method (Gupta 1996). Less time and cost are required for developing the system, software packages are freer of errors, and the maintenance cost is lower than that for customised systems. However, there are limitations of using software packages; Laudon and Laudon (2006) state that when the organisation purchases a software package, it does not have any control on its design. This means that instead of tailoring the system to users' requirements, the organisation has to adapt its business processes to the new software. Sometimes, if the system is difficult to customise, the organisation has to change its procedures entirely to match the capabilities of the new system. Moreover, Montazemi, et al. (1996) postulate that software packages might not be an appropriate ISDM when the IS department does not choose the right system that achieves users' acceptance.

2.2.4.4. Outsourcing

Outsourcing is defined as *"hiring outside professional services to meet the in-house needs of an organisation"* (Gupta 1996: 460). Application Service Providers (ASP) are outside professional companies that design, build, manage, and maintain information systems, and provide other support services to their customers (Laudon & Laudon 2006).

Nowadays, outsourcing is one of the commonly used strategies for building information systems (Gonzalez, Gasco & Llopis 2006). Outsourcing is useful when organisations seek to focus their limited resources on achieving strategic goals, and concentrate on the primary line of businesses or services they provide to customers. In addition, companies can adopt an outsourcing strategy for economic reasons, because outsourcing contracts are agreed at fixed prices, companies can avoid the escalation of cost associated with building in-house information systems. Laudon and Laudon (2006) postulate that outsourcing is also used for technical reasons because organisations may not have the technical knowledge and skills required for building such a system.

Beynon-Davies et al (1999) state that few studies have been conducted to investigate how ISDMs are selected or adapted, or how they are used. Thus, the author intends to present the above ISDMs to highlight awareness of their advantages and limitations. Moreover, emphasis must be placed on how using these strategies influence the organisations and individuals, in terms of their acceptance to the information systems.

2.3. *INFORMATION SYSTEMS IN HEALTHCARE*

Because healthcare industry is transaction-intensive, an enormous amount of information needs to be processed, stored, and retrieved for future use (Wager, Lee & Glaser 2005). This situation necessitates using IT in healthcare organisations to overcome some problems that have existed for a long time in the healthcare industry, such as lost, incomplete, and inefficient information. With time, information systems have constituted an integral component in managing health services in the developed countries, and a separate professional discipline regarding IT in healthcare emerged.

The author highlights some of the IT-related terms, which pertain to understating the nature of the LORENZO. Electronic health (e-health), Health IS (HIS), administrative and clinical information systems, Electronic Medical Records (EMR), Electronic Patient Records (EPR) and Electronic Health Records (EHR) are discussed in this section.

2.3.1. E-health, Telehealth and Telemedicine

Because the processing power of computers is doubling every 18 months (Darkins & Cary 2000), new applications for technologies continuously emerge. Thus, what seems to be appropriate for today in terms of technologies used might not be the same for tomorrow, and this has led to an evolution of various terms used to describe electronic health, which is provided through communications technologies.

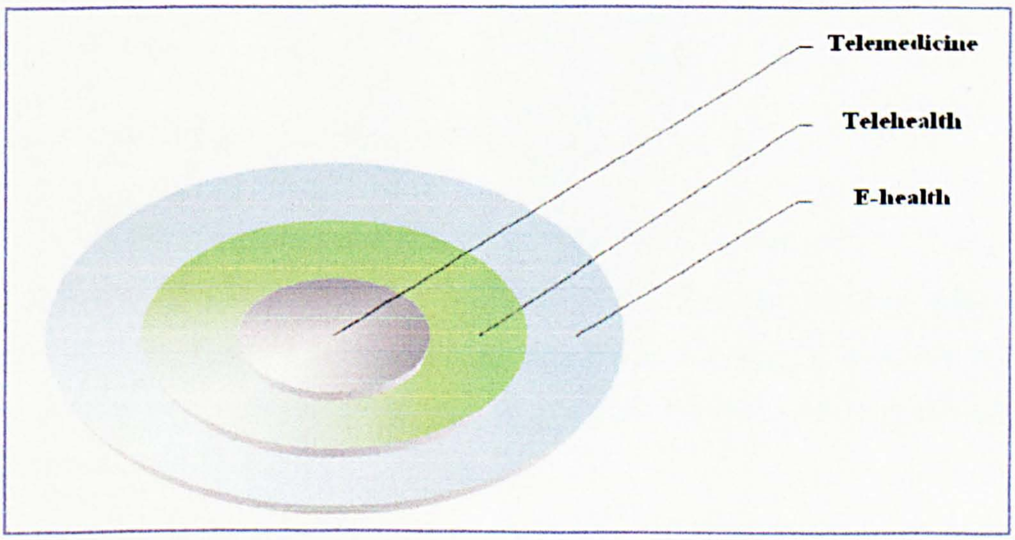
Telemedicine won popularity in the early 1990's to denote health care that is provided at a distance (Darkins & Cary 2000). Another description of telemedicine is *"the provision of health care services. Clinical information, and education over a distance using telecommunication technologies"* (Maheu, Whitten & Allen 2001: 2).

Telehealth is another terms used increasingly by authors as being a subset of telemedicine (Darkins & Cary 2000). Darkins & Cary (2000) state that telehealth denotes to the remote delivery of health care, while telemedicine is restricted to the interactive patient-physician teleconsultation or exclusive to physicians (Maheu, Whitten & Allen 2001).

With the widespread growth of the Internet, **e-health** emerged in 1999 to represent the provision of health care over the internet (Maheu, Whitten & Allen 2001). Health care that is provided over the internet can comprise informational, educational, and commercial products, as well as direct services offered by either professional or non-professional business and consumers themselves (Maheu, Whitten & Allen 2001: 4).

In sum, telemedicine, telehealth, and e-health share a common key component, which is information and/or telecommunications technology. Thus, it is important to clarify what information technology means. Figure 2-4 shows that e-health encompasses the other two terms, and consequently, most authors minimally use telemedicine and telehealth to describe electronic health (Maheu, Whitten & Allen 2001: 11).

Figure 2-4: E-health, Telehealth, and Telemedicine



2.3.2. Health Care Information Systems (HCIS)

As has been discussed, e-health is a health practice that is supported by electronic processes and communications (Rodrigues & Vaidya 2010). In spite of the intensive use of information and communication technologies, e-health still suffers from the poor management of information flows (Medina-Garrido & Crisóstomo-Acevedo 2010). Therefore, it becomes necessary to create Computer Based Health Information Systems (CBHIS) that store and provide information to health professionals without hindering access.

A Health Care Information System (HCIS) is *"an arrangement of information (data), processes, people, and information technology that interact to collect, process, store, and provide as output the information needed to support the health care organisation"* (Wager, Lee & Glaser 2005: 92). HCIS comprise a wide category of administrative and clinical applications that are used across various health organisations and meet the needs of many professional groups (Wager, Lee & Glaser 2005). Nowadays, HCIS are required to provide users with information of all types, and thus, such a separation between clinical information systems and administrative systems is no longer relevant (Van de Velde & Degoulet 2003).

Different classifications of HCIS has been discussed in the literature, for instance, Yusof (2008) present different types of HCIS, Table 2-1 shows these types.

Table 2-1: Classification of HCIS

Information systems	Descriptions	Characteristics
Patient centered information systems	They are the electronic version of patients' information. Different terms are used to refer to these systems including electronic patient record (EPR), electronic medical record (EMR) and computer based patient record (CPR)	• Manage comprehensive patient care information such as medical records, appointment scheduling, theatre management and ward reporting • Have entry and retrieval functions for medical records and clinical procedures
Administrative information systems	Record the main business processes and routine transactions of organizations such as patient admission, discharge and transfer, bill processing, reporting and other management purposes.	• May constitute accounting subsystems, financial subsystems, inventory subsystems, equipment subsystems and general management subsystems tailored to the clinical environment
Clinical information systems (CIS)	Represent separate systems in specialized service of clinical departments. Examples of CIS include patient monitoring systems and anesthesia documentation system	• Perform specific tasks including collection of specific data for patient care, research, management, planning and maintenance of national data repositories • Specific tasks operate in departments such as internal medicine, cardiology, neurology, obstetrics, surgery and psychiatry • CIS are used for administrative support, patient data collection, decision support, picture archiving, image analysis, monitoring, reporting, assessment and research
Radiology information systems	Support the acquisition and analysis of radiological images as well as administrative functions of radiology department. Example: picture archiving and communication systems (PACS)	• May be stand alone or integrated in hospital information systems
Laboratory information systems	Perform data validation, administration, electronic transmission and computer storage	• In high demand when a large number of tests generate large data. Samples are analyzed fully automatically, and the results are computer generated • Support clinician to analyze trends to assess treatment effects
Pharmacy information systems	Maintain medication information	• Include functions such as keeping patients' medication records, checking prescriptions, and providing drug prescriptions and administration to physicians and nurses
Telemedicine	Telemedicine provides and supports healthcare services and education across distances via electronic communications and IT	• Facilitates exchange between primary care physicians and specialists as well as patients from disperse locations • "Allows physicians to practice medicine at a distance"
Clinical decision support systems	Designed specifically to aid clinical decision making	• Common functions: alerting, reminding, critiquing, interpreting, predicting, diagnosing, assisting and suggesting
Hospital information systems	Consist of integrated hospital information processing systems. Examples: computerized physician order entry (CPOE) (which are also referred to as computerized provider order entry), patient care information systems, nursing (bedside) documentation systems, nursing IS, general practitioner IS	• Support healthcare activities at the operational, tactical and strategic levels • Encompass patient management, administration, facilities management and medical applications • Contain database systems, data communication facilities and terminal or workstations

Source: (Yusof, Papazafeiropoulou et al. 2008)

Wager, et al (2005) use a similar classification of HCIS to that used by Yusof, et al (2008) but with emphasis on two main types of HCIS, Administrative Information Systems (AIS) and Clinical Information Systems (CIS). The main distinctions between the two information systems are the type of data each system stores, and the scope of (sub) systems.

An AIS is an information system that encompasses either administered or financial data used to support the fulfilment of management functions in health organisations (Wager, Lee & Glaser 2005). Examples Table 2-2 depicts various types of AISs.

Table 2-2: Types of AIS

Administrative information systems (AIS)		
	Information system type	**Description**
Patient Administration Systems	**Admission, discharge, transfer (ADT)**	tracks the patient's movement of care in an inpatient setting
	Registration	may be coupled with ADT system; includes patient demographic and insurance information as well as date of visit(s), provider information
	Scheduling	aids in the scheduling of patient visits; includes information on patients, providers, date and time of visit, rooms, equipment, other resources
	Patient billing or accounts receivable	includes all information needed to submit claims and monitor submission and reimbursement status
	Utilization management	tracks use and appropriateness of care
Financial Management Systems	**Accounts payable**	monitors debts incurred by the organisation and status of purchases
	General ledger	monitors general financial management and reporting
	Personnel management	Manages human resource information for staff, including salaries, benefits, education, training
	Materials management	monitors ordering and inventory of supplies, equipment needs and maintenance
	Payroll	information about staff salaries, payroll deductions, tax withholding, pay status
	Staff scheduling	assists in scheduling and monitoring staffing needs
	Staff time and attendance	Tracks employee work schedules and attendance

Source: (Wager, Lee & Glaser 2005)

On the other hand, a CIS is an information system that includes clinical/health information that is used to diagnose, treat, and monitor patients' care. CIS may be departmental based and confined to a certain area such as radiology. Alternatively, CIS may be comprehensive and cover all aspects of health care process, e.g. Electronic Medical Records (EMR). Table 2-3 shows different types of CIS.

Table 2-3: Types of CIS

Clinical information systems (CIS)		
	Information system type	**Description**
Ancillary Information Systems	**Laboratory information**	Supports collection, verification, and reporting of laboratory tests
	Radiology information	Supports digital image generation (picture archiving and communication systems (PACS), image analysis, Image management
	Pharmacy information	Supports medication ordering, dispensing, and inventory control; drug compatibility checks; allergy screening; medication administration
Other Clinical Information Systems	**Nursing documentation**	Facilitates nursing documentation from assessment to evaluation, patient care decision support (care planning, assessment, flow-sheet charting, patient acuity, patient education)
	Electronic medical record (EMR)	facilitates electronic capture and reporting of patient's health history, problem lists, treatment and outcomes; allows clinicians to document clinical findings, progress notes, and other patient information; provides decision-support tools and reminders and alerts
	Computerized provider order entry (CPOE)	enables clinicians to directly enter orders electronically and access decision-support tools and clinical care guidelines and protocols
	Telemedicine and telehealth	Supports remote delivery of care; common Features include image capture and transmission, voice and video conferencing, text messaging
	Rehabilitation service documentation	supports the capturing and reporting of occupational therapy, physical therapy, and speech pathology services
	Medication administration	Typically used by nurses to document medication given, dose, and time

Source: (Wager, Lee & Glaser 2005)

Because the focus of the current study is on the implementation of LORENZO in the NHS, the author concentrates his discussion on the EMR, which represents the major output of the NPfIT. One point to bear in mind is that some of the CISs (which are listed in Table 2-3), are considered later when the major components of the NPfIT such as Radiology and Pharmacy information systems are discussed.

Since the beginning of the 21st century the healthcare industry has witnessed an intensive use of HCIS such as: Electronic **H**ealth **R**ecords (EHR), **C**linical **D**ecision Support Systems (CDSS), to improve the quality of health care (Wager, Lee & Glaser

2005). The author explains the essence of EMR, its value (the benefits) it offers to health organisations, and the challenges faced with the adoption of EMR.

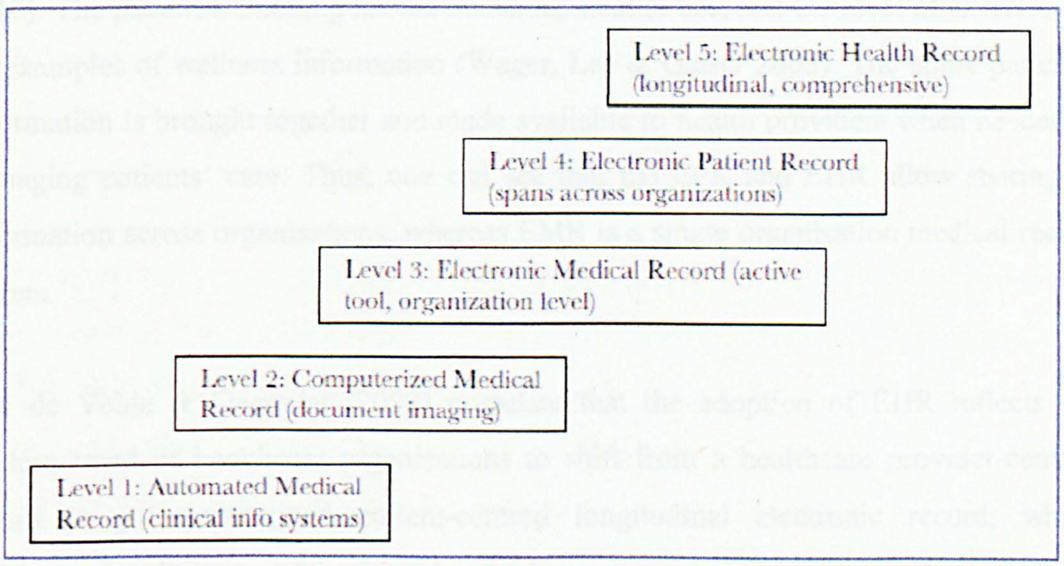
2.3.3. Electronic Medical, Patient and Health Records

One of the most important IT applications in the healthcare industry is the so-called **E**lectronic **M**edical **R**ecord (EMR) (Goldsmith 2005). The EMR is used in health organisations to document clinical information about patients and as a communication tool among health providers who are involved in patients' care (Wager, Lee & Glaser 2005). In addition, the EMR is also used as a tool, which provides clinicians with decision support capabilities, and access to clinical knowledge resources, reminders, and alerts (Spil et al. 2010).

2.3.3.1. The Essence of EMR, EPR and EHR

The author wishes to stress the distinction between different IT-related concepts that are frequently used in the health informatics domain. For instance, EMR, **E**lectronic **P**atient **R**ecords (EPR), and **E**lectronic **H**ealth **R**ecords (EHR) are often used interchangeably (Spil et al. 2010). However, there are significant differences in scope between these terms. Figure 2-5 demonstrates the differences between EMR, EPR, and EHR.

Figure 2-5: The Five Levels of Medical Records Computerisation



Source: (Wager, Lee & Glaser 2005)

The first level of medical records computerisation involves automating patients' medical records. This means that health organisations rely on paper-based medical records and part of the clinical information is generated and stored as computer printouts. The second level pertains to the digitisation of medical records using scanning/imaging technologies to keep medical records electronically.

The core difference between EMR, EPR, and EHR is represented in the last three levels of medical records computerisation. One point worth mentioning is that upgrading from EMR to either EPR or EHR does not occur overnight, it may take a number of years (Wager, Lee & Glaser 2005).

The EMR is an organisational-contained system, which means that EMR includes patient information, which is only kept in a single health organisation. On the other hand, the EPR is broader as it contains the patient's health-related information, which is collected and available across two or more health organisations (Spil et al. 2010, Wager, Lee & Glaser 2005). The EPR is connected to a central database (i.e. data warehouse) that holds all health information available on a patient to facilitate the exchange of this information between those who are involved in the patient's care.

The broadest medical record in terms of the scope is the EHR; that encompasses all health related information as well as wellness information about the patient (Spil et al. 2010). The patient's smoking habits, nutrition, alcohol use, and the level of exercise are all examples of wellness information (Wager, Lee & Glaser 2005). The entire patient's information is brought together and made available to health providers when needed in managing patients' care. Thus, one can see that the EPR and EHR allow sharing of information across organisations, whereas EMR is a single organisation medical record system.

Van de Velde & Degoulet (2003) postulate that the adoption of EHR reflects the modern trend of healthcare organisations to shift from a healthcare provider-centred record to a computerized patient-centred longitudinal electronic record, which encompasses all types of health-related information about the patient from birth to death. In addition, Wager, et al (2005) state that using EHR in healthcare institutions prevents medical errors at the time and point of care. Goldsmith (2005) stresses the fact that clinicians and other health professionals can use an EHR system at the point and time of care because of the **C**omputerized **P**rovider/Physician **O**rder **E**ntry (CPOE) that is embedded in EHR.

A CPOE system's decision making capabilities such as medication ordering, diagnostic procedures and medical interventions are combined with EHR system's functionality in order to allow healthcare providers to take medical/clinical actions to fit with the patient's health status (Goldsmith 2005). Therefore, one can conclude that EHR has become an "intelligent" record system that shows current and up-to-date health information with the probable consequences of care decisions.

2.3.3.2. Benefits of EMR

Physicians are the people who perceive the benefits from using HCIS (Anderson 2010). Anderson (2010) states that the use of IT applications has tremendous impact on health institutions' performance. Thus, healthcare providers and organisations are becoming more aware of the potential benefits EMR offers to patients, clinicians, health organisations and the community at large (Wager, Lee & Glaser 2005).

One can find a wide assortment of benefits from implementing HCIS, for instance: improved quality of health care provided to patients, enhanced patient/clinical safety, and reduced costs (Wager, Lee & Glaser 2005). Anderson (2010) mentions that the use of HCIS encourages patients to take more responsibility in maintaining their health, while Van de Velde & Degoulet (2003) postulate that using CPOE enhances communications within the institution and improves healthcare delivery processes.

Many studies have focused on identifying the benefits of using numerous IT systems in health institutions. It is worth mentioning that some of these studies focus on identifying the benefits, which are derived from using specific HCIS such as CPOE (Van de Velde & Degoulet 2003) or EMR (Wager, Lee & Glaser 2005). Other studies have concentrated on defining the benefits from using general health IT (e.g. (Anderson 2010)).Thus, the author discusses the most prominent and frequently listed benefits that were identified in the reviewed studies. The benefits are classified into the following categories:

1. Gains in efficiency, productivity and reduction in cost

studies have shown that the use of an EMR influences positively efficiency and productivity, as well as leading to a reduction in costs (Wager, Lee & Glaser 2005). Because EMR and EHR are fused with CPOE, which allows clinicians to order test results, diagnostic procedures, and transcribe medications electronically, they save clinicians' time, improve the efficiency of their work, and minimise transcription services and/or errors (Wager, Lee & Glaser 2005). Moreover, Van de Velde and Degoulet (2003) state that 70% of the healthcare costs result from what health providers order (e.g. tests, medications and any clinical intervention) for treating patients. Thus, providing detailed information or proposing alternative cost-effective orders reduces costs. Furthermore, 60% of the US primary care physicians in a survey responded that the use of IT applications reduces costs (Anderson 2010).

2. Reducing medical errors and enhancing patient safety

Studies have shown that relying on health IT and CPOE in particular assists health providers in detecting and preventing medical errors (Anderson 2010, Wager, Lee & Glaser 2005). Anderson (2010) states that electronic prescribing systems which utilise computing capabilities in supporting the creation, transmission, and dispensing of drug therapies, prevent prescription errors.

One may conclude that the ability of IT-enabled health systems to prevent medical errors stems from the high quality clinical information. EMR and other intelligent health records provide complete, up-to-date, sufficient, and accurate health-related information about the patient and the drug (Bates & Gawande 2003), which is readily available, and accessible to health providers at the time, and point of care.

2.3.3.3. Barriers to Implementation of EHR Systems

In spite of the enormous benefits that can be attained from implementing IT tools in healthcare organisations, some IT applications have not been successful enough, or have failed to provide the promised benefits (Van de Velde & Degoulet 2003). Therefore, reasons for failure and barriers to successful IT implementation have been intensively discussed in the health informatics domain. To highlight these barriers the author presents justifications for the lag in implementing health information technology in the healthcare industry in general, and then discusses the main factors hindering the adoption of applications such as EPR and EHR.

2.3.3.3.1. Barriers to HCIS Adoption in the Healthcare Sector

It is argued that the healthcare sector has been slow to adopt HCIS (Wager, Lee & Glaser 2005) and other IT applications if compared with other sectors in the modern economy (Goldsmith 2005). The reasons for the slow adoption of IT tools in health sectors according to Goldsmith (2005), Wager, et al (2005), and Bates & Gawande (2003) are:

2.3.3.3.1.1. Complexity of Healthcare Information and Procedures

Health-related information is complex because of its large scale variation. For instance, clinical information can be found as texts, images, and pictures. Moreover, there is no single standard operating procedure, which guides health professionals as to how to treat and maintain the health of patients. The author stresses the notion that even though there are guidelines for performing clinical activities, clinicians may not follow them as they rely on their medical experience and knowledge. Analysis of the data gathered supports the author's claim that clinicians relied on their medical knowledge and experience in performing clinical processes, not the guidelines.

Health information is very sensitive and personal, since it relates to people's personal information, such as: family medical history, mental health status, and sexual orientation (Wager, Lee & Glaser 2005). Thus, patients need to feel comfortable about sharing their health-related information with health professionals, as well as confident that their provision of such sensitive information is not exposed to unauthorised access or abuse.

Furthermore, the lack of standardised health services is one of the common barriers to the adoption of IT tools. Lack of standardised health practices reflects the variability and uncertainty of health services provided at the point of care. This means that the provision of health care is dependent on the cases (patients) treated. For instance, one patient may need a certain type of diagnosis or treatment, which can be different from that provided to another patient.

2.3.3.3.1.2. Complexity of Healthcare Organisations

The complexity of healthcare organisations is another barrier that contributes to the slow adoption rate of health IT. Because health services are provided by public and private sectors, different health systems are required to process and store an enormous amount of clinical information. Moreover, Alalwany & Alshawi (2010) state that the healthcare sector is characterised by having various stakeholders, or so-called health professionals (Goldsmith 2005) who are located in different medical disciplines, and who perform different clinical processes. This fragmentation in clinical processes leads to conflicts in systems requirements among health professionals at the point of care since each one of them requires different clinical information, and accordingly different records are created for patients. Thus, it is very common for one to find different types of health care systems in a single health institution.

2.3.3.3.1.3. Difficulty of Integrating Healthcare Systems

Heterogeneity in the healthcare systems, which results from the fragmentation in the clinical process itself, causes integration and/or connectivity problems that hinder successful implementation of IT tools in the healthcare sector. Wager et al (2005) state that integration issues become more important when the health institution aims to construct a HCIS from subsystems supplied by various vendors. Analogously, one could imagine the difficulty of integrating and connecting various health IT systems throughout the country as in the case of the NPfIT in England.

2.3.3.3.1.4. Cultural Barriers

Bates and Gawande (2003) state that health professionals and decision makers in healthcare organisations do not consider technological tools important for accomplishing clinical processes. In addition, people in the healthcare industry are encouraged and rewarded for developing drugs, and achieving progress in medical research, more than for developing computerised health-related systems. Bates and Gawande (2003) state that because technological innovations are still new in medicine, health providers may not feel comfortable with using IT, or are concerned about the privacy of information.

2.3.3.3.1.5. Financial Barriers

The focus of developing health IT applications has been on technological innovations that improve the back-office functions of clinical practice rather than developing technological products, which improve medical practice itself (Bates & Gawande 2003). Moreover, the cost of adopting IT tools for health providers and institutions is still high, and the quality of decision support mechanisms associated with these applications is highly variable. The author argues that investing in IT applications in healthcare industries should not be seen as an incurred cost or burden, instead it must be seen as an investment in future, better quality health service.

2.3.3.3.2. Barriers to EHR Adoption

Radhakrishnan, et al (2010) postulate that the adoption and use of EMR, EPR, EHR, telehealth and other health-related computer applications encounter challenges that obstruct successful implementation. Wager, et al (2005) classify these challenges into three main categories are financial, organisational or behavioural, and technical challenges. Financial challenges reflect the lack of capital and other financial resources needed to design, develop, and implement EHR. Organisational and/or behavioural barriers are those factors that pertain to clinicians' acceptance and use of EHR. Technical barriers are related to the work needed in creating such a HCIS and lack of adequate standards and definitions for data interchange. The author discusses the factors that hinder successful adoption and use of EHR, which have been frequently cited in the literature and that reside in one of the above three categories of challenges.

2.3.3.3.2.1. Financial Barriers

1. High initial cost

EHR systems are expensive to develop and implement (Wager, Lee & Glaser 2005). Anderson (2010) found in his study that more than 80% of the surveyed physicians in primary care perceived the lack of financial support for IT tools to be a major barrier.

2. Difficulty in realising positive financial returns

Anderson (2010) and Wager, et al (2005) state that because the initial investment level of IT tools in the healthcare industry is high, top-level management finds it difficult to justify the amount of resources invested in developing EHR or other computer based systems, although improvements in the quality of health service are realised.

3. Lack of incentives

Radhakrishnan, et al (2010) stress the need to provide incentives (e.g. financial) to health providers by their health institutions or governments. Numerous financial incentives can be utilised to encourage and reward health organisations for their use of EHR (Wager, Lee & Glaser 2005). *Payment differentials* is one of the financial reward strategies used, this rewards health providers for adopting and diffusing EHR by offering bonuses and add-on payments for their use. Another strategy is *cost differentials* that uses patient copayment or deductibles for steering patients to health institutions that have adopted HCIS. *Innovative reimbursement* is also used by rewarding health institutions for innovative services that are related to HCIS (for instance, the use of telecommunication technologies for communication between patients and physicians or virtual provider-patient visit).

2.3.3.3.2.2. Organisational or Behavioural Barriers

Several organisational and behavioural barriers hold back the adoption of EHR in health organisations. These are:

1. Changes in practice patterns

Introducing EHR may result in changing the way that health providers interact with patients and provide the health service. Changes brought about by the implementation of EHR make it difficult to incorporate EHR and other CISs into work flow processes (Wager, Lee & Glaser 2005). Anderson (2010) states that it takes physicians more time to diagnose and treat patients when using EHR. Consequently, though using such a technology brings about higher quality of health service, physicians resist using it because it leads to longer working hours and fewer patients seen.

2. Lack of physicians' time

The author has pointed out that implementing EHR brings about changes to the medical practices, and subsequently, complementary (i.e. organisational) changes should occur in parallel (e.g. patient registration, prescription generation, billing, and surgical/medical processes) (Radhakrishnan, David & Zaveri 2010). For complementary changes to take place, clinicians in hospitals should redesign their workflows, which in turn take enormous time for the administrative and medical staff. Wager, et al (2005) proposed that leadership in health organisations take the responsibility for supporting the implementation of EHR, by intensifying initial and ongoing training, to enable administrative and clinical employees to gain the required level of expertise.

To summarise, for EHR to be managed effectively, fully utilised, and accepted by end users, it must be incorporated into the daily operations of healthcare organisations, and gain the support from the leaderships of health organisations.

3. Lack of understanding of the nature of clinical practices by systems developers

Van de Velde and Degoulet (2003) postulate that systems developers do not have enough understanding of the nature of clinical processes, as they are more concerned with the technological aspects of developing EHR.

4. Lack of education

One may expect that medical knowledge and expertise that clinicians posses to be enough for enabling them to use EHR. Unfortunately, this is not true as most of health organisations lack employees who are capable of managing the implementation of EHR (Anderson 2010).

5. Clinicians' reluctance to use EHR

The lack of education in managing the implementation of EHR has led clinicians to have concerns, about and sometimes fear of the use of EHR. Clinicians' fear constitutes a major barrier to the adoption of EHR because it brings about negative or less favourable attitudes to the use of EHR (Miller & Sim 2004).

Radhakrishnan, et al (2010) state that clinicians' concerns or fear of using EHR in their day-to-day operations derive from numerous reasons. Firstly, clinicians show reluctance to use EHR because they consider their main role is treating the patient not the automation of clinical practice. They may need to put enormous time into using the system instead of providing health service to patients. Secondly, clinicians may feel offended when taking recommendations from a CIS because reliance on computerised health systems may restrict their independent thinking, and devalue their accumulated training and learning in medical schools.

6. The lack of clinicians' involvement

Van de Velde and Degoulet (2003) highlight that the lack of involvement of health providers when applications are put into practice is one of the reasons for the lack of successful implementations of EHR in organisations. The author argues that clinicians are less willing to participate in managing and using EHR because of the previously listed behavioural barriers.

2.3.3.3.2.3. Technical Barriers

Health professionals are intimidated by technology and may feel insecure when interacting with it because personnel (in the adopting health organisations) believe that technology can replace or outperform them (Radhakrishnan, David & Zaveri 2010). In addition, Van de Velde and Degoulet (2003) postulate that the too much consideration is given to the technological side of the implementation of EHR, and other health-related applications. The focus on the technological issues of EHR implementation does not prevent the following technology-related factors from impeding the use of EHR. These factors are:

1. Complexity of EHR systems

Anderson (2010) states that the complexity of EHR and other CIS composes a major barrier to adopting EHR. Because EHR are not contained in a single health organisation and integrate health-related information from various health institutions (see 2.3.3.1), the technology used in terms of computer hardware and software needs to be highly sophisticated to capture and store all kinds of health information from numerous sources. Consequently, medical staff needs extra time to learn how to use the system and find effective ways of retrieving the requested information.

2. Inadequate standards

Wager, et al (2005) state that there are a lack of standards to enable different information systems from various vendors, and various healthcare institutions to share health-related data.

3. Problems in usability

Usability of EHR remains one of the barriers that cause clinicians' resistance (Radhakrishnan, David & Zaveri 2010). According to Miller and Sim (2004), the multiplicity of screens, options, and navigational aids in the EHR, and other health applications, force clinicians to spend time learning the various functions, and get used to utilising the system. Even though training personnel in health organisations on the usability of the EHR system is useful, small health institutions may find it difficult to conduct training programmes due to their limited financial resources (Radhakrishnan, David & Zaveri 2010).

4. Problems in interoperability

Interoperability is another issue that poses a threat to the success of EHR systems (Anderson 2010). Interoperability refers to *"the ability of EMR system to facilitate exchange of patients' medical records across medical institutions such as hospitals, polyclinics, independent testing labs, and medical centres"*. (Radhakrishnan, David & Zaveri 2010: 988). According to this definition, poor interoperability means the lack of ability to exchange clinical data between laboratories and hospitals (Radhakrishnan, David & Zaveri 2010) or so-called inadequate electronic data exchange (Miller & Sim 2004). Miller and Sim (2004) postulate that poor data exchange stems from the existence of the parallel electronic and paper-based systems which hospitals usually have. Clinicians in this case are forced to enter clinical data from paper-based to electronic systems and deal with enormous amount of data from other external sources. Thus, one can surmise that this extra time spent on entering clinical data causes reluctance to use the EHR systems.

5. Problems of security and privacy

Rodrigues and Vaidya (2010) stress the importance of data security and confidentiality of health information in the application of e-health technologies. Security and confidentiality concerns are becoming increasingly pivotal because health technologies are making health information, and other personal health-related materials, available to a large number of people (i.e. users), who are dispersed geographically.

Health providers and patients have concerns about the privacy and security of the medical records that they share electronically through the web-based technologies (Anderson 2010). With the wide spread use of electronic commerce, and the use of web-based technologies, the concept of IS security is no more confined to confidentiality of information. IS security also encompasses the protection of the privacy of information, and the prevention of fraudulent activities (Smith & Jamieson 2006). Nowadays, privacy and security have become key factors that determine end users' usage of e-commerce and internet based technologies (Molla & Licker 2001).

Security is a general term that pertains to all the precautions taken whenever health information collected, used, disclosed, or accessed (Van de Velde & Degoulet 2003) for protecting health information against unauthorised access, or against the denial of service to authorised users (Smith & Jamieson 2006, Molla & Licker 2001).

Van de Velde and Degoulet (2003) classify security issues into three main groups; *access* issues that relate to user authorisation management and user identification (e.g. smart cards, biometric devices, password/PIN generation), *communication* issues that include securing messages (encryption), and finally *content* security issues that pertain to content filtering to delete unwanted content.

Smith and Jamieson (2006) and Van de Velde and Degoulet (2003) mention that the objectives of security are assuring confidentiality, integrity, and availability of information. Confidentiality ensures that the information is available only to the people who are allowed to access it. In addition, confidentiality can be defined as the obligation of the holder of the sensitive and personal information to protect the person's privacy (Van de Velde & Degoulet 2003: 175).

On the other hand, integrity is the act of ensuring that the information is only altered by the people and systems authorised to do so. Whereas, availability is a security measure that demands the assurance of the availability of information, and information processing systems when required. Van de Velde and Degoulet (2003) highlight some precautions applied to stored and communicated information to ensure the achievement of the security measures, which are: confidentiality, integrity, and availability, as shown in Table 2-4.

Table 2-4: Security Precautions

	Storage	Communication
Authentication and user identification	Validation of credentials Electronic signature	Digital signature Cryptography
Authorization and access control	Granting of rights Access control list	Not applicable
Confidentiality	Firewall	Encryption Secured networks: tunneling (VPN, SSL)
Availability	Replication Clustering Backup Redundancy	Virus scanning Redundancy (high availability)
Integrity	Input validation checking Virus scanning	Cryptography
Nonrepudiation	Not applicable	Digital signature
Auditing and monitoring	Failed login attempts Intrusion detection system alarms	Intrusion detection system

Source: (Van de Velde & Degoulet 2003)

6. ***Lack of IT support***

Inadequate IT support is another factor that poses a threat on the success of the EHR implementation (Radhakrishnan, David & Zaveri 2010). Anderson (2010) highlights the fact that EHR systems vendors provide limited IT support to clinicians in health institutions. Moreover, Anderson (2010) states that maintaining EHR systems is costly since systems developers charge high maintenance fees, and clinicians have limited technical expertise.

2.4. CONCLUSION

The discussion of the various ISDMs reveals that end users' involvement in the determination of information needs is pivotal for developing successful systems that win users' acceptance. Although the SDLC is the most traditional and oldest ISDM, it provides a fundamental principle, which is converting end users' information needs into design specifications to be incorporated in the system. Nevertheless, the SDLC encompasses a set of sequential stages, where the process of engaging end users takes place only at the outset of the early stages. Thus, iterative ISDMs were introduced such as prototyping and RAD, to develop systems iteratively and quickly. Software application packages and outsourcing are alternative solutions for developing computer systems when organisations lack the financial resources, or/and IT skills and experience.

The use of IT in the healthcare sector is introduced in this chapter by highlighting the main types of IS that comprise HCIS. CIS information systems are concerned with storing and retrieving clinical information that is primarily used to diagnose, treat, and monitor patients' care. Laboratory, radiology, pharmacy systems, EMR and CPOE are among the most common types of CIS. On the other hand, AIS deals with administrative and financial information that is mainly used to manage the fulfilment of management functions in the health providing organisations. PAS is commonly used AIS.

The author focused on the adoption of EHR and the barriers to its implementation because LORENZO is the EHR in the NPfIT. EHR is a patient centred, longitudinal electronic record that holds health related information about patients from birth to death. Unlike the EMR that is an organisation-contained electronic records system, EHR allows such exchange of health information among health organisations to provide complete, accurate, and up-to-date information to health providers at point and time of care.

The adoption of EHR systems encounters challenges that stem from the characteristics of end users. For instance, the lack of time, lack of technical education, in spite of the medical knowledge that, by itself, is not enough to develop such a complex system, and clinicians' reluctance to use EHR systems. This reluctance is caused by the fact that clinicians may feel that EHR systems outperform them and thus, replace them, or devalue their accumulated training and learning in medical schools. Moreover, the lack of clinicians' involvement when EHR systems are put in practice is one of the barriers related to the individual users.

There are also technical barriers to successful implementation of EHR systems, such as problems of security and privacy since health information is shared between various health organisations. There is usability obstacles represented in the multiplicity of screens, options, and navigational aids as well as interoperability problems that denotes to the poor electronic data exchange.

Financial barriers hinder successful take up of EHR systems that stem from the high initial costs that decision makers might find it difficult to justify their investment decisions in EHR systems, lack of incentives for stimulating users and health organisations to use advanced health technologies, and difficulty in realising positive financial returns. Furthermore, vendors' lack of understanding of clinical processes and their limited provision of IT support are considered as hindering factors to successful implementation of EHR systems.

The healthcare industry lags behind some other industries in deploying IT projects. This is because the nature of the healthcare industry is characterised by fragmented and autonomous systems, various organisations and user groups, and complexity of the health information. These features cause connectivity and integration problems for the adoption of EHR systems, since these systems are meant to connect/integrate various health systems developed by numerous vendors. The above discussion of the hindering factors necessisates academic researchers and practitioners to look at the various healthcare actors to examine their potential influence on the adoption of HCIS.

Chapter Three

3. SUCCESSFUL IMPLEMENTATION OF IT PROJECTS

3.1. *INTRODUCTION*

Once the organisation has finalised the contract with its vendors to acquire the required information systems, the implementation process begins (Wager, Lee & Glaser 2005). Usually implementation process involves the design, delivery, and use of the system in the organisation (Yeo 2002). Top management and individuals hold high expectations when they make the decision to develop and implement an IS, yet implementation efforts may end up in failure.

Cooper and Zmud (1990) and Kwon and Zmud (1987) describe IT implementation as the effort made by an organisation to appropriately diffuse information technology within intended user groups, units, or organisations. Laudon & Laudon (2006) represent an organisation's effort to diffuse an innovation in organisational activities, which facilitate the adoption, management, and routinisation of an innovation.

In this chapter, the author discusses the concept of success and how it is measured relying on the Delone and McLane model, as well as shedding light upon IT failure and its causes. In addition, as the implementation process involves the use of the adopted systems by the intended users, the author gives attention to the intra-organisational acceptance of IT relying on the Technology Acceptance Model (TAM), which explains and predicts end users' behaviour toward IT usage. Furthermore, Critical Success Factors (CSFs) in successful implementation of Health Care Information Systems (HCIS) are discussed.

3.2. IS SUCCESS

There is an ambiguity surrounding the determination of whether an IT project is a success or failure (Belassi & Tukel 1996). Belassi & Tukel (1996) state that there are two main reasons behind this ambiguity; the first is that different stakeholders who are involved in implementing an IT project perceive IS success or failure differently. Secondly, even though the IS literature has been generous in providing a wide array of success or failure factors, these factors seem to be too general, or too specific to be applicable to certain types of projects. Furthermore, Molla & Licker (2001) give as a reason for the difficulty of assessing IS success that it is a multidimensional concept, which can be measured at various levels (e.g. technical, individual, group, organisational).

Mário & John (2003) see the concept of IS success as rather than is problematic because there are many ways of defining this concept. IS success can be related to *"the final efficiency in the accomplishment of the task for which the information system is to be developed"* (Brabander and Thiers, 1984: 139 cited in, Mário & John 2003). Caldeira & Ward (2002) state that IS effectiveness is used to measure IS success. Yuthas & Eining (1995) stress that the effectiveness of an IS should be determined by its impact on the organisation's competitive advantage and its ability to achieve the organisational objectives (Caldeira & Ward 2002).

IS effectiveness encompasses three distinct constructs, which are decision performance, user satisfaction, and system usage (Yuthas & Eining 1995). Decision performance is the most direct and relevant measure of IS effectiveness and defined as *"the degree to which the system supports or improves decision making"* (Yuthas & Eining 1995: 72).

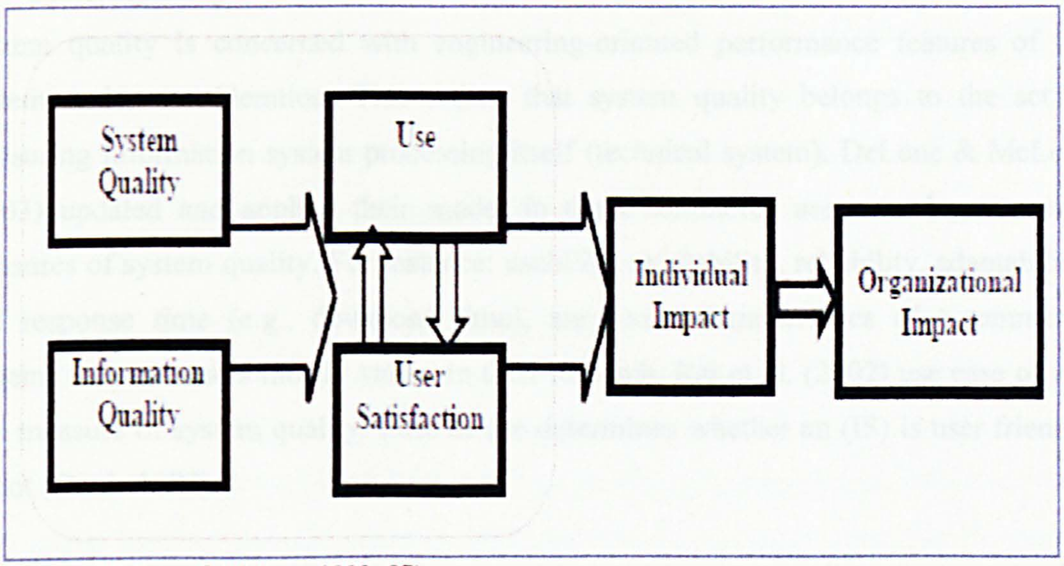
On the other hand, user satisfaction has also won popularity in the IS literature as an outcome measure, which is attitudinal in nature. Yuthas & Eining (1995: 72) describe user satisfaction as *"the degree to which system users are satisfied with the information system and/or the support provided by the IS department"*. In addition, system usage is a behavioural measure that considers the level of interaction between the user and the system (Yuthas & Eining 1995). When intended users show resistance to using the system, it denotes system failure (Sharma & Yetton 2003). Thus, system usage is an important measure of system success that should be considered when evaluating IS effectiveness.

3.2.1. DeLone and McLean Model of IS Success

In the IS literature, User Information Satisfaction (UIS) and system usage, or so called end user system utilisation (Coombs 1999) are the most prominent constructs, which measure IS implementation success (Sharma & Yetton 2003, Gelderman 1998, Yuthas & Eining 1995, DeLone & McLean 1992). DeLone & McLean (1992) admit the importance of UIS and system usage as surrogate measures of IS success. Additionally, DeLone & McLean (1992) argue that UIS and system usage reflect IS researchers' interest in studying the interaction of the information product with its recipients. However, after a comprehensive review of 180 studies, which are concerned with IS success, DeLone & McLean (1992) found out that some IS researchers have focused on studying the characteristics of the system itself (system quality), other researchers have concentrated their study on the characteristics of the information generated (information quality), and others have focused on investigating the impact of IS on both individual and organisational performance.

In sum, DeLone & McLean (1992) synthesized six dimensions, which constitute a wider taxonomy of IS success that is still widely used by IS researchers. Figure 3-1 shows DeLone and McLean (hereafter "D&M") model of IS success.

Figure 3-1: D&M's Taxonomy of IS Success



Source: (DeLone & McLean 1992: 87)

Figure 3-1 shows the six constructs that represent IS success. The quality of the IT system and the quality of the information generated in the system in question affect singularly and jointly UIS and system usage. UIS and system usage are direct antecedents of individual impact (Rai, Lang & Welker 2002). The amount of system usage affects the degree of UIS either positively or negatively and vice versa. The impact on individual performance should have some influence on organisational performance.

3.2.1.1. D&M Model Components

Ammenwerth (2006) state that DeLone & McLean (1992) formulate a multidimensional construct for IS success, which is based on the interaction of the six factors. DeLone & McLean (1992) classify the six success constructs into three distinct categories, the creations of the IT system, the use of that system, and the consequences resulting from using the system on individuals and organisations. Furthermore, the six factors are interrelated rather than independent, and represent a *temporal process* model rather than *causal* model (DeLone & McLean 2003). To distinguish between process and causal (variance) model, DeLone & McLean (2003) state that when A merely follows B, it symbolises a process model. When A causes B, it symbolises a casual model. The author presents a brief discussion of the success measures in D&M model.

1. System Quality

System quality is concerned with engineering-oriented performance features of the system under consideration. This means that system quality belongs to the act of measuring information system processing itself (technical system). DeLone & McLean (2003) updated and applied their model in the e-commerce arena, and gave some measures of system quality. For instance: usability, availability, reliability, adaptability, and response time (e.g., download time), are some characteristics of e-commerce systems that end users mostly value. In their research, Rai et al. (2002) use ease of use as a measure of system quality. Ease of use determines whether an (IS) is user friendly or not (Davis 1989).

2. Information Quality

This success factor is concerned with the quality of information, which is generated from the IS. The assessment of the quality of the produced information is based on the reports produced. Information quality refers to the *"degree to which information produced has the attributes of content, accuracy, and format required by the user"* (Rai, Lang & Welker 2002: 57).

3. Individual Impact

This category measures the effect of information produced by the system on the user's behaviour. DeLone & McLean (1992) state that measuring the impact of the information system is the hardest among the other IS success measures. In addition, this category measures the degree to which the system has enhanced user's understanding of the decision context, has improved the user's decision-making productivity, has produced a change in user activity, or has changed the user's perception about the usefulness of the (IS).

4. Organisational Impact

Organisational impact denotes the influence of the information system on organisational performance. DeLone & McLean (1992) states that productivity gains can be used to represent (IS) impact on the host's organisational performance.

5. System Usage

IS usage is considered as an IS success construct, and therefore is encompassed in the D&M model. As one can see from Figure 3-1, IS usage is a predecessor of individual impact. One may conclude from the link between IS usage and individual impact that the former should significantly influence realisation of the system benefits (Rai, Lang & Welker 2002).

DeLone & McLean (1992: 66) define information usage or use of system as "*recipient Consumption of the Output of an Information System*". In addition, DeLone & McLean (1992) state that the use of IS reports is one of the most frequently used measure of IS. They stress the fact that IS use is possibly the easiest and most objective IS success variable if compared to the other success variables. Some examples of system actual use are: number of computer inquiries, amount of user connect time, and number of client records processed.

6. User Satisfaction

DeLone & McLean (1992: 68) describe user satisfaction as "*Recipient Response to the Use of the Output of an Information System*". They claim that user satisfaction or UIS is probably the most used IS success measures because of its high face validity. They also state that user satisfaction is strongly associated with users' attitudes toward the IS.

3.2.1.2. Critiquing the D&M Model

Although the D&M model has informed a number of successive studies and has enriched IS knowledge (Molla & Licker 2001), some academic researchers and IS practitioners have criticised the D&M model. For instance, Seddon (1997) states that the problem in D&M model is that it combines process and variance (causal) explanations of IS success and that may lead to confusion. In addition, Rai et al. (2002) comment that the D&M model does not provide empirical validation, and consequently, further development is needed.

Molla & Licker (2001) have reported opponents' criticisms of the D&M model. For instance: unclear theoretical foundation, the irrational unidirectional relationships among use, user satisfaction, individual impact, and organisational impact. In addition, Molla & Licker (2001) postulate that although DeLone & McLean (1992) have made a great contribution in identifying direct antecedents (system quality and information quality) of the two most used success variables (i.e. usage and user satisfaction), the linear causality established between user satisfaction, individual impact, and organisational impact is not strong and informative. The D&M model has been criticised that more factors should be included to measure IS success, such as user involvement (Coombs 1999). DeLone & McLean (2003) warned that variables such as, user involvement, and top management support may cause success, but are not a part of the success construct.

The author argues that system quality and information quality are resulting outputs of the design process, by which an (IS) is developed. This has led the author to look at how development methodologies affect end users' behaviour toward the use of such a system. Saarinen (1996) included the success of the development process as a dimension used to assess IS success. Saarinen (1996: 106) defines a successful IS development project as *"The system development process leads to a high quality IS product whose use has a positive impact on the organisation"*. According to this definition, the success of IS projects is determined by four distinct constructs or dimensions. These dimensions are: the success of the development process, the success of use, the quality of the IS product, and the impact of IS on the organisation.

Because the system development life cycle consists of various stages, as was discussed in section 2.2.4.1 of the Information Technology in the Healthcare Sector chapter (System Development Life Cycle (SDLC)), assessing the success of each stage can be more informative in assessing the development process success (Saarinen 1996). In addition, Saarinen (1996) stresses the importance of having skilled users and system developers who can work together to identify the requirements for the system. In addition, having system analysts who have the ability to design a system that meets the requirements already determined by users, implement the system into a technically feasible solution within a predetermined time and budgetary plan, and assist users to use the system in their working environment, are all crucial for a successful development process.

3.3. *IS FAILURE*

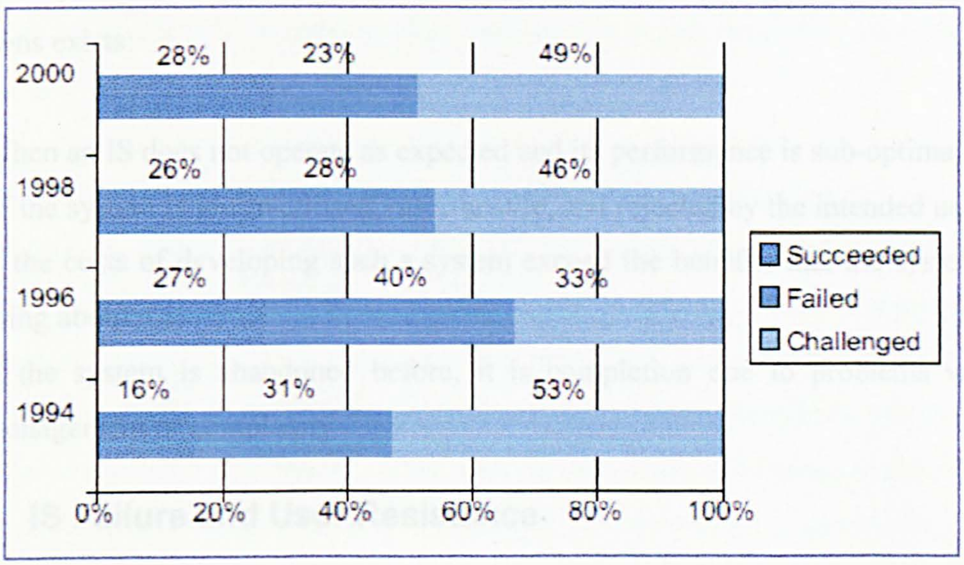
As has been discussed previously, implementation process may end up in either success or failure. IS failure has become a major concern for IS researchers and practitioners. Research conducted to understand this undesirable condition of IS projects reveal that more than 40% of IT projects in numerous industries including the health care failed, or have been abandoned (Kijsanayotin, Pannarunothai & Speedie 2009, Sharma & Yetton 2003). In this section, the author discusses some aspects that are related to IS failure, and spotlights the main failure factors which lead to disastrous end of IS projects.

3.3.1. IS Failure: A Serious Dilemma

Currie & Guah (2006) state that the failure rate of large scale IT projects in public sector is 80%. Ammenwerth et al. (2006) commenting on the high failure rate of healthcare IT projects, (which sometimes reach 60-70%,) show that it leads to tremendous lose of financial capital, and weakened confidence in IT capabilities from users' perspective.

Cost and time are among a wide set of factors that pose a challenge to organisations implementing IT Projects. Projects that go "out of control" in terms of budget (Over-budget), time (behind schedule), and behind the intended functionality, have been described as "runaway" (Keil & Robey 2001, Mahaney & Lederer 1999, Glass, Robert L. 1998b). In 1994, a study pursued by KPMG in the UK revealed that over 60% of 120 companies had experienced runaway projects (KPMG, 1994 cited in, Keil & Robey 2001). In addition, a widely used and well known study conducted by Standish group called the Chaos Report (2001) in the United States revealed the percentage of failure in IT projects as shown in Figure 3-2.

Figure 3-2: Failure Rates of IT Projects – CHAOS Report



Source: (Standish Group 2001)

According to the Standish group's report, successful IT projects are the projects that are completed within the time, and the budgets set, and deliver the promised functionalities to users. Challenged projects are completed and operational computer systems, yet they yield less functionality, and encounter budget overruns (Yeo 2002). Failed projects are IT systems that are stopped or abandoned at some point during their development process. As a result of the alarmingly high failure rates, there is a pressing need for understanding the (IS) failure phenomenon, and investigating the factors that lead to such failure.

3.3.2. IS Failure Categories

Lyytinen & Hirschheim (1987) classify IS failure into four main categories. The first category is *correspondence* failure, which occurs when the system design objectives are not met. The second category is *process* failure, that occurs when systems developers are not capable of developing an IS within the intended budget and time schedule. The third type of failure is *interaction* failure. This refers to the fact that when system usage is taken as a measure of IS success and performance, this might be misleading because heavy system usage does not necessarily mean high user satisfaction or positive attitudes. Heavy usage may result from mandatory usage, legal compulsion, or no other alternatives existing, except using the system to accomplish the required workload (Yeo 2002). Finally, *expectation* failure occurs when the information system does not meet the stakeholders' expectations, values, and requirements.

Additionally, Flowers (1996) describes an IS as a failure if any of the following conditions exists:

1. When an IS does not operate as expected and its performance is sub-optimal
2. If the system is under-utilised, user-hostile, and rejected by the intended users
3. If the costs of developing such a system exceed the benefits that the system may bring about
4. If the system is abandoned before, it is completion due to problems with its management or complexity

3.3.3. IS Failure and User Resistance

Authors in the IS field have been studying the real causes behind the failure phenomenon. For instance, Kijsanayotin et al. (2009) postulates that inadequate understanding of the socio-technical aspects of IT is one of the major factors leading to failure. Laudon & Laudon ((2006) attribute IS failure to inaccuracy and inconsistency of data generated, operational flaws, and a system design that does not take into account the business requirements. However, the author thinks that all causes of failure lead to one outcome, which is user resistance, and consequently system failure. Sharma & Yetton (2003) and Jiang et al. (2000) stress that user resistance is the key factor, which is responsible for failure in IS implementation.

Jiang et al. (2000) emphasise that there are three theoretical perspectives that explain resistance to information system. The *People-oriented* perspective suggests that resistance is created by the users' internal characteristics such as age and gender (Meade, Buckley & Boland 2009) and their varying backgrounds, values and beliefs that affect users' attitudes toward using IT. The *System-related* perspective describes resistance as being caused by external factors that pertain to the design of the system or the technology itself. For instance, user-friendly interface, reliability, and performance of the system are some factors that should be designed carefully to overcome resistance, and accordingly system failure.

According to the *interaction* perspective, resistance is caused neither by the system's characteristics nor by the user features. Instead, the real reasons for resistance stem from the interaction between the user and the system being used. For example, because different users may perceive the same system differently, some users might be reluctant and avoid using the system because they think that it jeopardises their social status in the organisation, or takes away their power.

In relation to Rogers (2003), adopting technological innovations causes uncertainty. This uncertainty stems from the newness of the innovation, which makes it difficult for target users to recognise the benefits of innovations, as well as whether the introduction of these innovations solves an existing problem. This undesirable situation causes resistance toward the use of new technologies. Rogers (2003) postulates that resistance to change is intensified in radical, more than incremental innovations, because radical innovations demand a higher level of knowledge from end users (measured in training and education).

3.3.4. Symptoms of IS Failure

There are symptoms that appear prior to the system failure, which may act as warning signs to which decision makers and system developers should be alerted to rescue the IT project from potential termination (Kappelman, McKeeman & Zhang 2006). Kappelman et al. (2006: 31) define the **E**arly **W**arning **S**igns (EWSs) as *"an event or indication that predicts, cautions, or alerts one of possible or impending problems"*. In addition, they pinpoint a dozen of EWSs, six of them are people-oriented factors, and the rest are process-related factors. Table 3-1 shows the 12 EWSs distributed to these two groups.

Table 3-1: EWSs of IS Failure

People-related risks	Process-related risks
Lack of top management support	Lack of documented requirements
Weak project manager	No change control process (change management)
No stakeholder involvement/participation	Ineffective schedule planning and/or management
Weak commitment of project team	Communication breakdown among stakeholders
Team members lack requisite knowledge	Resources assigned to a higher priority project
Subject matter experts are overscheduled	No business case for the project

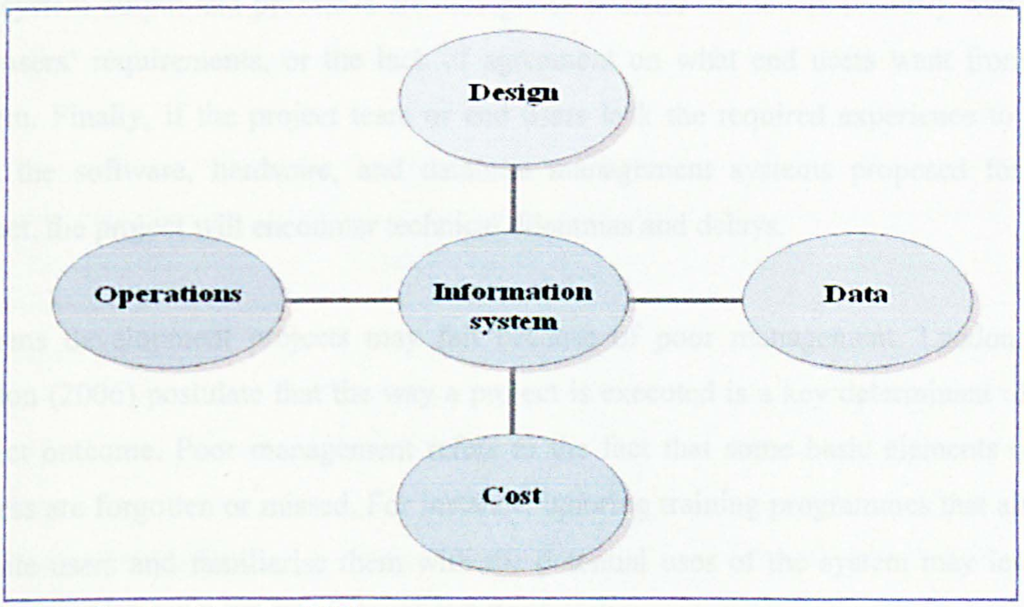
Source: (Kappelman, McKeeman & Zhang 2006)

The author stresses the fact that EWSs such as lack of top management support and lack of end users' involvement (see Table 3-1) might be devastating forces, which can lead to absolute failure if they persist in the IT project. This notion means that EWSs should be considered seriously by the IT project team and the required corrective actions undertaken otherwise, these signs may turn to be the real reasons for failure.

3.3.5. Critical Failure Factors (CFFs)

Laudon & Laudon (2006) confine the causes of problem failure to four main areas or categories, design, data, operations, and cost. Figure 3-3 depicts IS failure areas.

Figure 3-3: Causes of IS Failure



Source: (Laudon & Laudon 2006)

Poor design of an IS discourages users from using the system because their business requirements are not met, the information may not be provided quickly and/or presented in a format that is difficult for users to use and find where the requested information exist. Laudon & Laudon (2006) place stress on designing a system that is compatible with the organisation's culture, structure, and goals.

A system is deemed a failure if the information it provides is inaccurate, inaccessible and not presented and organised properly. Regarding the cost, some systems may operate as intended but their implementation and running costs are quite high outweighing, the benefits. An IS may fail because of deficiencies in its operations represented in, for instance, frequent system breakdowns or crashes that cause delayed accomplishments of jobs and missed provisions of scheduled information.

Moreover, Laudon & Laudon (2006) state that some IT development projects are more vulnerable to failure than others because of the level of complexity and risk they contain. The level of risk is influenced by the project size, structure and the technical expertise of the IS staff. For example, large-scale IT projects are more likely to fail than the smaller ones by 50 to 75% more. Highly structured IT projects in terms of properly identified and clear requirements and consequently well-defined processes have less risk than poorly structured projects. Poor structuring of IT projects stems from the fact that system output and processes are ambiguous because of the continuously changing end users' requirements, or the lack of agreement on what end users want from the system. Finally, if the project team or end users lack the required experience to deal with the software, hardware, and database management systems proposed for the project, the project will encounter technical dilemmas and delays.

Systems development projects may fail because of poor management. Laudon and Laudon (2006) postulate that the way a project is executed is a key determinant of the project outcome. Poor management refers to the fact that some basic elements of IS success are forgotten or missed. For instance, ignoring training programmes that aim to educate users and familiarise them with the potential uses of the system may lead to user resistance and consequently causes failure.

Bush et al. (2009) identify the managerial actions and the organisational characteristics that hinder health organisations in choosing the appropriate systems that support their goals and strategies. The managerial hindering factors are: poor and/or ineffective communication, which lead the end users to be less willing to approve the new system, lack of stakeholders' involvement and participation, and the disorganised decision making process. Bush et al.(2009) state that the lack of an organised decision process may bring about decisions to acquire systems that obsolete quickly or fail to meet users' requirements.

Regarding the hindering organisational factors, Bush et al. (2009) identify five major hindering factors. The hindering factors are: resistance to change, lack of management support, lack of IT understanding, lack of resources, and complexity of organisation.

Yeo (2002) points out that identifying CFFs can be a complex task. To determine holistically the factors that mostly affect the project outcome he adopted the triple **S** framework, classifying the factors into three distinct spheres of influences, which are: process, context, and content spheres. Process-related issues pertain to business planning, project planning and project management. Context-related issues pertain to corporate culture and management, users and politics. Content-related issues pertain to IT, business processes, system design and IT/IS professional knowledge and resource. According to these three categories, CFFs are classified as shown in Table 3-2.

Table 3-2: CFFs based on the Triple S Framework

Sp Process driven issues	S1 Context driven issues	S2 Content driven issues
Underestimate of timeline	Lack user involvement and inputs from the onset	Consultant/vendor underestimated the project scope and complexity
Weak definitions of requirements and scope	Top down management style	Incomplete specifications when project started
Inadequate project risk analysis	Poor internal communication	Inappropriate choice of software
Incorrect assumptions regarding risk analysis	Absence of an influential champion and change agent	Changes in design specifications late the project
Ambiguous business needs and unclear vision	Reactive and not pro-active in dealing with problems	Involve high degree of customisation in application

Source: (Yeo 2002: 245)

3.4. USERS' ACCEPTANCE OF IT

Agarwal and Prasad (1998a) state that enhancing the organisational performance and productivity can be achieved by acquiring information technology. However, acquiring IT is not enough, as computer technologies must be used by the intended user groups. An organisation may adopt and implement computer systems but lack end users' acceptance. Lack of/resistance to using information systems causes "Shelfware

Syndrome", which embodies the systems whose productivity remains idle without usage (Bhattacherjee 1998). Therefore, motivating end users to use the system, and understanding the factors that affect their behaviour toward the use of IT are crucial.

3.4.1. Intra-organisational IT Acceptance

The importance of understanding the factors that influence users' adoption of innovations stems from the fact that adoption of innovation takes place within an organisation (Intra-organisational adoption), in conjunction with the organisational adoption. IS adoption/diffusion literature has pinpointed the notion of the two-level adoption process (organisational and individual) (Jeyaraj, Rottman & Lacity 2006, Rogers 2003, Frambach & Schillewaert 2002, Premkumar & Roberts 1999, Agarwal & Prasad 1998a).

For example, Frambach and Schillewaert (2002) describe adoption as an individual's or an organisation's decision to make use of a technological innovation, whereas, diffusion of innovation refers to the accumulation of users of an innovation. These definitions of adoption and diffusion imply that adoption of innovation occurs at two levels. The first level is when an organisation decides to adopt and implement IT, while the second level represents individual's acceptance and commitment toward continual use of IT. In addition, Agarwal et al (1997) state that the adoption and diffusion processes of new IT occur at two distinct levels, individual (micro level), and organisational (macro level). The micro level embodies a single identifiable entity, while the macro level embodies top management that usually supervises and manages the flow of work.

Based on what has been discussed, looking at not only how organisations adopt IT but also how individual users behave toward IT is imperative (Quaddus & Xu 2005, Frambach & Schillewaert 2002, Leonard-Barton & Deschamps 1988). Consequently, the author highlights some of the well-known theories, which have focused on intra-organisational adoption, and explains their components.

3.4.2. IT Adoption/Acceptance Theories

The IS literature offers a plethora of theories, which explain users' acceptance of the newly installed systems in terms of the factors that mostly affect their inclination to use new systems. For instance, Unified Theory of Acceptance and Use of Technology

(UTAUT) (Venkatesh et al. 2003), Model of PC Utilization (MPCU) (Thompson & Higgins 1991), Diffusion of Innovations (DOI) (Rogers 2003), Perceived Characteristics of Innovations (PCI) (Moore & Benbasat 1991) and Technology Acceptance Model (TAM) (Davis 1989). However, little research has been conducted to utilise and adapt these theories to the healthcare sector, which causes a shortage of explanations of end users' usage of IT (Schaper & Pervan 2004).

Rogers (2003) in his DOI theory postulates that the rate of adoption, which is represented in the number of individual users who adopt and use the new technology, is affected by the perceived attributes of the innovations. These attributes are:

1. Relative advantage (RA)

RA is defined as *"the degree to which an innovation is perceived as being better than the idea it supersedes"* (Rogers 2003: 229). The degree of RA is usually expressed in terms of economic profitability. Rogers (2003) states that RA is positively related to its rate of adoption.

2. Compatibility

Rogers (2003: 240) defines compatibility as *"the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters"*. An innovation is considered compatible if it fits well with the socio-cultural values and beliefs, previously adopted innovations and adopters' needs.

3. Complexity

Rogers (2003: 257) defines complexity as *"the degree to which an innovation is perceived as relatively difficult to understand and use"*. Complexity is considered as the most pivotal feature for innovation to be accepted and used by adopters.

4. Trialability

Rogers (2003: 258) defines Trialability as *"the degree to which an innovation may be experimental with on a limited basis"*. New technologies that are trailable at the outset of their installation are more likely to be adopted faster than technologies that are not divisible.

5. *Observability*

Observability denotes to the fact that an innovation's results or benefits are visible and communicated to others. Rogers (2003) generalises the notion that the higher the observability of an innovation, the faster and easier for adopters to use.

An extensive review and meta-analysis performed by Tronatzky & Klein (1982) on 75 articles concerned with innovation attributes and their significance and/or relationship to technology adoption and implementation, found out that relative advantage, compatibility and complexity were the most significant innovation characteristics that influence innovation adoption.

Moore & Benbasat (1991) further develop an instrument for measuring individual users' actual perceptions of using an innovation. Moore & Benbasat (1991) extended Roger's DOI by presenting observability in two separate factors, which are *results demonstrability* and *visibility* and adding *image* and *voluntariness*. Moore & Benbasat (1991) name the eight factors as Perceived Characteristics of Innovations (PCI).

Venkatesh et al.(2003) conducted an extensive review of eight prominent models that are concerned with user acceptance and diffusion of technology. Venkatesh et al.(2003) formulated a unified model that integrates elements across the eight models. They call their unified model Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT comprises four main factors that affect users' behaviour toward the use of technology. These factors are:

1. Performance expectancy (PE)

Venkatesh et al.(2003: 447) define PE as *"the degree to which an individual believes that using the system will help him or her to attain gains in job performance"*. PE is similar to RA, which was mentioned in Roger's DOI.

2. Effort expectancy (EE)

Effort expectancy is defined as *"the degree of ease associated with the use of the system"* (Venkatesh et al. 2003: 450). EE is similar to ease of use or complexity construct.

3. ***Social influence (SI)***

SI is defined as *"the degree to which an individual perceives that important others believe he or she should use the new system"* (Venkatesh et al. 2003: 451). SI is synonymous to image, which was presented in Moore & Benbasat (1991) model's of PCI.

4. ***Facilitating conditions (FC)***

Facilitating conditions are defined as *"the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system"* (Venkatesh et al. 2003: 453).

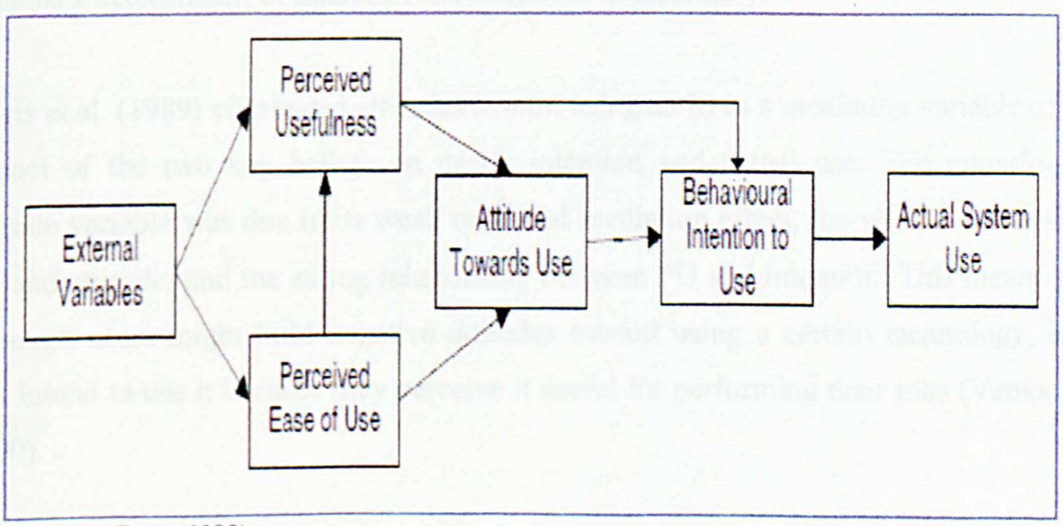
3.4.3. Technology Acceptance Model (TAM)

The TAM of Davis (1989) is one of the most widely used models that explain and predict users' behaviour toward the use of technology by determining factors affecting it (Carter & Bélanger 2005, Venkatesh 2000). The TAM is based on the premise that individuals can evaluate the outcomes of using the innovation before using it. Davis et al. (1989: 985) state the goal of the TAM as shown in the quote below:

> *The goal of TAM is to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behaviour across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified*

The TAM has been widely applied to a variety of users and technologies (Shih 2004, Venkatesh et al. 2003). TAM is depicted in Figure 3-4.

Figure 3-4: The Technology Acceptance Model (TAM)



Source: (Davis 1989)

As shown in Figure 3-4, the main idea and/or contribution of the TAM (Shih 2004) is the identification of two major beliefs that affect users' attitudes toward the use of technology, which are **P**erceived **U**sefulness (PU) and **P**erceived **E**ase **o**f **U**se (PEOU). Davis (1989: 320) define PU as *"the degree to which a person believes that using a particular system would enhance his or her job performance"* whereas, PEOU is defined as *"the degree to which a person believes that using a particular system would be free of effort"*.

According to the TAM, system usage is a dependent variable that is affected by an individual's behavioural intentions to use an IS, which, in turn, is affected jointly by PU and a user's attitude toward the use of an IS. A user's attitude is influenced by PU and PEOU. PEOU is solely determined by the external variables such as systems design features (Davis 1993), organisational support (user support, management support), user characteristics (training, experience) (Lou, Luo & Strong 2000), social norms (Holsapple & Sasidharan 2005) or political influences, task characteristics, and the nature of implementation or development process (Davis, Bagozzi & Warshaw 1989). PU is influenced by PEOU and external variables. Thus, PU and PEOU mediate the influence of external variables on user's attitude and, in turn, intention, and actual usage. In addition, Shih (2004) notes that some studies have revealed a positive relationship between PU and intention to use an IS and its actual usage, while several studies have shown that a positive association link PU and PEOU with the intention to use an IS and the actual usage. From these results, Shih (2004) concludes that PU is a primary determinant of the intention to use technology and, in turn, the usage. PEOU remains a determinant of intention and usage but is secondary.

Davis et al. (1989) eliminated attitudes toward using an IS as a mediating variable of the impact of the two key beliefs on user's intention and actual use. The omission of attitude variable was due to its weak or partial mediation effect, the weak link between PU and attitude, and the strong relationship between PU and intention. This means that although users might hold negative attitudes toward using a certain technology, they still intend to use it because they perceive it useful for performing their jobs (Venkatesh 2000).

Venkatesh & Davis (2000) develop and test a theoretical extension of TAM. The modified model includes Subjective Norms (SN) as an additional predictor of the intention to use an IS in the case of compulsory usage. SN is defined as *"a person's perception that most people who are important to him think he should or should not perform the behaviour in questions"* (Fishbein & Ajzen 1975: 302). Venkatesh & Davis (2000) conclude that SN has a direct effect on the intention and usage in the case of mandatory usage, while there is no direct impact of SN on intention when usage is voluntary.

Brown et al. ((2002) applied and tested empirically the TAM in a mandated IS usage environment. According to Brown et al. (2002: 283), a mandatory use environment is *"one in which users are required to use a specific technology or system in order to keep and perform their jobs"*. They argued that the omission of the mediating attitude construct from TAM affects its explanatory power in understanding users' behaviour toward IS usage in such a mandatory environment. One of the striking results that they came up with is that PEOU is the primary significant determinant of the behavioural intention, and PU is a secondary determinant when attitude was deleted as suggested by Davis et al. (1989). This suggests that organisations adopting computer systems should focus on the degree of systems complexity. However, with the inclusion of attitude, PU becomes primary predictor of attitude and there is only a weak link between attitudes and intention to using an IS.

3.5. CRITICAL SUCCESS FACTORS (CSFs) OF IT IMPLEMENTATION

It is not surprising for one to find a considerable amount of research that has been conducted to identify the Critical Success Factors (CSFs) for the development, implementation, and use of IT (Yeo 2002, Mahaney & Lederer 1999, Robert & Albert 1999, Glass, Robert L. 1998a, Belassi & Tukel 1996, Hougham 1996). These studies have presented a wide array of success/failure factors. It is difficult for a researcher to apply a uniform set of success variables in all IS projects (Belassi & Tukel 1996). The absence of a unified set of CSFs is because the nature of the IS project (small, medium and large size projects), and the nature of the industry in which IS projects are implemented may require different factors to exist in order for the projects to succeed.

The author thinks that conducting this study in the NHS might be helpful in identifying and understanding what affects the development and implementation of LORENZO. This would result in a set of success/failure factors that closely match the nature of the UK health sector in general and the NPfIT in particular.

The CSF approach is one of the well-established techniques used in the IS field (Shah & Siddiqui 2006). CSFs refer to those variables that determine success or failure for a business unit or an organisation. In addition, CSFs represent the areas to which top management should pay considerable attention (Ang, Sum & Chung 1995). Moreover, Rockart (1979: 85) defined CSFs as "*the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organisation. They are the few key areas where "things must go right" for the business to flourish*". In some studies, CSFs represent the operationalisation of the independent variables (Poon & Wagner 2001).

Even though CSFs is a well-known factor-based technique, it suffers from drawbacks. For instance, Fortune & White (2006) claim that the CSFs approach does not take into consideration the inter-relationships between the individual factors. In addition, the CSF approach assumes that the effect of a factor is the same throughout the stages of project implementation. Thus, the CSFs approach ignores the dynamic and iterative nature of IT projects (Kucukyazici et al. 2010).

Belassi & Tukel (1996) classify diverse CSFs into four major groups of factors. The four groups of factors are: project-related factors, project manager and team-related factors, organisation-related factors, and external environment-related factors. Furthermore, a Chaos study conducted by Standish group (2001) ranked the most important CSFs, which gained more than 10 points out of 20 as shown in Table 3-3.

Table 3-3: Success Factors of IS Development Projects-Chaos Study

Factors	
1998	**2000**
Executive Support	User Involvement
User Involvement	Executive Support
Experienced Project Manager	Clear business objectives
Clear Business Objectives	Experienced project manager
Minimized Scope	Small milestones

Source: (Standish Group 2001)

Kucukyazici et al. (2010) emphasise the importance of developing a more comprehensive framework, which takes into consideration the interactive and dynamic nature of the EHR implementation. In addition, Kucukyazici et al. (2010) state that the development of such a comprehensive framework enables researchers to understand the interdependencies of individual, organisational, and technological factors. The author thinks that discussing countless sets of CSFs seems unviable. Thus, the author concentrates his attention on some variables that have been given greater importance in the IS literature due to their enormous effect on the destiny of the EHR systems.

3.5.1. Top Management Support

Radhakrishnan et al. (2010) state that top management support is imperative to encourage medical staff to use the advanced capabilities of EHR systems. Moreover, top management support can be exploited to overcome the fear associated with using such a complex EHR system. Furthermore, Radhakrishnan et al. (2010) postulate that strong communication channels and co-operative work should be made with users for management support to achieve its intended outcome .

When design and implementation of the system have enough support and commitment from the various managerial levels, users and technical staff believe that their involvement/participation in the system development is appreciated and has considerable attention from the management leadership (Laudon & Laudon 2006).

Top management support plays an important role in assuring that the implementation of IT schemes is completed without frustration. The role of management support is emphasised to be essential for both the employees and the entire organisation (Jeyaraj, Rottman & Lacity 2006).

3.5.2. User Involvement

Involving end users in the design and operation of the system has several positive results. For instance, users feel more positive and responsible toward the implementation of the system. In addition, when users participate in the design and operation of an IS, they can tweak the system according to their business needs. Moreover, it is more likely that end users will react positively and hold positive attitudes toward using the system (Laudon & Laudon 2006).

According to Power (2004), companies that use information technologies effectively are also effective in Human Resource Management (HRM). One of these HRM practices is user involvement that plays an important role in leveraging training programmes benefits. User involvement, along with user-participation culture, is also essential in redesigning organisational processes effectively where people are considered as active participants in the organisational learning.

User involvement has been considered in the IS literature as one of the most important reasons for the success of developing IS (Laudon & Laudon 2006, Standish Group International Inc 1999). Engaging end users in the determination of information requirements is crucial because it helps to overcome the user-designer communication gap.

Most researchers who tested the role of user involvement in the IS development (Rondeau, Ragu-Nathan & Vonderembse 2006, Malhotra & Galletta 2004, Winston & Benjamin 2000, Choe 1998, 1996, Saleem 1996) have found that user involvement has a positive impact on IS success. However, this relationship exists under the premise that users are homogeneous in terms of their system needs. Additionally, one should take into account that group conflict and the difficulty of reaching consensus among users restrict their participation in the IS development process.

In the NHS, there is a wide variety of user groups, based on medical specialisations and departmental divisions. This situation of users' heterogeneity denotes to potential problems in representing end users in the design and identification of their requirements as each group may have its own clinical requirements.

3.5.3. User Support

For an organisation to benefit from IT, it should assist its intended users (Kamal 2006). User support considered as one of the important factors for IS success (Hussein, Abdul Karim & Selamat 2007, Jeyaraj, Rottman & Lacity 2006). Assistance is given to users in terms of technical support and guidance. Radhakrishnan et al. (2010) postulate that technical support is imperative for implementing a complex system such as EMR-like systems and users feel more encouraged to use it when they are provided technical assistance.

Coombs (1999) states that user support can be provided through information centres, more localised (i.e. *in-situ*) IS staff, or informal support from colleagues and lead users. In addition, Coombs (1999) emphasises that users may feel disappointed by information centres, as users' expectation may be higher than what is actually provided through these centres. One point to bear in mind is that support can be provided by vendors who are responsible for the design, development, and use of IS (Ang, Sum & Chung 1995).

3.5.4. User Training

User training is pivotal for successful individual IS adoption (Jeyaraj, Rottman & Lacity 2006). Training programmes enable IS staff to possess the required skills and knowledge for using the computing hardware and software efficiently and effectively. Radhakrishnan et al. (2010) suggest that health organisations should place greater emphasis on training their system users, and be given more time to acquire the necessary skills for the use of the system. Sharma & Yetton (2003) argue that other variables may eradicate the positive effect of training on IS success. Sharma & Yetton (2003) postulate that the greater extent of technical complexity and task interdependence, the less favourable effect of training on IS success.

3.5.5. Availability of Resources

The availability of financial resources is one of the strongest CSFs. However, financial capital is not the only resource required for developing and adopting IT (Kamal 2006). Kamal (2006) classifies IT capabilities as one of the CSFs for developing advanced IT projects in the public sector. IT capabilities refer to *"the level of IT resources, personnel IT knowledge and IT sophistication of an organisation"* (Kamal 2006: 213).

The availability of IT resources or facilities is one of the factors that is positively related with the success of IS projects (Hussein, Abdul Karim & Selamat 2007). One main component in IT facilities is the IT infrastructure. The IT infrastructure allows different organisational units to share the repository of information or knowledge. Byrd et al (1995) define IT infrastructure as "*the shared information services delivery base within an organisation that is built around information technologies and a specific body of knowledge such as skills and experience*". Data communication networks, workstations, and clinical repositories are examples of IT infrastructure that enable health organisations to establish a delivery system-wide network to combine various applications (Wager, Lee & Glaser 2005).

Kamal (2006) posits that the level of IT competence or skill set has a positive impact on IT adoption in government organisations. However, Donald (1999) highlights the fact that employees working in governmental organisations lack adequate training for using IT. Inadequate training leads to resistance to use and under-utilisation of computers.

3.5.6. Championship

Rogers (2003) emphasises the pivotal role of the project champion who supports the organisational efforts in implementing technological innovations, and overcomes any resistance that new ideas may bring about in organisations. The champion is a charismatic person (Rogers 2003) who is committed to introducing an IS to the organisation (Kamal 2006). A champion can be thought of as an antecedent to successful IT implementation or, at least, to minimal resistance to use or under-utilisation of the introduced system.

3.6. CONCLUSION

Determining whether an IT project is a success or failure is difficult because various stakeholders perceive success and failure differently, and the success/failure factors discussed in the IS literature are not tailored to the implementation of HCIS in the NHS in England. Therefore, even though IS success is a multidimensional construct, usage was the ultimate measure of success because the author aimed to approach user issues concerned with the use of LORENZO's deployment units from a user perspective (bottom-up). The D&M success model is widely used in the IS field for studying IS success. According to the D&M, system quality and information quality affect singularly and jointly both UIS and usage. UIS and usage are direct antecedents of individual impact, which in turn, should have some effect on the organisation.

The author perceives system quality and information quality as a resulting outcome of the methodology, by which the system is developed. This means that the ISDM adopted should have some impact on end users' usage. The author decided to investigate this potential relationship in the case of LORENZO.

IS failure was given a considerable amount of discussion as it is a major concern for most IS researchers and practitioners. In healthcare sector, the failure rate of IT projects reaches 60-70% and is 80% for large IT projects in the public sector in general. IT projects are considered a failure if they run over budget, deliver less functionality than expected, and under-utilised or rejected by the intended users. IS failure could be a result of technical related factors represented in the characteristics of the technology itself (e.g. complexity of the systems), human related factors that reflect the internal traits of end users such as age and gender. Additionally IS failure could be as a consequence of the interaction between the technology and the intended users.

Different theories aimed at identifying influencing factors on users' behaviour toward the use of technological innovations. However, the TAM was the model of interest to the author because it was widely used, tested, and validated in various contexts. According to the TAM, system usage is affected directly by uses' intention to use technology, which in turn, is affected by the perceived usefulness of the adopted technology, and the user's attitude toward the use of that technology. PU and PEOU are direct antecedents of the user's attitude. These two attitudinal beliefs are also affected by external factors.

The use of the TAM to predict or explain users' usage of LORENZO should be based on the fact that the nature of the working environment, in which LORENZO's deployment units operate in the NHS is distinct from other contexts and therefore, extensions or modifications to the original TAM are crucial. In the current study, modifying the TAM is executed through the adoption of the qualitative approach to obtain rich data from the real settings (i.e. the people who are involved in the implementation of LORENZO).

The most important critical success factors (CSFs) concerning the implementation of EHR are discussed in this chapter. The CSFs are top management support, user involvement, user support, user training, availability of resources, and championship. However, these factors are not confined to the nature of the NHS organisations and thus, this study aims to determine the set of factors that has an enormous impact on the success of LORENZO in the NME region.

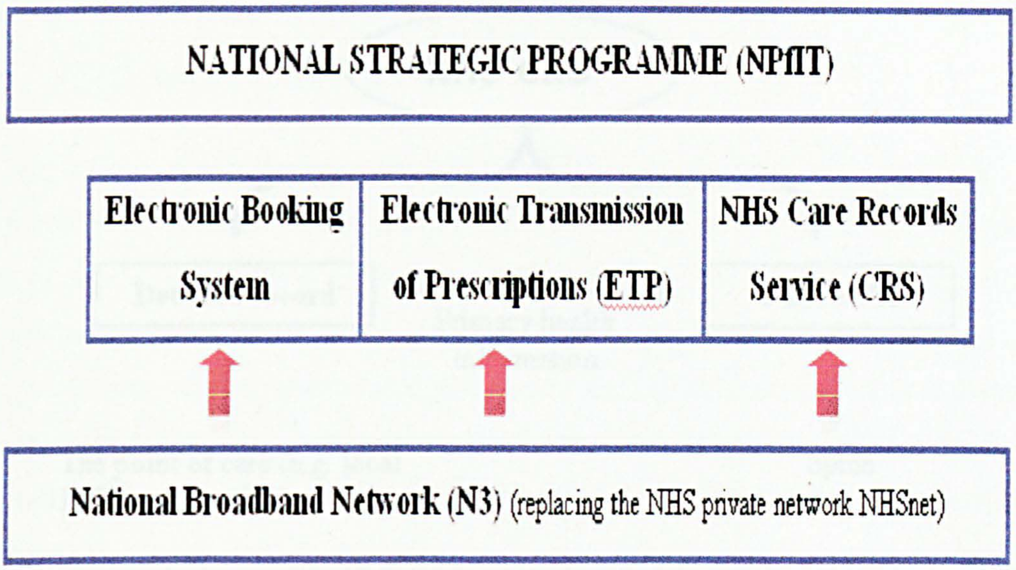
Chapter Four

4. THE NPfIT IN THE NHS IN ENGLAND

4.1. COMPONENTS OF THE NPfIT

The NHS decided to adopt a strategic outsourcing approach, which entails selectively outsourcing the major components of NPfIT in an incremental 3-phase change strategy (Department of Health 2002d). There are four main components of the project: the NHS Care Records Service (NHS CRS), Electronic Transmission of Prescriptions (ETP), Electronic appointment booking (Choose and Book) and, the NHS National Network (N3), which provides high-speed internet connection (Department of Health 2002d). Figure 4-1 depicts these components.

Figure 4-1: Strategic Components of the NPfIT

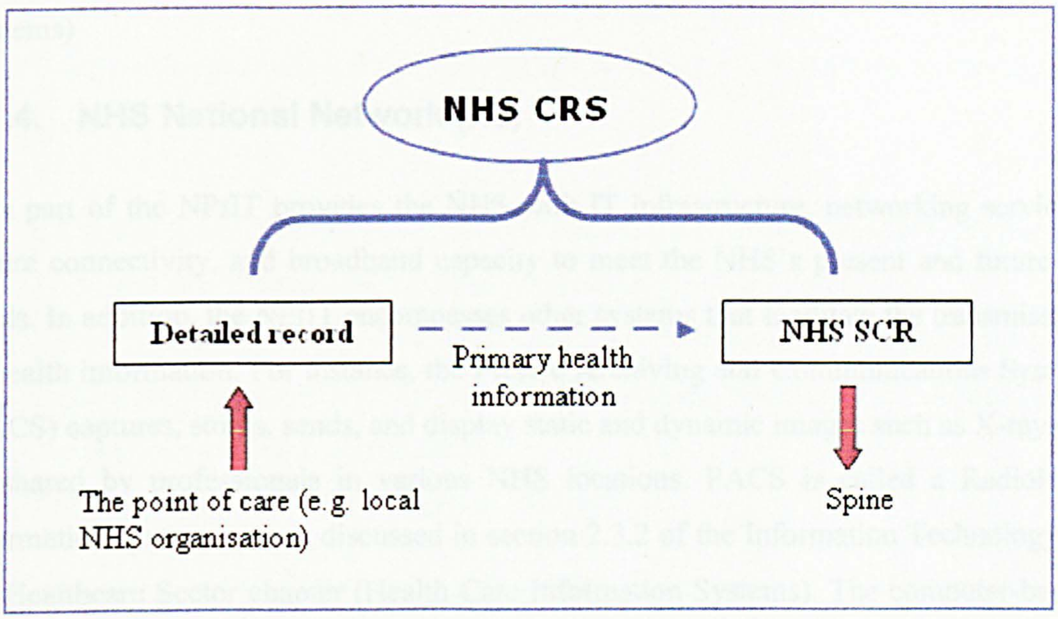


Source: (Department of Health 2002d)

4.1.1. The NHS Care Records Service (NHS CRS)

The NHS CRS, or so-called National or Integrated CRS, is ultimately the end output of the NPfIT. Each patient will have two records: a detailed record (i.e. a detailed EPR) held locally, and a Summary Care Record (SCR), which is a summary version of the detailed record. The SCR holds primary information that is automatically uploaded and stored in the "Spine" (The NHS Confederation 2008, NHS Connecting for Health 2005). Over time, summary information in the SCR will accumulate to shape the EHR (Brennan 2007). The Spine is a key part of the NHS CRS and represents the national warehouse. This data warehouse holds summary information about patients' health and care. Patients can access their information through the Healthspace. The Spine supports other programmes within the NPfIT such as Choose and Book, Electronic Prescription Service (EPS) and the Secondary Uses Service (SUS). Figure 4-2 shows the elements of the NHS CRS.

Figure 4-2: Elements of the NHS CRS



Once the NHS CRS is fully implemented and each citizen in England has his/her electronic summary record, health providers will be able to access securely the summary clinical information, wherever and whenever the patient seeks care in England. In addition, summary records stored in Spine are designed to point clinicians to where the full detailed local records are held (Brennan 2007).

4.1.2. Electronic Booking System (Choose and Book)

Patients will be able to choose the appointment that suits their time without anxiety to miss it or clash with their other personal or career life. Choose and Book is a combination of two sets of systems: an electronic booking system and a choice of time (date) and place for consultant led and outpatient appointments (NHS Connecting for Health 2005).

4.1.3. Electronic Transmission of Prescriptions (ETP)

ETP is analogous to the Electronic Prescription Service (EPS). NHS organisations issue approximately 1.4 million prescriptions on a daily basis. The ETP enables prescribers to generate and transmit electronic prescriptions to nominated or selected dispensers. This system is similar to the Pharmacy information system mentioned in section 2.3.2 of the

Information Technology in the Healthcare Sector chapter (Health Care Information Systems)

4.1.4. NHS National Network (N3)

This part of the NPfIT provides the NHS with IT infrastructure, networking services, secure connectivity, and broadband capacity to meet the NHS's present and future IT needs. In addition, the NPfIT encompasses other systems that facilitate the transmission of health information. For instance, the Picture Archiving and Communications System (PACS) captures, stores, sends, and display static and dynamic images such as X-rays to be shared by professionals in various NHS locations. PACS is called a Radiology information system, as was discussed in section 2.3.2 of the Information Technology in the Healthcare Sector chapter (Health Care Information Systems). The computer-based images are uploaded to the NHS CRS for future retrieval (NHS Connecting for Health 2005). Another IT application within the NPfIT is NHSmail, which is the email and directory service.

Cresswell and Sheikh (2009) postulate that there is a problem facing the implementation of the NPfIT that is mission creep. Mission creep implies an increased scope and sophistication of IT projects as time passes. For instance, the NPfIT was originally planned to deliver Choose and Book, EPS, and NHS CRS. With time, other systems such as PACS, NHSmail, and GP2GP were added for improved performance. However, Cresswell and Sheikh (2009) state that this may take NHS CfH's attention off the major focus of the programme. the author thinks that the increased scope and complexity of the NPfIT over time, is perceived as a natural consequence of the continuous technological development since the inception of the NPfIT in 2002.

4.2. DELIVERY OF THE NPfIT PRODUCTS

The NHS CfH is responsible for the delivery of IT infrastructure in the NHS. This infrastructure encompasses a wide array of national services and applications to be delivered through national and local contracts, as well as Existing System Providers (ESPs) (NHS Connecting for Health 2007b).

4.2.1. National Application Service Providers (NASPs)

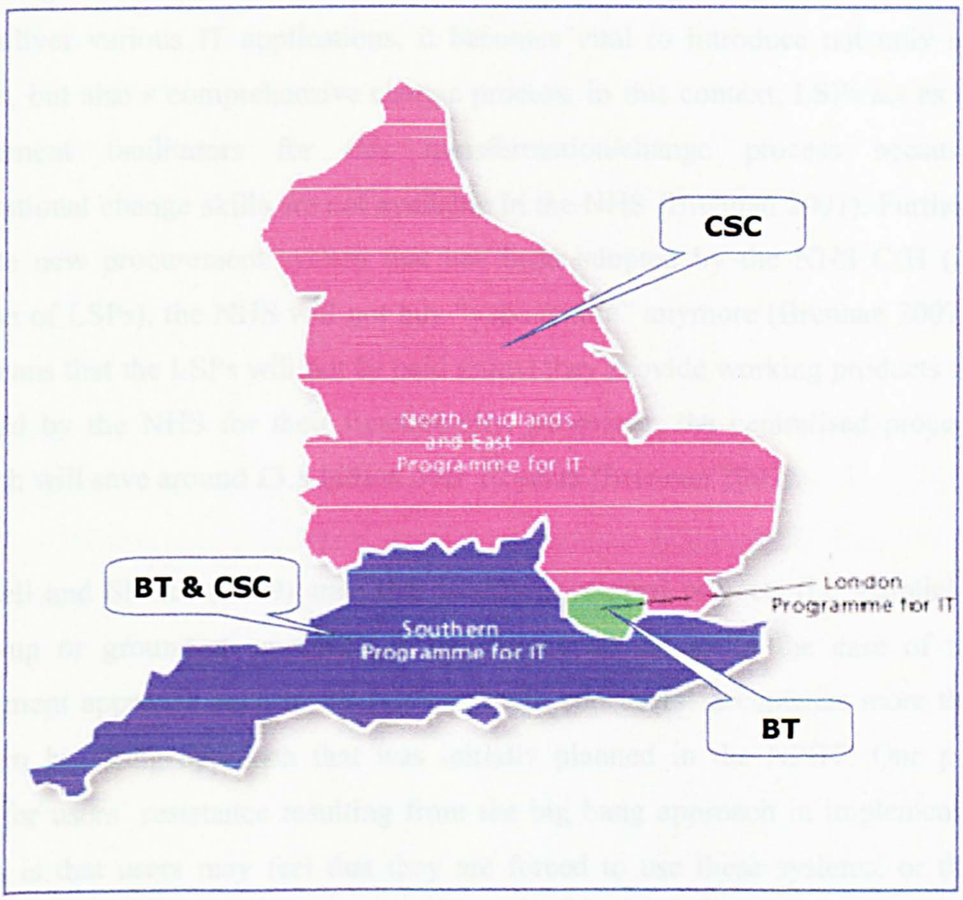
NASPs are committed to deliver IT applications included in the national contracts. The NASPs are:

1. BT is the NASP for the national data warehouse (spine), and is responsible for delivering N3 (the national broadband network).
2. Atos Origin is the NASP for Choose and Book, which allows appointments to be booked for first outpatients through: at GP surgeries, online, or call centres (NHS Connecting for Health 2007b, 2005).
3. Cable and Wireless is the NASP for NHSmail.

4.2.2. Local Service Providers (LSPs)

Local Service Providers (LSPs) are committed to provide the agreed upon applications in the local contracts. LSPs are required to develop and implement IT services in the NPfIT locally, and link these systems with the national systems (NHS Connecting for Health 2007b). In addition, the LSPs are responsible for developing and deploying PACS in assigned local regions. In April 2007, the responsibility for delivering the NPfIT transferred to the SHAs and took effect on 1st July 2007. The ten SHAs have been divided into three major programmes for IT, as shown Figure 4-3 (NHS Connecting for Health 2007b).

Figure 4-3: LSPs of the NPfIT



Source: CfH website: http://www.connectingforhealth.nhs.uk/area

- ***The North, Midlands and East Programme for IT (NMEPfIT)***

There are six SHAs in the NMEPfIT (60% of the contract) which are; North East, North West, East Midlands, West Midlands, East of England, and Yorkshire and the Humber SHAs. CSC is the LSP and its main subcontractor is iSOFT. The NMEPfIT is committed to LORENZO, which is procured by CSC.

- ***The London Programme for IT (LPfIT)***

This cluster encompasses only one SHA, which is NHS London. BT Care Capital Alliance is the LSP for NHS London with Cerner as the main subcontractor.

- ***Southern Programme for IT (SPfIT)***

The SPfIT is comprised of three SHAs in the southern part of England: South Central, South East Coast, and South West SHAs. IT services and applications are procured by BT and CSC.

To perform their activities effectively LSPs work directly with the local NHS organisations such as NHS trusts who act as Local Health Communities (LHCs) (NHS

Connecting for Health 2007b). Moreover, due to the enlarged regions in which BT and CSC deliver various IT applications, it becomes vital to introduce not only new IT systems, but also a comprehensive change process. In this context, LSPs act as change management facilitators for this transformation/change process because the organisational change skills are not available in the NHS (Brennan 2007). Furthermore, with the new procurement system that has been adopted by the NHS CfH (i.e. the insertion of LSPs), the NHS will not buy "vapourware" anymore (Brennan 2007: 206). This means that the LSPs will not be paid unless they provide working products that are approved by the NHS for their functionality. Moreover, the centralised procurement approach will save around £3.8 billion over 10 years (Brennan 2007).

Cresswell and Sheikh (2009) state that locally developed projects (i.e. parallel to the bottom-up or ground-up approach in developing an IS, as in the case of the old procurement approach used in the NHS can win end users' acceptance more than the top-down big bang approach that was initially planned in the NPfIT. One possible reason for users' resistance resulting from the big bang approach in implementing IT systems is that users may feel that they are forced to use these systems, or they are imposed upon them. Brennan (2007) observed that a "One size fits all" strategy may not hold true as there are various NHS organisations with numerous requirements.

4.2.3. Existing System Providers (ESPs)

ESPs are responsible for delivering IT systems at the trust level to be integrated and deployed within NHS trusts. Existing systems encompass the systems that are already installed in the NHS, and the IT systems that are installed in non-NHS organisations, which provide NHS patient care (e.g. independent private sector providers) (NHS Connecting for Health 2007b). The NHS CfH announced that they deal with 80 ESPs in order to provide IT solutions to more than 23,000 sites.

4.3. LORENZO: THE NHS CRS IN THE NMEPFIT

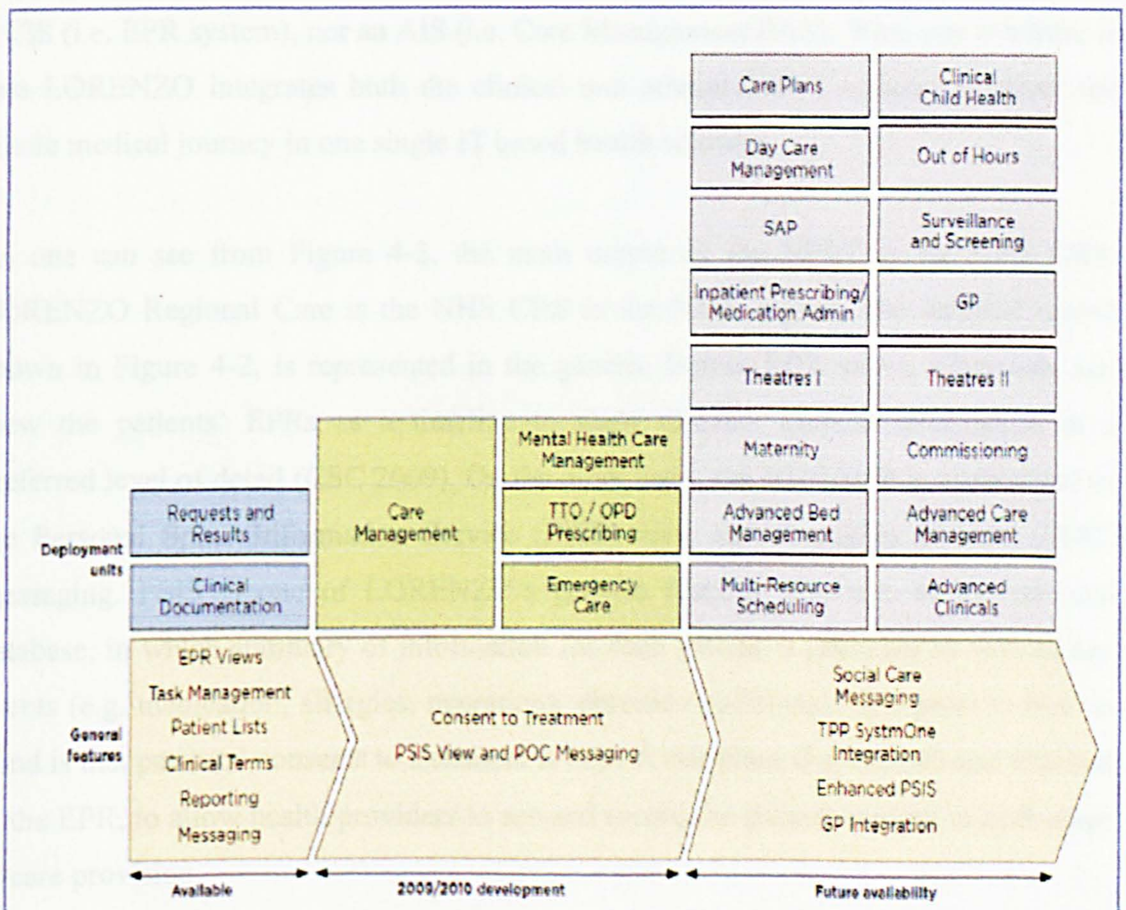
The LORENZO Regional Care system or the so-called LORENZO has been designed by iSOFT subcontractor in the CSC alliance (CSC 2009). As one can see from Figure 4-3, LORENZO is being implemented in the NMEPfIT that covers six out of the 10 SHAs covering the whole of England. LORENZO was chosen, and accredited by the

NHS CfH as a key system on which the creation of the NHS CRS is based, to develop connected EHRs for the 30 million patients in the NME region (iSOFT, 2010). LORENZO replaces the existing patient administration and clinical management systems in the NHS organisations to give them an extraordinary ability to share clinical and patient information among them. In addition, LORENZO is expected to provide more integrated and complete EHR that covers the complete healthcare journey.

4.3.1. Deployment Units Approach

Even though LORENZO is a single healthcare solution, it has been developed and delivered in separate but interrelated parts called deployment units. Each unit delivered extends or adds more functionality to the preceding one (CSC 2009). Figure 4-4 shows LORENZO's deployment units.

Figure 4-4: LORENZO's Deployment Units



(CSC 2009)

The blue boxes in Figure 4-4 represent the deployment units that are available for deployment in the NHS organisations. The green boxes displayed in the diagram denote the units that were in development in 2009 and 2010, and the grey boxes denote the deployment units that will be available in the future. There are generic features that come as standard in any deployment unit. Each unit can be delivered separately as a single deployment project, or more than one unit can be delivered for greater functionality and benefits (CSC 2009).

As has been discussed, LORENZO is expected to deliver an **integrated EHR** to NHS organisations. This means that, according to the author's view, LORENZO should not be seen as only a traditional EHR- like system, where complete and accurate health-related information to be available to health providers at the point and time of care. Instead, LORENZO also contains its own PAS that is represented in the Care Management deployment unit as one can see in Figure 4-4. Thus, LORENZO is neither a CIS (i.e. EPR system), nor an AIS (i.e. Care Management PAS). What one can infer is that LORENZO integrates both the clinical and administrative systems to cover the whole medical journey in one single IT based health solution.

As one can see from Figure 4-2, the main output of the NPfIT is the NHS CRS. LORENZO Regional Care is the NHS CRS in the NME region. The detailed record shown in Figure 4-2, is represented in the generic feature EPR views. Clinicians can view the patients' EPRs as a timeline to show relevant clinical information at a preferred level of detail (CSC 2009). On the other hand, the NHS SCR is represented in the Personal Spine Information Service (PSIS) view and Provision of Care (POC) messaging. PSIS is one of LORENZO's generic features that acts as the national database, in which summary of information for each patient is provided as well as key events (e.g. medication, allergies, operations, chronic conditions). One point to bear in mind is that patients' consents to treatment is kept in one place (i.e. record) and attached to the EPR, to allow health providers to see and record the patient consent at each stage of care provision.

The author did not find journal articles or textbooks that discuss LORENZO and highlight its main units except the official website of CSC that gives a brief description of some deployment units and the generic features of LORENZO. However, the author obtained a fair understanding of the nature of LORENZO from participants in this research study, who had knowledge and experience in dealing with LORENZO. Those participants asserted that LORENZO embodies a completely new underlying feature, which is the integration capability that overcomes connectivity problems of various existing systems.

Moreover, some participants stated that even though the US health care system is considered as one of the most developed health care systems in the world in terms of the heavy adoption of ICT, there is still a serious integration dilemma of fragmented systems (e.g. different GP systems). Thus, LORENZO, if installed successfully in the NHS in England, would become the most integrated HCIS, if not worldwide, at least in Europe.

The author argues that despite the name of the system (i.e. LORENZO Regional Care), LORENZO could be seen as a national HCIS if one considers the fact that LORENZO is going to serve 30 million citizens living in the NME region a population which is greater than the population of some other European countries. Consequently, LORENZO is a mega sized IT project if compared to others in the health care, or other service industries in the UK or the world. The implication of this gigantic size is that the use of the existing IS success models (e.g. D&M), or theories of intended users' behaviour toward the use of technology (the TAM as an example) was not appropriate. This is because the huge scope and scale of the computer systems in question were not taken into account when these models/theories were developed. Thus, it was the author's decision to conduct an interpretive case study to examine the suitability of the TAM and modify it to adapt the extraordinary size of LORENZO.

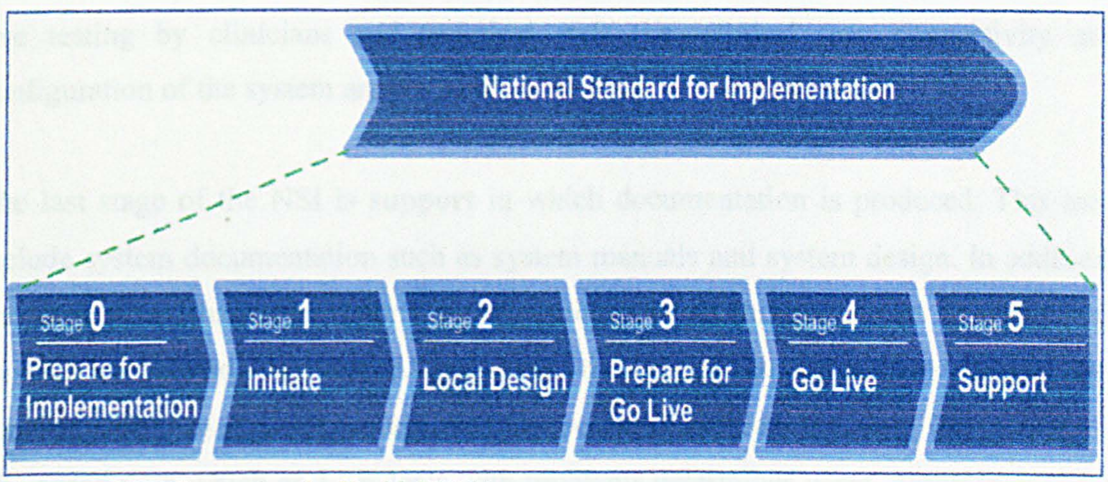
As we saw in section 2.2.4.2.1 of the Information Technology in the Healthcare Sector chapter (Rapid Application Development (RAD)), phased delivery and reduced waste are two main principles of the RAD approach. The author thinks that these two principles apply to the Deployment Units approach, as LORENZO is delivered in various segments called units. Moreover, deployment units approach reduces the waste of allocated resources needed to develop these units. For instance, any error detected in one of the units installed does not require the system developers to fix the entire set of units, or to affect the functionality of the other units except the defective unit(s).

However, the NHS CfH agency adopted a centralised outsourcing approach to install LORENZO in the NHS organisations. As we saw in section 2.2.4.4 of the Information Technology in the Healthcare Sector chapter (Outsourcing), outsourcing is an appropriate ISDM when end users lack the required technical knowledge and skills. Therefore, the author thinks that an outsourcing strategy was a good choice because end users in the NHS are supposed to possess clinical/medical rather than technical skills to perform their jobs.

4.3.2. Deployment Process of LORENZO

The feedback from previous national IT implementation projects emphasised the need for a standardised approach for implementing national programmes, in order to avoid confusion and inefficiencies (NHS Connecting for Health 2007b). Based on this, the National Standard for Implementation (NSI) was created. NSI encompasses a lifecycle of six major stages, as shown in Figure 4-5.

Figure 4-5: National Standard for Implementation



Source: (NHS Connecting for Health 2007b)

LORENZO's deployment units will be delivered relying on the NSI (CSC 2009). The activities performed throughout the entire lifecycle differ according to the deployment project and size. Yet, there are a common set of activities to be pursued for all deployment units. The author highlights the common tasks that are undertaken to deliver LORENZO's units.

At the first stage (**preparation**), trusts and their local NHS organisations are checked to ensure that they are prepared to start the implementation. The **initiation** stage is about assuring there is a clear understating of what is to be delivered. An organisational change strategy and a training strategy, which assesses the basic computer skills, are created.

The local design stage is about reviewing processes, working practices and organisation to ensure that the planned benefits can be realised through the alignment of people, processes, and systems. In addition, business and clinical design takes place, various hardware, software, network connections, training, and human resources are procured.

In the **prepare for go live** stage, all activities identified in the design stage should be completed, and change to clinical processes is undertaken. In the **go live** stage, the new local service and its supporting systems are completed and ready to be used by the end users. The end of the go live stage is announced after a successful implementation of go live testing by clinicians and technical staff (i.e. clinical risk, connectivity and configuration of the system are pursued).

The last stage of the NSI is **support** in which documentation is produced. This may include system documentation such as system manuals and system design. In addition, end project and handover reports are also produced. At this stage, user feedback and lessons learned are documented and thus, for an LSP to gain users' buy-in and commitment, it must work on resolving any potential problem that may face end users. The speed with which an LSP deals with problems determines users' acceptance of the system. This confirms the notion, which was discussed in section 3.5.3 of the Successful Implementation of IT Projects chapter (User Support), that user support that is provided by the vendors is crucial for successful deployment of IT projects.

By having a closer look at the NSI stages, the author concludes the following:

- The six stages of the NSI represent, more or less, the System Development Life Cycle (SDLC) stages. One may look at the NSI stages as three distinct stages: planning (designing the system and other pre-go-live activities), implementation (i.e. the go-live status), and feedback (the support stage).

- Because the NSI approach is similar to the SDLC approach, system requirements are identified at the outset of the design, and are assumed unchanged (i.e. frozen), the deployment unit is designed (local design stage), and then delivered to the NHS organisation or trust. This indicates the fact that end users are not consulted on a continuous basis during the stages, and this may lead to resistance to using LORENZO by end users. This is because end users may feel the system is imposed from outside by commercial outsourcing companies.

Even though lessons learned and feedback reports are produced in the last stage of the implementation project, this could be extended, by having users' feedback at the exit point of all the stages of the NSI. The author's suggestion of generating lessons learned and feedback report for each stage of the NSI, is based on the grounds that assessing the success of each stage of the SDLC is more informative in assessing the success of the development process, as was discussed in section 3.2.1.2 of the Successful Implementation of IT Projects chapter (Critiquing the D&M Model).

- Regarding support and training, the NHS CfH (2007b: 51) declares that training takes place just before the go live stage. As one can see in section 2.2.3 of the Information Technology in the Healthcare Sector chapter (Socio-technical Theory), ongoing training after the installation of IT systems is pivotal because it enables top management to manage the change process resulting from the introduction of IT. Therefore, the author emphasises the fact that ongoing training can take place before, during, and after the installation (i.e. go-live stage) of the deployment units.

- The author stresses the point that training could be targeted not only at informing users about how the new system and its features can be used, but also educating users about the benefits of applying the new system, and how it can enhance their performance in order to gain their buy-in before the systems are even delivered.

4.4. CRITIQUE TO THE NPFIT IMPLEMENTATION

The author has pointed out previously that large-scale IT projects are more vulnerable to failure, incorporate a higher degree of risk, and require more sophisticated management and control than smaller projects. In addition, the Standish Group (2001) confirms the notion that larger IT projects tend to have a greater likelihood of failure compared to smaller IT projects. Taking into account that the NHS initiated various IT implementation projects, along with the establishment of the NPfIT (which is the largest IT project in Europe (Eason 2005)), puts the NHS efforts at risk. Risk stems from the likelihood of facing system failure or at least poor performance of these systems. The author reviews the existing literature pertaining to the implementation of the NPfIT, and its chances of achieving its goals.

The author emphasises the notion that failure exists in the NHS world and there is nothing more convincing than a real-life example, which symbolises IT project failure in the NHS. Failure occurred to London Ambulance Service Computer-Aided Despatch System (LAS) (Hougham 1996). Hougham (1996) stated that LAS, which was the largest in the world, failed because of not only technical flaws, but also fatal design flaws. According to Hougham (1996), the most important factor that led to the failure was the poor management and organisation of such a complex system.

Currie & Guah (2006) state that the UK government spends around £2.3 billion per year on IT. However, the government has experienced failure of major IT-enabled projects. Failure in IT projects took place in form of delays, overspending, poor performance, and abandonments. In this context, one of the criticisms to the NPfIT is related to its cost and delay. For instance, by 2007 the deployment process of the NHS CRS was two years behind schedule, with no accurate estimate of the total project expenditure (House of Commons 2007). Moreover, the document published by the House of Commons (2007) showed that the termination of Accenture contract added more pressure on the other suppliers who might not be able to have enough capacity to deliver the systems required on time.

The large scale and scope of the programme in terms of the various deliverables that are emerging with time pose more threats to the project, which is represented in delay and extra budget (Currie & Guah 2007, National Audit Office 2006). The National Audit Office (NAO) report revealed a four year delay in the project. This delay confirmed by the NHS Chief Executive, David Nicholson, who stated that, the NPfIT in a "Pivotal Position" (E-Health Insider 2008). In addition, the NAO report published in 2010 (National Audit Office 2010) confirms that delay is still a prominent issue in the implementation of the healthcare records.

Eason (2005) argues that people's problem in the NHS is not with the overall goals of the NPfIT, but with the way by which the programme is being implemented, and the clarity of benefits. The problem of the clarity of benefits stems from the fact that there are different IT applications within the NPfIT, and users have shown various responses accordingly (Eason 2007). For instance, people accepted the PACS without organisational problems because the benefits of this system were clear to them. On the other hand, people (i.e. end users) showed minimal usage of some IT applications, as the benefits were less clear to them. For example, usage of the electronic records (the NHS CRS) is characterised as minimal and accompanied with workarounds, which affect negatively the confidentiality of information besides other organisational problems. The minimal usage of the electronic records mirrors end users' reluctance to use the NHS CRS (Eason 2007). Eason's view supports the notion that was discussed in section 3.2.1.1 of the Successful Implementation of IT Projects chapter (D&M Model Components) that using the system should make end users realise the benefits of the system in order to obtain the required individual impact such as enhancing users' decision-making productivity. Thus, if users can not see the benefits of using the NHS CRS, they will either not accept it, or use it minimally.

Lack of benefits realisation is a problem facing organisations in public sector. Brynjolfsson (1993) argues that the reason for the lack of benefits realisation in the service sector is due to intangibility of IT benefits as compared to that in the manufacturing sector. We saw in section 2.3.3.2 of the Information Technology in the Healthcare Sector chapter (Benefits of EMR), that using Electronic Medical Records (EMR) reduces medical errors, and enhances clinical safety. Enhancing clinical, safety for instance, is an intangible benefit that would be difficult for end users to realise. The non-physical nature of IT benefits (e.g. improved quality, timeliness of delivery, and enhanced responsiveness) prevents end users, and the organisation from perceiving them because they do not appear properly in the productivity statistics.

The NAO report that was published in 2008 (National Audit Office 2008) stated that the commitment of the NHS users is a critical factor for the success of the programme. Additionally, the NAO report argued that realising the benefits of the systems would enhance end users' confidence in the new systems (National Audit Office 2008).

Clegg & Shepherd (2007) state that managing the radical change within the NPfIT is still a difficult task. This difficulty stems from the fact that the NPfIT is expected to connect around 1.3 million people working in the NHS, and enables them to exchange information across geographically dispersed locations. This task is massively complex to deal with. Moreover, the fact that the NHS comprises strong professional groups that set the standards of healthcare practices, and subsequently have gained enough political power makes it more difficult to infuse and manage change into such a political environment (Clegg & Shepherd 2007).

Hendy et al (2007) conducted a qualitative study on four acute trusts to investigate the challenges to the implementation of NPfIT. These trusts showed that low morale of the NHS, unrealistic programme timetable, trusts' uncertainty about the implementation schedule, short-term benefits, and trust's circumstances (e.g. financial deficit) all pose threat to its success. Additionally, they postulate that the poor communication between the CfH and local management, delays in delivering PAS affects SCR implementation, and delay in delivering some components of the programme causes integration problems and in turn, threatens patients' safety.

Bernnan (2007) states that the NPfIT lacks enough understanding and engagement of end users (e.g. clinicians, doctors), top seniors, and training programmes are inappropriate to provide the required skills. Bernnan's findings may be explained by the fact that seniors are more clinically oriented than technically oriented.

Randal (2007) analysed the NPfIT from a computing or technical perspective. He claimed that the availability and access of clinical records at both national and local levels jeopardise confidentiality of information. Additionally, he states that LSPs are reluctant to provide documented specifications, which are not available for either NHS CfH or the public. Commercial confidentiality, and lack of documentation increase the user-designer communication gap that intensifies users' resistance to accepting the new IT systems.

In 2007, Chief Clinical Officer, Professor Michael Thick mentioned that the key risks facing the implementation of NPfIT are not mainly technical issues. Instead, he stressed the importance of end users' attitudes and behaviours that need to be the priority of senior management at the local level. In addition, lack of clarity on what is mandatory or optional, fear over consent/confidentiality, and conflicting local NHS priorities are some challenges to be taken into account (NHS Connecting for Health 2007a).

Despite the various studies conducted to assess the NPfIT implementation, the author focuses on the end user and the LSP side of the development and deployment of LORENZO, as these two perspectives have gained little attention from academics and researchers.

4.5. CONCLUSION

The NPfIT, which was created officially in October 2002, is an IT enabled transformational/change project to help the NHS fulfil its reform programme started in 2000 for re-structuring the way the NHS provides health service to the citizens of England. The NPfIT encompasses four main cutting-edge technological solutions that are: the NHS CRS, ETP, EPS, and the N3. As any other mega IT project, the scope of the NPfIT has increased to include more IT applications that improves the efficiency of clinical processes.

The NHS CRS is the primary output of the NPfIT which is delivered locally through two main LSPs (BT and CSC) who signed contracts with the NHS. The NMEPfIT is one of three major clusters of SHAs that was assigned to CSC to deliver their integrated EHR called LORENZO. LORENZO is the NHS CRS in the NME region covering 60% of the SHAs in England.

LORENZO is composed of 22 major deployment units; each module or unit pursue certain functionalities that altogether cover the entire medical processes. There are also general features that come as standard with any deployment unit. LORENZO is a comprehensive and integrated EHR that has not been applied in any other health sector, whose fundamental feature is the integration of the various systems in the NHS for health providers to share and access information from different locations. Therefore, it becomes apparent that looking at and/or adapting IT adoption/usage models is necessary to adapt to the size of LORENZO.

Chapter Five

5. QUALITATIVE RESEARCH: NATURE, TYPES AND LIMITATIONS

5.1. INTRODUCTION

Because qualitative research encompasses a variety of methods for collecting and analysing data, qualitative researchers tend to present a detailed description of the data collection and analysis methods adopted in their studies (Shah & Corley 2006). Thus, the author discusses thoroughly the methodological (data collection and analysis methods) and the philosophical foundation (the research paradigm and approach) of the current research.

Sekaran (2003: 5) describes business research as "*An organized, systematic, data-based, critical, objective, scientific inquiry or investigation into a specific problem undertaken with the purpose of finding answers or solutions to it*". Sekaran's description of business research implies that, research is a process, which enables managers to produce informed decisions through the analysis of already existing data or gathered data. Holloway (2005) postulates that research is a method that aims at generating robust evidence and understating in response to a question.

Sarantakos (2005) postulates that research is diverse and pluralistic in terms of its aims, focus, methods and underlying paradigms. For instance, research may aim at increasing knowledge through exploring social reality, explaining social life, developing and testing theories, or understanding human behaviours and actions. Furthermore, research may focus on people, organisations, physical environment or implicit meanings. The underlying paradigms for research are also diverse but there are two main research paradigms; qualitative and quantitative. Under each paradigm, there are various methods that researchers can choose to undertake their researches.

5.2. NATURE OF THE RESEARCH

There is no standard categorisation for the various types of business/management research. Thus, the author discusses the various types of research based on different criteria and locates the current research in the spectrum accordingly.

Many researchers have classified business/management research into categories; for instance, Saunders et al (1997) postulate that research is found in three forms, which are exploratory, descriptive and explanatory research. In addition they extend their discussion to highlight two alternative research approaches, which are positivist and phenomenological. They also pinpoint different research strategies, which are summarised in experiments, surveys and case studies.

Sekaran (2003) identifies two types of business research, applied and basic (pure or fundamental) research. In addition he classifies business research based on its purpose into three types, exploratory, descriptive and hypotheses testing (analytical and predictive). In addition, Sekaran (2003) mentions other types of research, which are action research and case study.

Creswell (1994) identifies two main research paradigms, qualitative and quantitative. In each paradigm, there are different methods for data collection and analysis. Punch (1998) also claims that social research can be found in two forms, qualitative and quantitative. Punch (1998) classifies research according to its purpose whether it is descriptive (concerned with *What* is the case) and explanatory (concerned with *Why* or *How* is the case). De Vaus (2001) argues that despite the fact that descriptive research might be seen as solely descriptive, and therefore has been given lower status than explanatory research (Punch 1998), it has contributed to the development of knowledge.

Sarantakos (2005) mentions various types of research according to their purpose (descriptive, explanatory and exploratory), according to their paradigm (hypotheses testing, hypotheses building) and according to the alternative design strategies for collecting and analysing data (e.g. action research).

The above discussion of the numerous types of business research reveals that research is diverse. This diversity denotes the fact that each type of research performs a task or achieves a goal. Thus, the author tends to apply qualitative and case study research, which most probably corresponds with what the author is trying to achieve in this research.

For simplicity, the author discusses the nature of the current research according to the categorisation shown in Table 5-1. The categorisation in Table 5-1 is based on Collis and Hussey's classification (Collis & Hussey 2003). However, the author does not intend to discuss all the research types as outlined by Collis and Hussey because not all of them apply to the current research. Therefore, the author just mentions these types of business research that mostly relate to the current research.

Table 5-1: Types of Research

Types of Research According to			
Process	**Logic**	**Purpose**	**Time**
Quantitative	Deductive	Exploratory	Cross-sectional
Qualitative	Inductive	Descriptive	Longitudinal
		Explanatory	

5.2.1. Research Approach (Methodology)

Silverman (2005) claims that research methodology is a general approach that entails identifying the case(s) to study and choosing the appropriate data collection and analysis methods. Collis and Hussey (2003:55) define research methodology as *"the overall approach in the research process, from the theoretical underpinnings to the collection and analysis of the data"*. Pole and Lampard (2002: 6) define research methodology as *"the way in which research is conducted and the way in which this relates to the knowledge that results from the research"*. In this research, the author uses the term "approach" to refer to the research methodology because most writers use the term approach instead of methodology (e.g. Bryman & Bell (2007), Creswell (1994)).

Bryman & Bell (2007) and Collis & Hussey (2003) postulate that there are quantitative and/or qualitative approaches for researchers to adopt in their research projects. Quantitative approach is objective in nature and focuses on statistically testing numerical data, whereas qualitative approach is subjective in nature and concentrates on understanding the phenomenon in question.

However, the distinction between quantitative and qualitative approaches is not only based on the nature of the data (i.e. numerical or non-numerical), but also involves deeper differences in their philosophical foundations and the paradigm employed (Bryman & Bell 2007, King, Keohane & Verba 1994). Thus, before discussing the paradigms used in both approaches and explaining the epistemological and ontological orientations that underpin each approach, the author discusses the quantitative and qualitative approaches and highlights their features.

5.2.1.1. Quantitative vs. Qualitative Approaches

Table 5-1 demonstrates that business research can be classified, based on the process researchers undertake, into quantitative or/and qualitative approaches (Collis & Hussey 2003). Creswell (1994) describes quantitative study as an inquiry into a social problem by *testing* theory empirically and analysing data statistically. On the other hand, qualitative study aims to understand the social phenomenon by *building* a comprehensive theory. Theory building in qualitative approach is based on the views of participants reported in words and conducted in the natural settings. Furthermore, King (1994) and Punch (1998) postulate that quantitative and qualitative approaches are different in the form of data used. Quantitative research tends to adopt numerical and statistical methods (i.e. numbers), whereas, qualitative research uses such methods that do not include numerical measurements (i.e. words).

Hussey (2003) and Ritchie and Lewis (2003) state that the use of either qualitative or quantitative research relies on the nature of the social phenomenon and the nature of research questions. Due to the wide array of data collection and analysis methods qualitative research provides, it has won popularity among researchers over time. Ragin (1994) differentiates between quantitative and qualitative researches as shown Table 5-2.

Table 5-2: Goals of Qualitative and Quantitative Strategies

Goals	Qualitative	Quantitative
Identify broad patterns		Primary
Test/refine theories	Secondary	Primary
Making prediction		Primary
Interpreting significance	Primary	
Exploring diversity	Secondary	Secondary
Giving voice	Primary	
Advancing new theories	Primary	Secondary

Source: (Ragin 1994)

5.2.1.2. Choosing the Qualitative Approach

One may argue that in both quantitative as well as qualitative studies, researchers tend to obtain the required data from a certain group of users, who are meant to be the intended users of a system or affected by the phenomenon in question so, what is the difference? The difference is that in quantitative studies, researchers aim to replicate what has been studied in other areas by constructing a theoretical framework and test it empirically in the intended field of study. The theoretical framework is a model that extracts a set of factors (variables) that mostly influence the phenomenon under consideration and propose hypotheses to be tested (Hussey & Hussey 1997). This model (deemed to represent reality) is tested statistically to either confirm or refute the assumptions that researchers already identified from the literature review.

On the other hand, qualitative researchers enter the field of study with an open mind as they try to understand the reality or the phenomenon by looking at it through people's lens. The author means by people those who are involved in and/or have experience with the phenomenon and subsequently, they are capable of identifying the most influencing factors. This may look like extracting the variables that affect the phenomenon, nevertheless, the extraction of variables in qualitative research stems from the phenomenon itself and the people who are concerned rather than the literature review or researchers' own preferences/ideas.

In the current research, the author adopts qualitative approach in order to interview end users or those who represent them and understand what influences their attitudes toward the use of LORENZO. The author's intention to employ qualitative research is based on his belief that the NHS end users' acceptance of IT may be affected by factors other than those which can be found in other contexts. For instance, the model of factors affecting end users' intention to use technology in the private sector may be different from that in the public sector. Even in the same sector, one may find that different public-sector organisations might face different levels of IT acceptance and a wide array of variables that cause resistance. Based on what has been discussed, it would be useful to go to the field and talk to the people who actually use LORENZO in the NHS. The interaction with the intended users enables the author to gain better understanding of the factors and other issues related to LORENZO's implementation.

The author believes that deciding which approach to be used should not be based on the researcher's preference. Instead, one should be aware of the potential benefits and disadvantages of each approach. Therefore, to attain enough understanding of each approach and to be able to identify which approach suits the current research, an investigation of the philosophical foundation of each approach is profoundly essential.

5.2.1.3. Research Paradigm: Positivism vs. Interpretivism

Despite the distinction between research paradigm and research approach, they have been used interchangeably by most researchers. For instance, Creswell (1994) uses quantitative and qualitative paradigm to denote the Positivism and Interpretivism paradigm respectively. Thus, One may look at research approach (qualitative or quantitative) and paradigm (positivism or Interpretivism), which is also called research philosophy (Collis & Hussey 2003), as two sides of the same coin. A positivistic paradigm coincides with a quantitative approach whereas; an interpretivistic paradigm coincides with a qualitative approach.

A paradigm is *"A cluster of beliefs and dictates which for scientists in a particular discipline influence what should be studied, how research should be done and how results should be interpreted"* (Bryman & Bell 2007: 25). Silverman (2005) looks at paradigm as general framework for looking at reality.

Sarantakos (2005) argues that there are two agreed upon paradigms that have guided business research, the empiricist (objectivism) and humanistic (subjectivism). In addition, Saunders et al (1997) discuss two paradigms that researchers can adopt to approach their research; the positivistic (quantitative) approach, which is equivalent to the scientific approach adopted in natural sciences and the phenomenological (qualitative) approach.

According to Saunders et al (1997), the phenomenological approach enables researchers to understand *how* and *why* it is happening by studying the context in which the social phenomenon is taking place. Moreover, the phenomenological approach entails gathering qualitative data from relatively smaller sample size if compared with that in positivistic approach. In addition, Saunders et al (1997) mention that in the positivistic approach, researchers tend to adopt a deductive approach, focus on causal relationships, collect quantitative data from a large sample, and use a highly structured methodology to enable them to replicate their findings.

It is essential to mention that the above paradigms have been given different terms (labels) by researchers. For instance, Bryman & Bell (2007), Corbetta (2003), Ritchie

& Lewis (2003), and Saunders et al (1997) state that the phenomenological paradigm is analogous to the interpretivistic approach. Table 5-3 demonstrates various terms for both positivistic and Interpretivistic paradigms.

Table 5-3: Alternative Terms for Research Paradigms

Alternative terms for	
Positivistic paradigm	**Interpretivistic paradigm**
Quantitative	Qualitative
Objective	Subjective
Scientific	Humanistic
Experimental	Phenomenological
Traditional	postpositivist
Empiricist	postmodern

Source: (Collis & Hussey 2003, Creswell 1994)

Based on the distinction between the two paradigms, the author employs **Interpretivism** as the main paradigm of the current research. The nature of the research questions that have been identified previously in section 1.4 of the Introduction chapter (Research Questions) necessitates and suits the adoption of an Interpretivistic paradigm. Interpretivism allows the author to identify *what* are the factors that influence significantly end users' acceptance of LORENZO and to *understand how* LORENZO's development methodology affects users' attitude toward the use of LORENZO. Answering why and how questions are better tackled by collecting rich data and studying the context (the NHS in general and the NME region in specific), in which LORENZO implementation takes place.

5.2.1.4. Ontological Foundation of Research Paradigm

Ontology is "*concerned with the nature of social world and what can we know about it*" (Ritchie & Lewis 2003:16) or "*What is assumed to exist*" (Mingers 2001: 242). Ontological orientation of the research paradigm is related to the nature of reality

(Creswell 1994), its basic elements (Silverman 2005), its essence (Sarantakos 2005) and how it can be constructed (Ritchie & Lewis 2003).

In management, researchers can rely on two ontological views; the first view states that the social phenomenon is *real* and *objective*. This means that the social phenomenon in question stands outside the human mind and is not influenced by its interpretation (Sarantakos 2005). Authors such as Creswell (1994) and Saunders et al (1997) state that positivistic paradigm is based on the notion that researcher are independent of what is being observed. Ritchie and Lewis (2003) argue that the positivistic paradigm follows **Realism**; realism means that external reality exists independently of people's beliefs or understanding about it. Bryman and Bell (2007) claim that the ontological orientation of the quantitative (positivistic) paradigm is **Objectivism**. Objectivism is similar to realism that assumes social phenomena and their meanings have an independent existence separate from the actors.

The second ontological view is that reality can not be constructed without the interaction of the researcher(s) involved (Creswell 1994). Collis and Hussey (2003) postulate that reality in qualitative (interpretivistic) paradigm is understood as *subjective* and *multiple*. Ritchie and Lewis (2003) argue that interpretivistic paradigm follows **Idealism**; idealism emphasises the fact that reality is knowable only through the human mind and socially constructed meanings.

In addition, Bryman & Bell (2007) postulate that **Constructivism** is the ontological orientation of the qualitative paradigm. Constructivism is similar to idealism and based on the premise that reality is a result of social construction and interaction between the phenomenon under consideration and the researcher. Moreover, constructivism does not consider reality as constant, instead, it is continuously revised.

From what has been discussed regarding the ontological views, the author adopts constructivism as the ontological basis of the current study. Considering reality as subjective and multiple is beneficial because it allows the author to be an active actor. This means that understanding how LORENZO's development methodology influences users' inclination to use it and what causes resistance enables the author to interact with the intended users or those who represent them and interpret their ideas and views.

The author thinks that the subjectivity of qualitative research is not necessarily a weakness; on the contrary, it provides flexibility to look at and interpret people's views in order to attain richer understanding. However, the author thinks that subjectivity may affect adversely the outcome of the research if researchers become wedded to certain views. The author discusses the criticism of qualitative research (the weaknesses) and presents the procedures that he has adopted to overcome them.

5.2.1.5. Epistemological Foundation of Research Paradigm

There are many definitions of epistemology; for instance, Ritchie & Lewis (2003: 13) define it as "*Ways of knowing and learning about the social world and focuses on questions such as How can we know about reality and what is the basis of our knowledge*", "*The nature of valid knowledge*" (Mingers 2001: 242), "*what is the nature of knowledge*" (Silverman 2005: 98) or "*what should be regarded as acceptable knowledge in a discipline*" (Bryman & Bell 2007: 16).

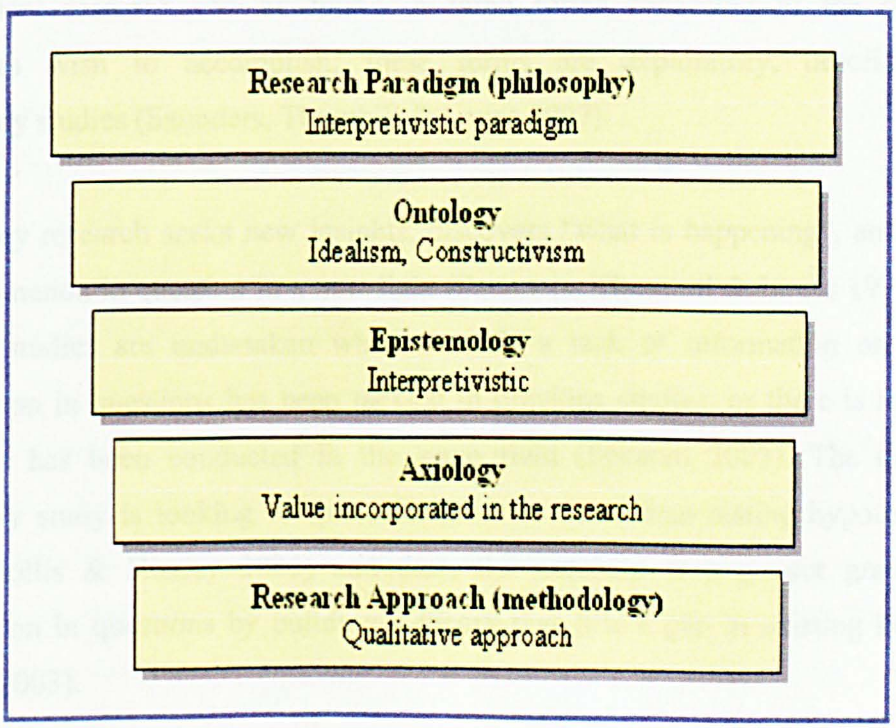
Sarantakos (2005) states that the epistemological orientation is largely based on the ontological foundation and concerned mainly with the relationship between *who* (the researcher) and *what* (the phenomenon being studied). Researchers who adopt the quantitative paradigm try to keep distance and be independent of what is being researched. This implies that researchers would use non-biased methodological techniques to be as objective as possible. Conversely, researchers who adopt the qualitative paradigm interact and construct realities through their beliefs and understanding. The interaction between the researcher and the phenomenon enables him/her to collect the data needed for building the knowledge (Creswell 1994).

Ritchie and Lewis (2003) and Bryman and Bell (2007) state that there are two epistemological views in business studies, **Positivism** grounded in the quantitative paradigm and **Interpretivism**, which governs the qualitative paradigm. The demarcation of the two epistemologies is based on the question that whether methods of the natural sciences are applicable for studying the social phenomenon or not. The positivistic paradigm assumes that social phenomena are controlled by regulatory procedures that have a law-like nature. In the Interpretivistic paradigm, researchers have to explore and understand the social phenomenon through its participants and their perceptions. Thus, both the researcher and the social phenomenon being studied influence each other.

In this research, the author adopts **interpretivism**. It is the author's belief that social phenomena in general lack the laws that exist in natural sciences and therefore, studying human behaviour in particular should not be conducted in the same way as studies conducted in natural science disciplines. Thus, asking participants from within the NHS is useful as they reflect and reveal what is actually going on inside, rather than understanding end users' acceptance based on external views such as examining the effect of the variables extracted from a certain theoretical framework tested in previous studies.

Despite the subjectivity associated with this research, the author thinks that looking at IT acceptance/usage as an "object" or "thing" is not useful and does not help him to understand what issues that are related to the implementation of LORENZO. Therefore, the author's role in the current research is not seen as just an outside observer, instead the author plays an important role in examining and interpreting the various views that participants hold about the implementation of LORENZO. Figure 5-1 summarises the philosophical ground of the current research.

Figure 5-1: The Philosophical Foundation of the Research



5.2.2. Deductive vs. Inductive Research

Collis & Hussey (2003) state that research can be classified based on whether the researcher moves from the general to the specific or the opposite. A deductive study is one in which the researcher develops a theoretical structure and then tests it empirically. The aim of testing the theoretical structure is deducing particular instances from the general inferences (Collis & Hussey 2003).

In inductive studies, the reverse occurs where a theory is generated from observations (moving from the specific to the general) (Bryman & Bell 2007). Sekaran (2003) argues that in inductive studies, researchers try to reach a conclusion or general proposition from observing facts. Facts might be patterns or behaviours that explain or explore the phenomenon in question.

The current study is an inductive research; the author starts with the data, which is obtained from the participants (empirical observations). Then, the author interprets participants' views to reach patterns or more generalisable inferences. In summary, the current research is conducted inductively with the purpose of generating a theory that is grounded in data (Darlington & Scott 2002).

5.2.3. Exploratory, Descriptive and Explanatory Studies

Management research can be found in three forms according to the purpose(s) researchers wish to accomplish; these forms are exploratory, descriptive and explanatory studies (Saunders, Thornhill & Lewis 1997).

Exploratory research seeks new insights, discovers "what is happening", and assesses the phenomenon in question in a new light (Saunders, Thornhill & Lewis 1997). These kinds of studies are undertaken when there is a lack of information on how the phenomenon in questions has been tackled in previous studies, or there is hardly any study that has been conducted in the same field (Sekaran 2003). The aim of an exploratory study is looking for patterns or ideas rather than testing hypotheses in a theory (Collis & Hussey 2003) and thus, the outcome is a greater grasp of the phenomenon in questions by building a theory that fills a gap in existing knowledge (Sekaran 2003).

The current research is an **exploratory** study in the first place as there is not enough knowledge available about how end users' requirements were taken into account in the definition and implementation of LORENZO. Without flexibility in the adopted data collection method (semi-structured interviews) and data analysis technique (Grounded theory method), the author could not have revealed the linkage between the IS development methodology and the individual IT acceptance.

Saunders et al (1997) stressed the notion that researchers may wish to accomplish more than one purpose in their research projects. The current research is a multipurpose study that is not only exploratory, but also covers descriptive and explanatory purposes as well. To understand these two types of research purpose, the author explains them and identifies the research questions that represent these purposes.

A descriptive study aims *"to portray an accurate profile of persons, events or situations"* (Saunders, Thornhill & Lewis 1997: 79). The aim of descriptive studies is enabling researchers to identify and describe the characteristics of a group of people, an organisation that performs certain practices, or the variables that represents a specific phenomenon (Sekaran 2003). Additionally, Collis & Hussey (2003) emphasise the point that the descriptive nature of business research answers basically the *what* questions.

The author perceives the current research, to some extent, as descriptive in nature. The descriptive nature of the current research offers the opportunity to answer some of the research questions that have been outlined in section 1.4 of the introduction chapter (Research Questions). These questions are related to identifying the main features that LORENZO should be characterised by to create a positive attitude toward its use. In addition, the descriptive nature is represented in determining the external factors that influence significantly end users' behaviour toward the use of LORENZO.

On the other hand, explanatory research does not only describe the characteristics of the phenomenon under consideration, but also explains things by asking questions such as *how* and *why* a certain practice is happening (Collis & Hussey 2003). Again, this research is, in part, an explanatory study as it tries not only to see if there is a correlation between the development methodology of LORENZO and end users' acceptance, but also to explain how the influence of the development methodology takes place.

5.2.4. Cross-sectional vs. Longitudinal Studies

Research in the management field can be classified according to the time horizon, in which a research study takes place (Sekaran 2003). Research can be seen as a "snapshot" of the phenomenon under consideration (i.e. cross-sectional) or can be considered as a "diary" that encompasses the change in many aspects or variables that represent the phenomenon in question over a period of time (i.e. longitudinal) (Saunders, Thornhill & Lewis 1997).

A cross-sectional study or so-called one-shot study (Sekaran 2003) is the one, in which information is collected just once or at a single point in time (Bryman & Bell 2007, Collis & Hussey 2003). Although data is gathered only once, it might take days, weeks or even months to finish collecting the required data (Sekaran 2003). In addition, Saunders et al (1997) state that cross-sectional research projects are used if researchers have limited time or resources. The second type of business research is longitudinal where the researcher aims to collect the data about a certain phenomenon over a period of time or at more than one point in time (Sekaran 2003).

The author intends to use a **cross-sectional** design. Due to the fact that the author is constrained with time as he has a time limit, during which he should finish his PhD, it is sensible to adopt the cross-sectional design. In addition, because the author does not have enough resources, it becomes more feasible to adopt the cross-sectional design in this research. Adopting a cross-sectional study implies that the process of data collection occurs just once. It took the author a year in order to interview the participants, and obtain the required data as one can see in section 6.4 of the Case Study Design chapter (Interviews Conducted).

5.3. DISADVANTAGES OF QUALITATIVE RESEARCH

There are positive features that qualitative research offers to researchers, for instance it allows researchers to gather rich (in-depth) data about the phenomenon of interest. In addition, qualitative research enables researchers to understand or see the phenomenon in question through the eyes of the people being studied (Bryman & Bell 2007). As a result of these advantages, the findings of the qualitative research, which are usually represented as theoretical hypotheses, are more derived from the context, in which the phenomenon exists (Bryman & Bell 2007).

In spite of the numerous advantages that qualitative research offers, it has not been excluded from criticism. In this section, the author sheds light on the main features, aspects and processes of qualitative research that has resulted in its critique.

5.3.1. Subjectivity of Qualitative Research

The author has discussed the notion that qualitative research looks at reality as something subjective; this requires the researcher to interact with the participants and interfere in interpreting the multiple perspectives. Because researchers should interact with the people being studied, they ground the interpretations on their own values and beliefs. This situation becomes problematic as reality is highly subjective and thus, people doubt the credibility of qualitative research practices.

Bryman & Bell (2007) state that the subjectivity of the qualitative research stems from the fact that generally speaking, researchers do not have a structurally predetermined research focus and therefore, research may take different direction, which might be totally different from what is supposed to be according to the data collected during the research process. This situation reveals that the findings are not based on explicit research questions or gap(s).

The author agrees with the notion that subjectivity is highly associated with qualitative research however, interviewing knowledgeable and expert people and discussing with them various aspects of LORENZO implementation enables the author to obtain more insights and puts him in a position to explore the "real" context, within which LORENZO is implemented.

5.3.2. Lack of Credibility

Qualitative research's aim is attaining data about the phenomenon under study by relying on research practices, which lack quantification (non-statistical) (Johnson et al. 2006). Due to the lack of quantification, the credibility of qualitative research might not be legitimate to positivists who use highly structured and statistical tools for data collection and analysis (Cassell et al. 2006).

However, the author thinks that if this research were a survey that is conducted quantitatively by distributing a questionnaire to a large sample, the researcher would not be able to find out the source of the data, whether the right people completed the data collection tool or not. In addition, Starbuck (2010) argues that researchers can acquire more information by investigating carefully and deeply some selected instances instead of relying on surveys. Starbuck's point is that people may hide a lot of information behind "facades", which are misleading in nature. Thus, one concludes that what can be attained from surveys in terms of data is sometimes superficial and does not provide researchers with sharp understanding of what is going on in reality.

In sum, the abundance and richness of data gathered in qualitative research can not be found in any other type of research and consequently, the author finds it useful to rely on qualitative methods to gain greater understanding of many issues associated with the implementation of LORENZO.

5.3.3. Lack of Transparency

Bryman & Bell (2007) claim that qualitative research does not show clearly what researchers have done during the research process. For instance, readers may find it hard to know how people were selected for interviews (the sampling technique) and how the data gathered was analysed. Consequently, there would be an ambiguity in finding out how the conclusions of the research were arrived at.

It is the author's belief that although there is a lack of transparency in qualitative methods, researchers can work to overcome the sources of ambiguity. For instance, the author assigned a separate chapter (see chapter seven) that explains thoroughly the nature and components of the qualitative data analysis tool used (i.e. grounded theory techniques and principles, and the various types of coding). Moreover, the author discussed the different stages that he has adopted in this research in order to analyse the collected data starting from transcribing the interview recording through to the categorisation of concepts (see chapter seven).

Furthermore, the author discusses in the next chapter (see chapter six) the various sampling techniques used in qualitative research and which one of these techniques has been used to select the participants. The author justifies the use of theoretical (snowball) sampling in the current research. The author stresses the point that qualitative researchers usually try to meet those who have something important to tell and on which the generated theory is based. Thus, the nature of qualitative research requires non-probabilistic sampling techniques, which are usually less structured and explicitly predetermined if compared to the sampling techniques in quantitative research.

In sum, the author thinks that as long as researchers give a sensible justification for using certain tools for data collection and analysis, document all the stages of the research process and reach findings, which clarify many aspects and enhance researchers' understanding of the phenomenon of interest, then transparency of qualitative research can be improved.

5.3.4. Lack of Generalisation

Generalisation is sometimes called "transferability" or "external validity", which is the possibility of applying the qualitative research findings beyond to other contexts (Ritchie & Lewis 2003). Bryman & Bell (2007) argue that when unstructured interviews are used as the main data collection tool with a small number of cases (participants), it becomes difficult to generalise the findings to other contexts. Ritchie and Lewis (2003: 263) define generalisation as *"whether the findings from a study based on a sample can be said to be of relevance beyond the sample and context of the research itself"*. In addition, Ritchie and Lewis (2003) differentiate between three main types of generalization; these are:

1. **Representational generalisation** means whether qualitative research findings can be generalised to the parent population from which the sample was drawn or not.

The author stresses the fact that the population refers to the end users in the NME region who are in direct contact with LORENZO. The sample that is drawn from this population represented in the six interviews, which have been conducted with expert and administrative people who have working experience with the NHS and consequently can represent the end users. However, in this research, the selection of the participants is not based on probability or statistical procedures and therefore, it would be difficult to argue that the sample is representative.

One may claim that because the sample is not representative, it becomes difficult to support representational generalisation. However, the author argues that all of the interviews were conducted with people, whose positions require them to travel to the users of LORENZO at their local NHS organisations in the NME region, to conduct workshops and training sessions about the benefits and potential uses of the various units of LORENZO, and to get end users' feedback and suggestions. These roles enable the interviewees to reflect the "real" end users' perceptions about the various aspects of LORENZO's implementation as they tell the story from within the NHS and accordingly, the findings of the current research might be generalisable to the parent population.

Thus, the sample may not be representative from a statistical point of view but in reality, the six interviews have provided valuable information and insights regarding the implementation of LORENZO in the NHS. In addition, because the interviews were conducted with various stakeholders of LORENZO, the sample was representative in terms of the multi-perspective thoughts generated from the analysis of the interviews rather than a standalone perspective.

2. **Inferential generalisation** is the generalisation of the research findings to other settings or contexts. According to this definition, inferential generalisation refers to the extent to which the present research's findings are generalizable to other working environments other than the NHS.

The author has discussed whether the current research's findings offer a good possibility of developing theoretical inferences, which are grounded in the data itself. In addition, the author has mentioned the notion that the data itself is obtained from expert people who represent multiple views. Based on these facts, the author thinks that this research comes with a holistic view of the possible variables (the LSP and the NHS views), which influence end users' acceptance and explores the potential for a relationship between LORENZO's development methodology and clinicians' attitudes toward its use. This means that it is most probable that the findings of this research will be useful to systems developers and decision makers in other organisations or other contexts who can take these findings and apply them to enhance their intended users' acceptance.

3. **Theoretical generalisation:** Ritchie and Lewis (2003: 264) define this type of generalisation as *"draws theoretical propositions, principles or statements from the findings of a study for more general application"*. The definition of theoretical generalisation coincides with Bryman and Bell's statement (2007) that the findings of the research should generalise to the theory rather than the population. This implies that it is more useful to extend the extant theory by creating new relationships between the variables or adding more concepts than just generalising the findings themselves to other settings as these findings might be seen as context-specific. Extending the theory and enhancing its explanatory power makes it generalisable to more contexts.

5.4. ASSESSING QUALITATIVE RESEARCH QUALITY

Despite the fact that quantitative research has robust criteria for judging its rigor that are represented in validity and reliability, it is difficult to adopt these criteria in qualitative research. The difficulty of using validity and reliability measures stems from the fact that the epistemological and ontological assumptions of qualitative research are totally different from those in quantitative research (Shah & Corley 2006, Mays & Pope 2000).

Achieving high quality qualitative research has become an increased interest in the management field in general (Shah & Corley 2006) and health studies in particular (Mays & Pope 2000). Consequently, various measures have been used to judge the quality of qualitative research; for instance, Guba and Lincoln (1994), Lincoln and Guba (1985) and Locke's (2001) way of judging grounded theory research. However, a major concern that faces qualitative researchers is the lack of clear or/and inappropriate assessment criteria for quality (Cassell et al. 2006) and thus, the process of evaluating qualitative research's quality becomes more problematic (Johnson et al. 2006).

In this section, the author discusses Lincoln and Guba's criteria for assessing the quality of qualitative inquiry. Lincoln & Guba (1985) state that trustworthiness is the measure of the rigor of qualitative research. Trustworthiness is composed of four criteria: dependability, credibility, transferability and confirmability. Each criterion of trustworthiness encompasses actions that help researchers to enhance the quality of their researches.

The author adopts Lincoln and Guba's measure of quality for two reasons; firstly, the author has noticed from the available references he has accessed that this measure has been used intensively in qualitative research journal articles and textbooks. Secondly, although there are alternative measures that have won acceptance among qualitative researchers such as Lock approach of evaluating grounded theory research (2001), Lincoln and Guba's measure applies to all types of qualitative research rather than focusing on a specific form of qualitative research.

5.4.1. Reliability of Qualitative Research (Dependability)

Dependability is parallel to reliability (Lincoln & Guba 1985), which can be either internal or external (Bryman & Bell 2007). When two or more members of the research team observe or hear the same thing, it is said that internal reliability is met (Bryman & Bell 2007). Because the author is the sole principal investigator in this research, it becomes difficult to state that internal reliability is achieved.

On the other hand, external reliability refers to the replicability of the research findings (Bryman & Bell 2007). Ritchie and Lewis (2003: 270) define reliability in qualitative research as *"whether or not the findings would be repeated if another study, using the same or similar methods, was undertaken"*.

Lincoln & Guba (1985) state that dependability criterion is met by adopting an auditing approach, which means that a full record of all the research stages are kept and shown to the readers. This idea is parallel to reflexivity where researchers tend to reveal as much as they possibility can of what they did in their researches (Ritchie & Lewis 2003). In this research, the author has adopted an audit of the data collection and analysis processes and has explained the sampling technique used. In addition, the author kept an original record of the interview transcripts and all the material used to analyse the data.

However, to protect participants' confidentiality, their names and titles were omitted from the final report of this research.

In sum, designing a systematic and robust plan that clarifies all aspect of the research process is important because it leads to a reliable research (Kuper, Lingard & Levinson 2008). The author made it clear from the beginning of this research what is expected to be achieved and how it is intended to be achieved. For instance, the author provides a considerable account about the formulation of the research problem, selection of participants, identification of data collection method, and explanation of data analysis procedures.

5.4.2. Internal Validity of Qualitative Research (Credibility)

Validity of findings in qualitative research refers to *"the correctness or precision of a research reading"* (Ritchie & Lewis 2003: 273) or *"the accuracy and truthfulness of the findings"* (Denzin & Lincoln 1998: 287).

Bryman & Bell (2007) describe internal validity as the match between the researcher's observations and the theoretical concepts they develop. This description denotes the fact that in qualitative research, internal validity is supported when researchers enrich their understanding of the phenomenon in question. Because qualitative researchers view reality (i.e. the phenomenon under study) as something subjective, it entails interacting with the participants and interpreting their meanings in order to understand the phenomenon in its real settings. Thus, researchers become more able, possibly, to reflect participants' views regarding various patterns, actions or processes, which explain the phenomenon accurately in a form of generated theoretical concepts.

It took the author a year to collect the data and saturate the concepts generated. During this year, he interviewed expert, and sometimes leading, people in health information systems adoption. In addition, spending enormous time in analysing the interviews and going back and forth in the data collection and analysis has enhanced the author's theoretical sensitivity of LORENZO's implementation in the NHS. This learning experience has made the author more capable of representing the participants' thoughts or views in concepts and categories.

Although the author has discussed previously that qualitative research lacks credibility (see 5.3.2), Lincoln & Guba (1985) propose some actions that may improve qualitative research's credibility. However, the author discusses just the actions that have been used in this research.

1. **Member checks**: this technique is sometimes called respondent/member validation (Bryman & Bell 2007) or respondent checking (Mays & Pope 2000). Respondent validation implies that researchers provide an account of the findings they have arrived at in order to get confirmation from the participants. Bryman & Bell (2007) state that respondent validation is essential as it enables researchers to achieve "good correspondence" between the findings and the participants' views and experiences.

The author agrees with the notion that adopting respondent validation assures that the findings are grounded in the data and the participants' perspectives. Accordingly, the author sent a copy of the interview transcripts to the corresponding participants to confirm the accuracy of the transcription and the ideas included. In addition, the author has provided some participants an account of the analysis conducted, bearing in mind the confidentiality of respondents, in order to get their corroboration.

2. **Triangulation:** involves the use of more than one data collection method or source of data (Bryman & Bell 2007). The aim of triangulation is to get more comprehensive interpretation of data, which is generated from different methods or sources (Mays & Pope 2000).

Patton (2002) states that the aim of triangulation is to check the consistency of data. In addition, he classified triangulation into four distinct types; methods triangulation, which refer to the use of multiple data collection methods (comparing the consistency of the data attained from qualitative and quantitative data collection methods), analysts/observers triangulation, which means relying on more than one analyst to review findings, theory/perspective triangulation, which means that the researcher uses more than one theory or perspective to analyse the data and finally, triangulation of sources.

In this study, the author uses the theory/perspective (Patton 2002) or data sources triangulation (Mays & Pope 2000). This type of triangulation is represented in the data the author has attained from various stakeholders such as the supply side (CSC) and the demand side (early adopters, local NHS organisations).

5.4.3. External Validity of Qualitative Research (Transferability)

The author believes that improving the credibility of the research enhances the possibility of generalising the research findings to the parent population or to other contexts or settings. However, one should be alert to the fact that qualitative research suffers from the lack of generalisation, although it entails studying the phenomenon in question in depth to provide thick description (Bryman & Bell 2007). Lincoln & Guba (1985) propose that qualitative researchers provide a detailed thick description of what is being studied by explaining thoroughly the concepts and categories emerging from the analysis. In this manner, the author analyses the data collected according to a systematic stage-based approach, which has led to the concepts. In addition, the author justifies the relationships between the numerous concepts and demonstrates the various categories and the resulting patterns schematically to make it convenient and simple for the reader to understand.

5.4.4. Objectivity of Qualitative Research (Confirmability)

Seale (1999) states that auditing is a useful action that researchers can adopt to establish/enhance their researches' objectivity. Auditing requires the researcher to document the procedures that were taken to collect and analyse the data.

In conclusion, qualitative researchers may encounter a challenge to establishing the validity and reliability of their findings. However, careful design and clear implementation of various research stages can boost the quality of qualitative research. the author believes that qualitative research remains an irreplaceable source of new theories or ideas. The new insights brought by qualitative research methods open new horizons for researchers to test empirically the new findings and develop the extant knowledge. Therefore, the author views qualitative and quantitative research as standing side by side, rather than opposing each other, to explore, describe and explain different aspects or/and trends in the social world.

5.5. CONCLUSION

This chapter gives the reader an overview of the nature of the current study and its philosophical stance. In the first place, the author adopted the qualitative approach to focus on the implementation of LORENZO in the NHS through the well known TAM. This in itself is an unusual case in the IS literature as the TAM was researched quantitatively in most studies. The author's decision to adopt the qualitative approach was based on the fact that the implementation of LORENZO in the NHS represents socio-technical phenomenon and thus, acquiring rich data and thick description is pivotal to enable the author to obtain a greater grasp of the implementation of LORENZO in its natural (i.e. real) settings.

Additionally, the author presented the philosophical underpinning of the current research represented in the ontological and epistemological foundations. Constructivism was the ontological stance of the current study where reality is seen as social construction. This justifies the author's direct interaction with the participants to obtain their views and ideas about the phenomenon in question. Regarding the epistemological stance, the author followed the interpretivistic approach. Moreover, the current study is an inductive, exploratory and cross-sectional in nature.

Furthermore, the disadvantages of qualitative research were presented in this chapter. Qualitative research is subjective, lacks credibility, transparency, and generalisability. However, the author presented Lincoln and Guba's criteria for assessing the rigor of the qualitative research. Although there was no claim of replicability in this study, the author adopted an auditing approach to enhance the reliability of the current study. The author adopted member checking/validation and triangulation of perspectives to improve the internal validity of the present study. Regarding the confirmability of the current study (objectivity), the author followed a systematic design and implementation of the current study's various stages.

Chapter Six

6. CASE STUDY DESIGN

6.1. INTRODUCTION

In this chapter, the author discusses the current study's design strategy by focusing on the selected data collection method, identifying its pros and cons, explaining the sampling design and the criteria applied for selecting the participants. Additionally, the author focuses on the scope of the research, and clarifies the unit of analysis. Even though the data analysis technique is considered as a major component of any research design, the author explains it thoroughly in chapter seven.

6.2. RESEARCH DESIGN

Bryman & Bell (2007: 40) describe research design as *"the framework for the collection and analysis of data"*. Research design is also defined as "*A plan or strategy aimed at enabling answers to be obtained to research questions*" (Burns 2000: 145).

The two definitions imply that the design of a piece of research entails making decisions regarding the collection and analysis of data. In addition, the second definition presumes that *research design* can be alternatively called *research strategy.* However, research design is not merely about collecting and analysing data and it is different from research strategy. To understand how research design is distinct from research strategy and what the main decisions concerning any research strategy are, the author relies on Punch's explanation (Punch 1998).

Punch (1998) states that research design refers to all the issues that relate to planning and implementation of a research project. This means that research design is the umbrella, under which the entire research process is undertaken. Moreover, Punch (1998) outlines four main elements of the research design; these are:

1. **Research strategy**: the cornerstone of the design of any study is its strategy, which is described as a general plan, by which researchers intend to have answers to their research questions. There is a wide array of research strategies used in qualitative and quantitative research. The author focuses mainly on one of the qualitative strategies that is case study design strategy. Case study strategy receives the most attention and discussion as it suits the nature and research questions of the present study.

From what has been discussed, research design is more general (broader) than research strategy. One point to bear in mind is that the author uses the term "design strategy" to refer to the research strategy used in this research, which is the case study strategy.

2. **Framework**: research framework refers to the conceptual (theoretical) framework, which represents graphically or in a narrative form the concepts (variables) to be studied and the potential relationships between them (Punch 1998). Because the current study is qualitative in nature, the conceptual framework emerges after the collection and analysis of the data.

3. **Sampling**: sampling gives an answer to what or who will be studied.

4. **Data collection and analysis**: a research design encompasses information about tools and procedures used to collect and analyse the data.

One can see from the components of research design, that data collection and analysis tools are not the entire design, instead, they are considered as tactics within the research strategy (Saunders, Thornhill & Lewis 1997). Figure 6-1 shows that obtaining answers to the current research questions needs careful decisions to be made regarding the three main design's component.

Figure 6-1: The Role of Research Design

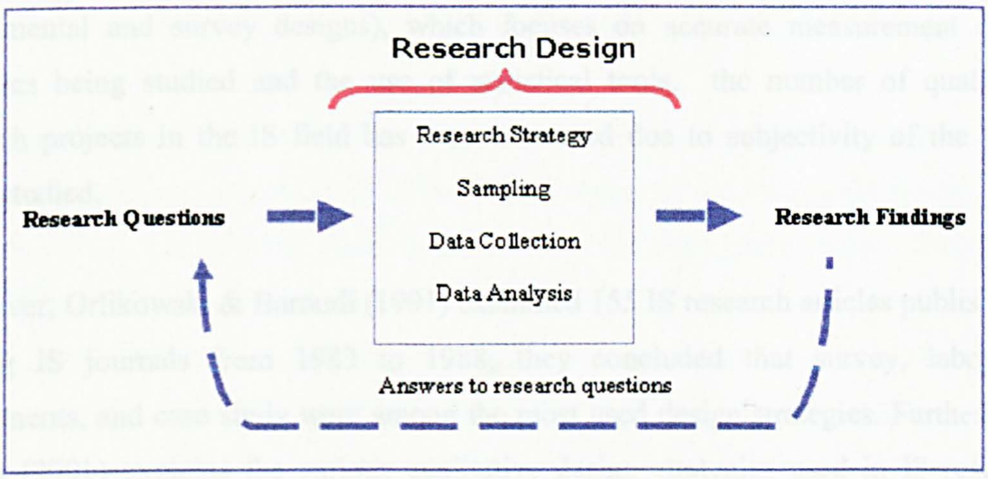


Figure 6-1 represents Hartley's definition of research design, which is *"the argument for the logical steps which will be taken to link the research question(s) and issues to data collection, analysis and interpretation in a coherent way"* (Hartley 2004: 326). In addition, Yin (2009) states that looking at the research design as a linkage between research questions and data collection and analysis tools and procedures, implies that the aims and questions must be clearly and explicitly defined at the outset of the research, in order that data collection and analysis tools are appropriately selected.

6.2.1. Design Strategy

There are various types of qualitative design strategies that researchers can adopt to attain answers to their research questions. For instance, Sekaran (2003) highlights two main designs for qualitative research; case study and action research, Punch (1998) discusses three types of qualitative design strategies; case study, ethnography and grounded theory. In addition, Bryman & Bell (2007) state that there are five design strategies that can be used in qualitative and quantitative inquiries; these are experiment, cross-sectional, longitudinal, comparative and case study design.

In the IS field, authors have proposed different taxonomies of qualitative design strategies. For example, Galliers & Land (1987) provide a range of quantitative and qualitative design strategies; these are laboratory experiments, field experiments, case study, survey, forecasting, simulation and action research. In addition, Galliers & Land (1987) state that even though IS researchers tend to use traditional designs (e.g. experimental and survey designs), which focuses on accurate measurement of the variables being studied and the use of statistical tools, the number of qualitative research projects in the IS field has been increased due to subjectivity of the topics being studied.

Moreover, Orlikowski & Baroudi (1991) examined 155 IS research articles published in leading IS journals from 1983 to 1988; they concluded that survey, laboratory experiments, and case study were among the most used design strategies. Furthermore, Trauth (2001) explains the various qualitative design strategies used in IS research. These strategies are participant observation, ethnography, action research, grounded theory, critical research, and multi-method design strategy.

6.2.2. Case-Study: The Selected Design Strategy

Due to the wide assortment of qualitative design strategies used in the IS research, the author reviews and evaluates relevant strategies to judge whether they suit the purposes and nature of the present research. Evaluating the available design strategies is important as each one of them has its own advantages and disadvantages and thus, one can not have one strategy that matches all research purposes (Benbasat, Goldstein & Mead 1987).

The author adopts the qualitative approach as it allows him to study and understand the implementation of LORENZO by investigating the perspectives and behaviours of the people involved and the context, in which LORENZO operates (Kaplan & Maxwell 2005). This means that collecting data from the natural or real settings is not possible with traditional design strategies such as laboratory and field experiments, as the author is more concerned with collecting rich data to gain greater understanding, more than quantification, and developing accurate measurement of the variables, this excludes the use of forecasting designs.

In addition, participant observation and ethnographic research requires the author to be immersed in and interact directly with the people, whose perspectives and insights are important to better understand the implementation of LORENZO (Bryman & Bell 2007). The author decided to discard these two strategies because of the difficulty of interacting directly with the people in the NHS and the limited time available to conduct the current research.

Although survey design allows researchers to collect empirical data about many aspects of the phenomenon under study (breadth of data) to achieve a high degree of generalisability, and accurate quantification of the variables being studied (Bryman & Bell 2007), surveys can not provide deep and rich data that is needed to establish a thick description of what is being researched. Besides, because the author found it hard to get an approval from the NHS to distribute questionnaires, he abandoned survey research.

In action research, the researcher and the client work together in diagnosing a problem and trying to solve it (Bryman & Bell 2007). Because the author has already identified the research gap and set the questions, action research is not a proper design strategy to adopt. In addition, the author does not have medical experience that enables him to collaborate with the people in the NHS to determine potential problems facing the implementation of LORENZO. Furthermore, the author could not use quantitative design in parallel with qualitative strategy (multi-method strategy) since it is time consuming and attaining approval to conduct quantitative (survey) design in the NHS local organisations is difficult. After reviewing the available design strategies, the author selected case study as the design strategy of the current research.

6.2.2.1. What is Case-Study

Hartley (2004) provides a description of case study design used in organisational research. Hartley (2004: 323) states that case study research

> *"Consists of a detailed investigation, often with data collected over a period of time, of phenomena, within their context. The aim is to provide an analysis of the context and processes which illuminate the theoretical issues being studied. The phenomenon is not isolated from its context (as in, say, laboratory research) but is of interest precisely because the aim is to understand how behaviour and/or processes are influenced by, and influence context"*

Yin (2009: 18) defines case study as *"an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident"*. Moreover, Yin (2003: 9) states that case study offers a distinct advantage when *"how" or "why" questions are being asked about a contemporary set of events over which the investigator has little or no control"*. Based on the definition of case study, the focus of case study design strategy is on the case in question to explore its unique features (Bryman & Bell 2007) and retain detailed and holistic understanding of the complexity surrounding it (Gerring 2007).

Bryman & Bell (2007) and Collis & Hussey (2003) state that case study design is used when researchers intend to obtain an intensive analysis of a case, which can be a person, a location, an organisation or an event (Punch 1998). Sometimes, researchers may wish to study a case, which is not well defined if compared to a case such as an organisation or individual (Yin, R. 2009). Yin (2003) outlines some examples of hard-to-define cases; these are decisions, programmes, implementation process and organisational change.

Hammersley & Gomm (2000) distinguish case study from other methods by four main characteristics. Case study investigates a small number of cases, and the information gathered covers relatively large number of features and various aspects that clarify the phenomenon (case) of interest. In addition, Hammersley & Gomm (2000) postulate that a case study offers an opportunity to examine the case(s) in their natural or actual setting. This means that case study does not allow the researcher to manipulate instances as occurs in experiment design (Dul & Hak 2008). Moreover, case study is concerned mainly about attaining a rich understanding of the case itself with no high priority given to obtain empirical generalisation.

The current research uses case study design to study a single case, which is the process of designing and implementing LORENZO in the NHS. Applying this programme in the NHS entails organisational changes and decisions to be made, which influence profoundly the success of LORENZO. Therefore, investigating the nature and context of the programme (i.e. LORENZO) is a complex topic as many forces interfere in it and consequences emerge from the implementation of the program. Accordingly, to deal with this complexity, the author adopts qualitative research methods, which enable him to obtain detailed and rich examination of the case in question. The use of qualitative research has been the most commonly used in case study design (Bryman & Bell 2007, Gerring 2007). Moreover, the current research symbolises the study of a hard-to define case because the difficulty stems from the fact that there is no definitive starting, or at least, ending point of LORENZO (Yin, Robert K. 2003).

6.2.2.2. Why Select a Case Study Strategy

Yin (2009) proposed three situations in which case study strategy can be applied; when, why, and how questions are posed, when there is little or no control over what is being studied and finally, when researchers are concerned about studying contemporary phenomena within their actual or real setting. The author selects case study design strategy as these conditions exist in the current research.

Yin (2009) postulates that case study is ideal for answering *how* and *why* questions, which are explanatory in nature. It has been discussed in the previous chapter (see 5.2.3 Exploratory, descriptive and explanatory studies) that this research is a multipurpose study, which encompasses exploratory and explanatory research questions.

Despite the fact that *what* questions are most probably descriptive in nature (Collis & Hussey 2003), Yin (2003) postulates that they can be exploratory as well. The author agrees with Yin as in the current study, looking at a potential relationship between LORENZO's development methodology and clinicians' acceptance is considered exploratory because no previous study, to the knowledge of the author, looked at this association. In addition, the author also aims to identify the factors that affect the implementation of LORENZO and its users' acceptance. Although identifying these factors may be seen as *describing* the phenomenon in question, the author thinks that this description is essential because it enhances the author's understanding and enables him to explore patterns in LORENZO's implementation. Gaining better understanding of LORENZO's implementation helps the author in *explaining* issues related to the relationship between the development methodology and clinicians' acceptance.

The second condition for adopting case study design is when researchers have little or no control over the case. In this research, the author does not intend to examine causal relationships between variables, which requires a sort of control over them. Instead, the aim is to gain meticulous and rigorous understating of the implementation of LORENZO that operates in real and natural settings (i.e. the NHS working environment). The author stresses the fact that independent and dependent variables are unknown to the author; this implies that there is nothing to control. Perhaps further research is needed in order to test this study's theoretical framework through quantified (positivistic) research methods. Overall, in this research, the author is more concerned with understanding the phenomenon under study and generating theoretical propositions than testing relationships between variables and consequently, the second condition of adopting case study is met.

The third condition for applying case study design is studying the phenomenon in its real settings. This condition is also cited by Benbasat et al (1987) who argue that the IS field is not only about learning about/from technological innovations in organisations, but also about the interaction between the adopted technology, the organisation and the people. As a result, implementing and evaluating information systems in organisations should be seen from not only technological perspective, but also managerial and organisational perspectives in order to understand how people perceive the system.

Because users' perceptions are not known in advance (Kaplan & Maxwell 2005), qualitative methods generally, and the case study particularly, is suitable to deal with alternative interpretations of the same phenomenon (Galliers & Land 1987). The author envisages that if LORENZO were adopted in a context other than the NHS, the factors that influence its implementation and the perceptions of users would be different.

Additionally, Benbasat et al (1987) state that the IS domain encompasses a steady state of technological advancement, which makes IS researchers lag behind practitioners in assessing computer systems and suggesting procedures (e.g. best practices), which help users and their organisations in maximising the benefits of utilising IT. Thus, a case study strategy is employed to capture the experience and knowledge of LORENZO's users and practitioners to construct a body of knowledge, which stems form realistic and informed inside views.

Furthermore, Benbasat et al (1987) highlight the fact that a case study strategy is useful when there are few studies that have been carried out in the area under consideration. Although adopting technology in the NHS is not new, LORENZO has been viewed as revolutionising the way the NHS runs the health service and thus, has won interest from IS researchers. Despite the interest in studying LORENZO by researchers and academics, the aim of this study has not been widely examined. The lack of preceding studies necessitates researchers to establish thick and detailed description of LORENZO development, implementation, and evaluation instead of testing empirically predefined extant theories.

In sum, the implementation of ISs is context specific and learning about this context is as vital as the examination of the system itself. In addition, case study design is a good design strategy when researchers tend to evaluate a technology, to explore the context in which it works and to explain various patterns.

6.2.2.3. Types of Case Studies

Authors have classified case studies into different categories, for instance, Stake (2005) distinguishes three main types of case studies; intrinsic, instrumental and integrative. In an intrinsic case study, the researcher aims to learn about a particular case itself, not to learn about other cases or to learn about a problem. An instrumental case study is employed when a researcher aims to refine a theory or to give insight into an issue. Instrumental case is seen as a tool, which enables researchers to find answers to research questions by obtaining insights from studying a particular case. An integrative case study is conducted when researchers want to extend the instrumental case study to other cases.

In the current research, the author takes *the implementation of LORENZO in the NHS* as an **instrumental case study**. This means that the author does not intend to focus on studying the physical components of LORENZO or learning the technical issues of the software itself. Instead, the author concentrates on learning *the development and implementation* of LORENZO in order to understand the nature of the relationship between LORENZO's development methodology and users' acceptance. The spatial boundary of the case study is the NME region, within which LORENZO is implemented. In other words, the purpose of studying LORENZO is not to improve its performance in terms of technicality, but to learn how its development methodology affects users' acceptance in the NHS.

Even though researchers are less inclined to focus on a single case (intrinsic) as it just aims to describe a particular phenomenon (Silverman 2005), Stake (2005) argues that researchers may aim at building a theory by studying a particular (single) case study. The current research is not an exception as the author aims to infer theoretical propositions resulting from his interpretation of people's perspectives about the implementation of LORENZO. Studying LORENZO's implementation is of value and interest in itself because the author believes that succeeding in implementing and rolling out the programme all over the NME area represents a major breakthrough in the use of IT in the NHS, and lead to the success of the NPfIT in general.

Yin (2009) also classifies case studies into three types according to their purposes; these are exploratory, descriptive or explanatory case studies. The current research adopts an **exploratory** case study design that aims to explore a relationship, to explain how it influences end users' acceptance in the NHS, and to identify the factors that influence significantly the implementation process of LORENZO (Multipurpose study).

6.2.2.4. Single vs. Multiple Case Studies

In this section, the author focuses on two types of case studies based on the number of cases studied (Yin, R. 2009). These are single- and multiple-case studies. Hartley (2004) and Benbasat et al (1987) state that researchers employing case study strategy must decide from the beginning of their studies whether a single- or multiple-cases design is going to be used. The use of either single- or multiple-cases is confined to specific conditions that should exist in research projects in order to justify their use.

Yin (2009) state that there are five main reasons for employing single-case study design; these rationales are:

- If a single case represents a *critical* case that is used in testing a well-formulated theory. The aim of critical case is to refocus future investigations in the area of interest.

(Benbasat, Goldstein & Mead 1987) argues that single-case is useful at the beginning of the research project to generate theory.

- When a single case represents an extreme or unique case.

- When a single case is a revelatory case, Bryman & Bell (2007) and Benbasat et al (1987) state that a case is revelatory when a researcher intends to investigate a phenomenon that is not previously accessible to scientific investigation.

- When a single case is longitudinal. The author has discussed the distinction between cross-sectional and longitudinal studies (see 5.2.4 Cross-sectional vs. longitudinal Studies), a longitudinal case study means that the same case is investigated over a period of time or at more than one point in time.

- When the case is *typical* or *representative* case, single-case design can be adopted. A typical case is the one that represents the conditions of an everyday situation (Bryman & Bell 2007).

Taking LORENZO's implementation as an instrument, by which the author explores and understands how the development methodology influences end users' acceptance in the NME region, represents a *revelatory case study*. Moreover, studying LORENZO and its implementation might be viewed as a unique case study. Its uniqueness stems from the fact that LORENZO is meant to link multiple health information systems together in order to facilitate the exchange of medical content across the NHS organisations, which has not been done before.

Yin (2003) mentions the fact that the use of single-case design is not confined to the above five rationales, instead, the rationales for single-case design can be extended. For instance, when the case under study is difficult to break down into logical units and thus, taking the case as the unit of analysis is advantageous.

On the other hand, multiple cases design is useful for comparative studies where researchers aim to compare the findings deriving form the cases (Bryman & Bell 2007).

In addition, Yin (2009) states that multiple-case design is used to replicate the findings of the original study. Replicating the findings enhances their robustness. One may perceive replication of findings as a sensible justification to continue examining the area of study.

Bryman & Bell (2007) suggest that researchers should determine accurately what their focus is in order to select between single- and multiple-cases designs. For example, if the author were aiming to study the implementation of LORENZO at a trust level to see if there are variations in the success level amongst trusts or not, he would adopt a multiple case design. Because the author's focus is on the development methodology of LORENZO and the examination of the global nature of the programme, a cross-sectional or single case would be an appropriate design strategy.

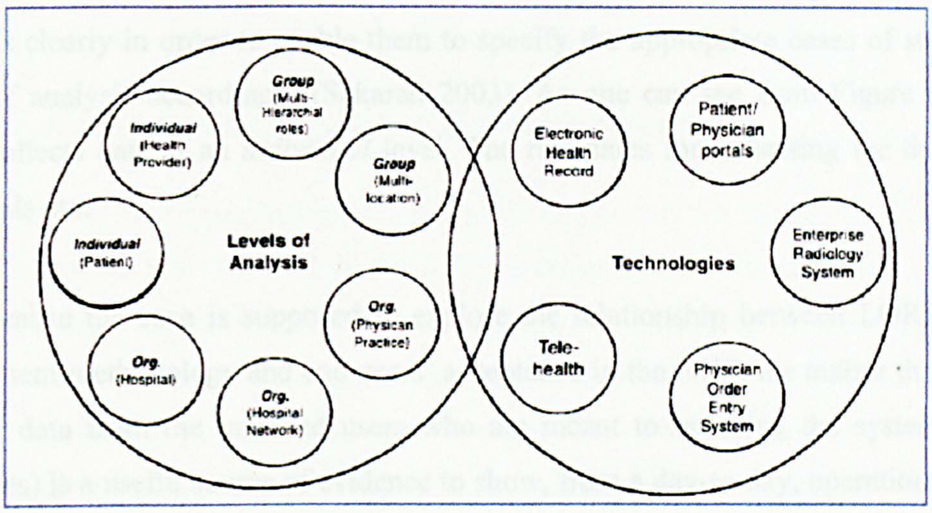
Employing a single-case study is associated with problems as well. For instance, Yin (2009) states that focusing on one case and studying it holistically may prevent researchers from examining specific issues at the operational level. Moreover, he postulates that the nature of the case study under consideration may change, or new orientation in the case study may emerge and thus, changing research questions becomes vital and necessitates starting over again. Yin (2009) proposes the adoption of the *embedded case study* to overcome the disadvantages of the holistic case study.

6.2.2.5. Level and Units of Analysis

Eisenhardt (1989) states that the embedded case study encompasses *multiple levels of analysis*, so-called *units of analysis* (Sekaran 2003), within the same case. Bryman & Bell (2007) shows four levels of analysis in case study design; SOGI, which stands for **S**ocieties, **O**rganisations, **G**roups, and **I**ndividuals. Additionally, Sekaran (2003) adds nations as a broad level of analysis.

As one can see in Figure 6-2, LeRouge et al (2007) present diverse levels of analysis and technologies used in published research articles in the special issue in European Journal of Medical Informatics (2007).

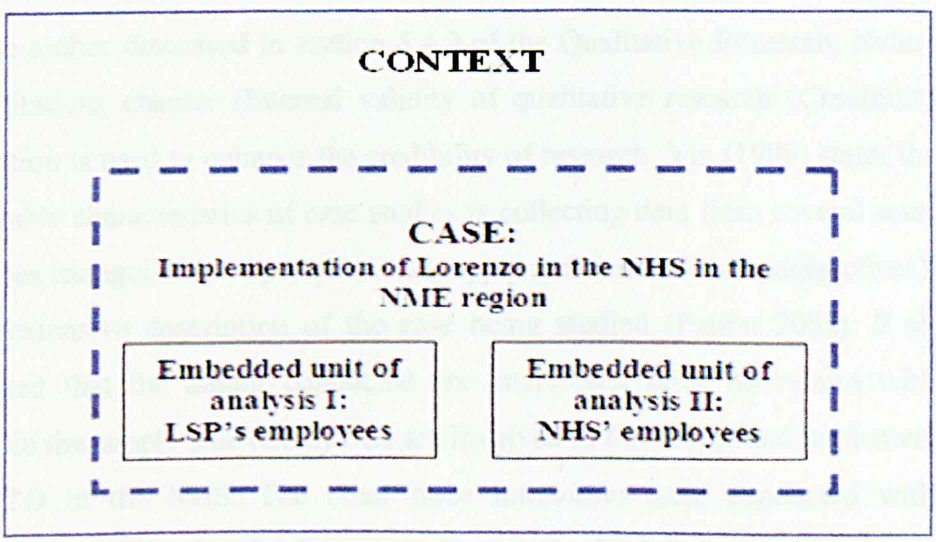
Figure 6-2: Technologies and Levels of Analysis



Source: (LeRouge, Mantzana & Wilson 2007)

In this study, LORENZO is the target technology to be studied. If one wishes to match LORENZO with the technologies demonstrated in Figure 6-2, EHR would be the one. In addition, the level (unit) of analysis selected in this research is *individual health providers*, represented by the NHS employees. It should be emphasised that the employees from the LSP side represent another level of analysis as one can see from Figure 6-3. Figure 6-3 shows the case study of the present study with its two subunits of analysis.

Figure 6-3: Levels (Units) of Analysis



The unit of analysis is defined as *"the kind of case to which the variables or phenomena under study and the research problems refer"* (Collis & Hussey 2003: 121). The definition of unit of analysis necessitates that researchers identify their research questions clearly in order to enable them to specify the appropriate cases of study and unit(s) of analysis accordingly (Sekaran 2003). As one can see from Figure 6-3, the author collects data at an *individual* level. The rationales for collecting the data from individuals are:

- Because the case is supposed to explore the relationship between LORENZO's development methodology and end users' acceptance in the NHS, the author thinks that colleting data from the intended users who are meant to be using the system (NHS employees) is a useful source of evidence to show, from a day-to-day, operational level, whether LORENZO's development methodology has an impact on their acceptance or not. Interviewing the NHS' employees would also show other salient factors that affect their attitudes toward the use of LORENZO.

- Even though obtaining data from the NHS' employees is useful to explain how LORENZO's development methodology affects their acceptance, the author argues that interviewing people from the supply side is valuable because they are the ones who understand how the system is being developed. It is the author's belief that getting extensive clarification of the way, by which the system is developed, is a prerequisite to examine its effect on the intended clients (the NHS people).

- The author discussed in section 5.4.2 of the Qualitative Research: Nature, Types and Limitations chapter (Internal validity of qualitative research (Credibility)), how triangulation is used to enhance the credibility of research. Yin (1999) states that one of the desirable characteristics of case studies is collecting data from several sources. The author uses triangulation of perspectives (supply and demand side perspectives) in order to gain extensive description of the case being studied (Patton 2002). It should be emphasised that the author conducted six interviews, three interviews with people working in the supply side (CSC) who are involved in the design and implementation of LORENZO in the NHS. The other three interviews were conducted with people working in the NHS who also have experience in health informatics in general, and the implementation of LORENZO in particular. All of the interviews with the NHS employees were conducted *in-situ* in the NME area. Two of the three interviews in the NHS side have been conducted in early adopter NHS trusts.

6.2.2.6. Writing Good Case Based Research Report

To write a good case based research, one should emphasise the importance of meeting validity and reliability measures. Yin (1999) describes some procedures that boost the rigor of case study research. For instance, he states that triangulation in terms of using multiple sources of data methods and applying respondent validation techniques are helpful in enhancing validity. In terms of reliability, Yin (1999) stressed the need for the establishment of a case study *protocol* and a case study *database*. A case study protocols is a detailed documentation of the case study project (relevant readings of the issue being studied, research objectives), research questions and the potential sources of data for answering the questions, data collection procedures and a guide for the case study report.

Yin (1999) states that case study research lacks the distinction between evidence and interpretation if compared to quantitative studies such as surveys. This means that researchers tend to present the part of data that support their line of argument, and discarding the rest. Thus, Yin (1999) proposes a case study *database* that presents the "raw data" and the results of the data analysis before discussion and interpretation of results take place. The author allocates a separate volume to show the interview guide, and provides a full copy of the interviews transcripts for the reader to review. Furthermore, the author has used quotes from the interviews for supporting his line of argument.

The author stresses the notion that writing good quality case based research needs not only meeting validity and reliability standards, but also paying attention to the design process of case study strategy. IS Researchers have revealed statistically that most case study researches have deficiencies in defining the components of case study strategy. For instance, A study pursued by Dube & Pare (2003) presented strong evidence of this problem. Dube & Pare (2003) reviewed journal articles in management information systems that adopted case study method. The study revealed that 42% of 183 papers stated clear research questions and only 8% of the papers stated the unit of analysis.

6.2.3. Data Collection Methods

Data collection methods are an integral part of any research design adopted to provide answers to the research questions (Sekaran 2003). The author provides an overview of the various types of data collection methods and explains the rationale of the selected data collection method.

6.2.3.1. Typologies of Data Collection Methods

Bryman and Bell (2007) state that there are numerous research methods that can be used in qualitative research, Ethnography/participant observation, qualitative interviewing, focus groups, language-based approaches and the collection of texts and documents. Silverman (2005) mentioned various methods, which are observations, textual analysis, interviews and transcripts. In addition, Kaplan & Maxwell (2005) mention three sources for data: observations, open-ended interviews and surveys and thirdly, documents and texts. Yin (2003) highlights six main data collection methods used in case study research; these are documentation, archival records, interviews, direct observations, participant observation, and physical artefacts. Moreover, Yin (2003) states that interviews considered as one of the most important sources of data in the case study research. In this study, the author uses *qualitative interviewing* as the main data collection method.

6.2.3.2. Types of the Data Collected

There are two main types of data that are used in the current study; Secondary and primary data (Collis & Hussey 2003). Sekaran (2003) defines secondary data as information that is collected from other sources that already exist. Primary data, on the other hand, refers to data that is collected by the researcher for the specific purpose of the study.

The author uses *Qualitative Primary and Secondary* data, which implies that the data collected is non-numerical. Secondary data is obtained from journal articles, books, governmental documents, and online sources (websites). Examples of the websites that were used to attain secondary information are the DoH, NHS CfH, Healthcare commission, NHS Information Centre, NHS confederation, and NHS Choices website.

Obtaining primary data from well-informed insiders rather than relying on outside sources such as existing documents is more useful. This is because outside sources may not give an accurate view about how LORENZO is implemented, and how it is situated in the NHS context

6.2.3.3. Types of Qualitative Interviewing

The main criterion used in classifying interviews is the extent to which the interview is structured or standardised across participants (Punch 1998). For instance, Bryman & Bell (2007) state that in qualitative research, researchers can use either semi-structured or unstructured qualitative interviews. In addition, Sekaran (2003) and Punch (1998) state that qualitative investigators adopt structured (standardised) or unstructured (unstandardised) interviews.

Saunders et al (1997) classify interviews used in business research into three main types; structured (standardised), semi-structured, and unstructured interviews (non-standardised). Structured interviews are of a questionnaire-based format where standardised and pre-determined questions are asked in the same order to all respondents. On the other hand, semi-structured interviews are non-standardised interviews where researchers aim to cover certain topics and to ask a list of questions to participants. Although the researcher enters the interview with an interview guide or schedule (Bryman & Bell 2007), which encompasses the questions and themes to be covered, this guide may vary from interview to interview, the researcher may omit, add, or change the order of the questions to be asked. Finally, unstructured (or so-called in-depth) interviews are one of the main data collection methods in qualitative research (Ritchie & Lewis 2003).

According to Saunders et al (1997), in-depth interviews are non-standardised interviews like the semi-structured interviews; however, they have no interview guide that contains the list of questions to be asked. Here, the author agrees with Ritchie & Lewis (2003) notion that even with the most unstructured interviews, researchers still have a general idea of themes they wish to explore during the interview. Because of this general awareness of what is going to be discussed, unstructured interviews are generally guided by a list of topics to be covered in an interactive manner that allows participants to reflect on issues raised.

6.2.3.4. Semi-structured Interviewing: the Main Research Method

The author adopts *semi-structured interviews* to establish a professional conversation with the target participants who agreed to be interviewed. The author's decision to use semi-structured is based on a set of reasons that justifies the author's choice.

Saunders et al (1997) state that the nature of the research in terms of what it tries to achieve determines to a great extent the type of the interview to be adopted. To clarify this point, Table 6-1 shows the three main research purposes and the corresponding suitable type(s) of interviews. (**) denotes most preferred and (*) denotes also or maybe suitable.

Table 6-1: Research Purposes and Types of Interviews

		Purpose of research		
		Exploratory	Descriptive	Explanatory
Type of interview	Structured		**	*
	Semi-structured	*		**
	Unstructured	**		

Source: (Saunders, Thornhill & Lewis 1997)

The present study is multipurpose with more emphasis on both exploratory and explanatory purposes. the author aims to understand, explore and explain the phenomenon under study from the interviewees' point of view and thus, establishing personal interaction between the author and the participants is significantly important to have this kind of interactive (Ritchie & Lewis 2003) conversation (Kvale 1996) where the author asks questions and the participants give answers.

Additionally, Saunders et al (1997) claim that managers are more inclined to be interviewed to talk about their perceptions and reflect on the topic under study than filling in a questionnaire. This is because a manager may feel that it is not appropriate to write down personal or confidential information (Saunders, Thornhill & Lewis 1997). In addition, managers are resistant to fill in a questionnaire, as they do not have enough trust in the researcher conducting the study.

The author interviewed six participants who occupy senior positions in their organisations. They have been contacted and given a brief idea of the current research before arranging the interview place, where they feel comfortable, and a time slot, when they have enough time to meet the author and provide the required information. Saunders et al (1997) state that senior people are generous in giving time and information accordingly. This idea denotes that the length of time required to obtain the data can play an important role in determining the type of the interview adopted.

The author realised another benefit of using semi-structured interviews that it enabled him to avoid the disadvantages associated with structured and unstructured (in-depth) interviews. The author's argument is based on Walsham's discussion (1995) that if researchers adopt a strict or rigid way of questioning, which does not permit interviewees to reflect on the topic under consideration because of the high control imposed by the researcher, the data obtained from participants will lose its richness, which is vital in the case of interpretive case studies. On the other hand, Walsham (1995) states that if researchers exhibit excessive passivity in their interviews, the interviewees may infer that the interviewer is not interested in what they are saying or s/he does not have enough knowledge of the topic(s) of investigation.

Sekaran (2003) states that researchers can conduct their interviews online, face-to-face or by telephone. The author used ***in-situ*, face-to-face semi-structured interviews**. One point to bear in mind is that the author has interviewed the first two participants along with his research supervisors and the last four interviews were conducted by the author individually. It is the author's belief that meeting expert people face-to-face to obtain their views requires good *"social skills and personal sensitivity"* (Walsham 1995: 78). The presence of the supervisors enabled the author to have feedback from them on his communication skills and guide the author to areas of improvement of his questioning mechanism.

6.2.4. Sampling Design

A sample is *"the segment of the population that is selected for investigation, it is a subset of the population"* (Bryman & Bell 2007: 182). Besides, Ritchie et al (2003) state that the selection of the sample follows either a probability approach, which is used in statistical research or a non-probability approach, which is used in qualitative research.

Sekaran (2003) postulates that in probability sampling, each *element* of the population is given a predetermined probability to be selected as a *subject* (in the selected sample). In this section, the author focuses on **non-probability sampling** because it suits the nature of qualitative research. Sekaran (2003: 266) defines sampling as

> *"the process of selecting a sufficient number of elements from the population, so that a study of the sample and an understanding of its properties or characteristics would make it possible for us to generalize such properties or characteristics to the population elements"*

6.2.4.1. Types of Samples

Authors have discussed various types of non-probability samples and classified them in different categorises. For instance, Judd et al (1991) classify samples into accidental (convenience), quota and purposive samples. Bryman & Bell (2007) categorise non-probability samples into convenience, snowball and quota samples; whereas, Sekaran (2003) put non-probability samples in two main groups that are convenience and purposive samples. The author highlights the common types of non-probability samples as shown below:

- **Convenience samples**: accessibility is the criterion of choosing the sample subjects (Bryman & Bell 2007). This means, as the name implies, that the researcher chooses the incidents or individuals who are conveniently available to collect the data from.

- **Quota sampling**: or a so-called proportionate sample implies that the researcher aims to represent certain groups in the research sample. For instance, if 100 women are among 1000 people in an organisation and the investigator is interested in getting women's views in a sample that constitutes 10% of the population, then 100 sample subjects to be selected and 10 of them should be women.

- **Snowball sampling**: Bryman & Bell (2007) perceives snowball sampling as convenience sampling. To apply this approach of sampling, the researcher first establishes contacts with small group of people or individuals and then uses these contacts to refer him/her on to other groups of people or individuals. Ritchie et al (2003) refer to snowball sampling as chain sampling since the people who have been already interviewed are asked to identify other people they know and at the same time meet the sampling criterion. Collis & Hussey (2003) states that a Snowball sample (or so-called networking sampling) is useful for accessing individuals who possess the required knowledge or experience.

- **Judgmental sampling**: Sekaran (2003) states that judgemental sampling is considered as a type of purposive sampling. By using judgemental sampling, the researcher tries to get the information from a specific group of people that s/he thinks these people are in the position to provide the required information.

- **Purposive sample**: means that the researcher picks cases (elements) from the population with a purpose in mind (Ritchie, Lewis & Elam 2003).

6.2.4.2. Snowball Sample: The Selected Sampling Technique

In the light of the above discussion, the author uses a ***non*-probability snowball sample**. The selection criterion of the sample subject is that the participants to be interviewed from either the NHS or the LSP side should possess the required knowledge and expertise in LORENZO's implementation. The selection criterion implies that people from the LSP side should be involved in designing and implementing the system in the NHS and be familiar with or have had prior contact with the target users in the NHS organisations. Moreover, interviewing knowledgeable and expert people from the NHS side in the NME means that the people interviewed should be end users who use LORENZO in their work, or represent the end users in order to reflect the real facts about the implementation of LORENZO at the operational level.

6.2.4.3. Selection Criterion of the Sample Subjects

Because the author has not been involved in implementation programmes of HCIS in the NHS and has not occupied any position in the NHS, it becomes difficult for him to identify people who meet the selection criterion. Thus, the author's decision was to contact Professor lain Carpenter, who is well informed and has a quite long experience in studying health informatics in the NHS. Professor Iain Carpenter guided the author to other people who can meet the selection criterion of the current study. This description denotes the snowball sampling technique explained by Ritchie et al (2003).

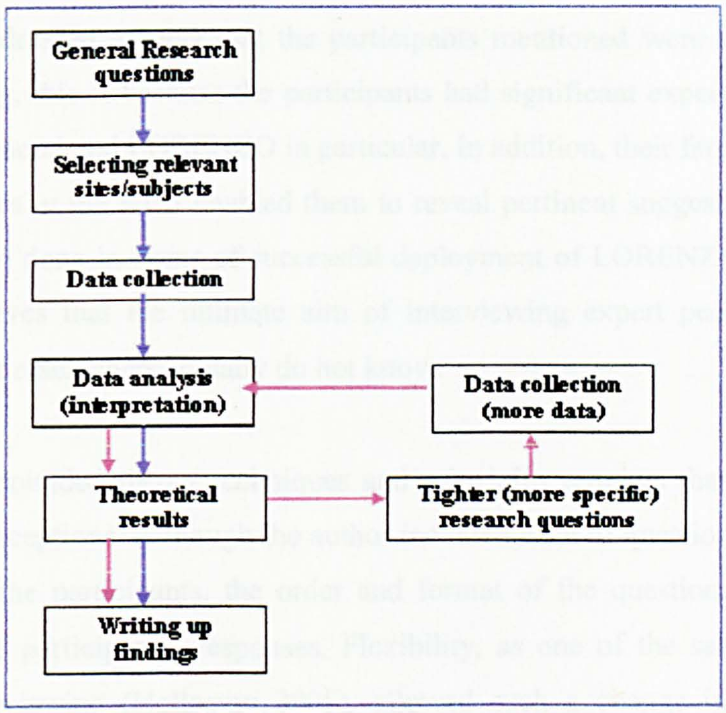
The author stresses the notion that adopting snowball sampling involves some difficulties summarised in the geographical dispersion of sample subjects, which requires prior arrangements with respondents. Because of the very demanding and busy nature of experts' jobs in the NHS, the author experienced delays in arranging dates, from postponed interviews, or inability of some people to be interviewed. The author emphasises the fact that since those people constitute the reservoir of the required information, he showed patience and tried to arrange alternative interview dates with them.

6.2.4.4. Theoretical Sampling

Patton (2002) postulates that there are no rules for determining the sample size in qualitative studies as the number of sample subjects depends on the nature of the study, its purposes, and the time and resources available in hand. Kvale (1996) on the other hand gives a general rule for determining the interview subjects, which is to interview as much as necessary in order that the author finds answers to his/her research questions.

The author follows **theoretical sampling** that was originated in the grounded theory approach. Ritchie et al (2003) postulate that by following theoretical sampling, researchers choose the sample subjects that contribute to the development of theoretical concepts. Theoretical sampling is conducted iteratively where the researcher repeats cycles of data collection and analysis until the researcher saturates the emerging categories. This process continues until the researcher feels that an extra interview adds trivial insights into the emerging categories. Figure 6-4 illustrates the stages that the author has executed in the current research.

Figure 6-4: The Stages of the Current Research



Source: (Bryman & Bell 2007)

6.3. DEVELOPING THE INTERVIEW GUIDE

Although the current study's participants were in senior positions, they also had significant clinical/medical experience. Their administrative and practical experience enabled the author to obtain significant ideas and uncovered data related to the implementation of LORENZO that the author was not aware of when he started the data collection phase. The author prepared an interview guide to be used as a written document to remind the author of the set of questions to be asked to the participants. In this section, the author discusses the rationale of creating the interview guide.

Qualitative interviewing does not follow a structured list of questions or topics to be asked in exactly the same words and in the same order. Instead, it uses an **Interview Guide** (King 2004). It is called interview guide because it captures the interviewer's list of ideas or questions to be asked in the interview (Bryman & Bell 2007). Because semi-structured interviews were used to collect the data, the author intended to use more structured set of questions to be addressed in the interviews. However, the author intended not to have too specific questions to be asked for two main reasons. Firstly, the author wanted to explore the participants' views and to know, from their perspective, the crucial aspects that influence the implementation of LORENZO.

Some of the addressed aspects that the participants mentioned were absent from the author's thinking, this is because the participants had significant experience in dealing with HCIS in general and LORENZO in particular. In addition, their familiarity with the working practices in the NHS enabled them to reveal pertinent suggestions or ideas of what ought to be done in terms of successful deployment of LORENZO's units. Thus, the author believes that the ultimate aim of interviewing expert people is to know inductively what researchers actually do not know.

Secondly, the grounded theory techniques and principles requires that the author not start with preconceptions. Although the author included a set of questions or ideas to be discussed with the participants, the order and format of the questions were changed according to the participants' responses. Flexibility, as one of the salient features of qualitative interviewing (Holloway 2005), allowed such a change in the order and format of the questions. Due to this change, new topics and/or questions emerged spontaneously during the interviews, which were necessary to clarify and probe thoroughly some of the participants' ideas. Because the new topics were based on the participants' perspectives they enabled the author to gain sharp understanding and spotlight important issues pertaining to the implementation of LORENZO.

The author prepared a separate interview guide for each interview, as the author had to modify the questions according to the resulting analysis of the previous interviews, the nature of the participants' work, and the roles and responsibilities they performed. Changing the questions according to the analysis of the previous interviews enabled the author to create theoretical concepts grounded in the data collected and again, this symbolises the emergence principle of grounded theory.

Modification of the questions was not executed arbitrarily. Instead, the author and his research supervisors discussed thoroughly the findings of each interview conducted and subsequently, the questions of the next interview were identified and agreed upon.

Considering the participants' backgrounds and practical experience was vital in order to use more questions that are relevant to their fields.

Even though some questions contained in the interview guide were modified according to the next interview conducted, the author intended to design the interview guide to contain three main parts that are:

1. Introductory Section

The first part of the interview guide starts with general questions about the participant's roles and responsibilities, positions, and how s/he got involved in the implementation of LORENZO. In addition, the author aimed to ask the participants about their opinion about LORENZO and what they can tell about it. The introductory part was meant to encourage the participant to talk and build a dialogue, which leads to more questions to emerge during the interview.

2. Issues Related To LORENZO

The author wanted to obtain a richer explanation of ideas the participants had mentioned in the interviews and to focus on relevant aspects that are important to the implementation of LORENZO in their view. One point to bear in mind is that the author's discussion with the participants was steered by the ideas they raised in the interviews. The ideas discussed reflected the participants' views, experience, and are related to their positions and responsibilities. For instance, interviewing doctors or ex-nurses led the discussion to focus on the medical/clinical processes and the organisational arrangements that influence the implementation of LORENZO.

However, the author argues that the essence of designing the interview guide is to steer the discussion to its original aim, which is answering or gaining greater understanding of the ideas that needed explanation. For example, the author in some instances tried to bring the discussion to an end and start on something more relevant to the topic under consideration by asking the participant questions such as "How do you think this relates to LORENZO?" or "Going back to my question about… ".

3. Closure of Discussion

In his PhD thesis, Coombs (1999) called the last part of the interview guide "Non-directed discussion". In this research, the interviewees were given the chance to raise topics or ideas that they thought were important to successful deployment of LORENZO. In addition, the author asked the participants to state suggestions or recommendations, which might help the various stakeholders in enhancing the usage of LORENZO.

6.4. INTERVIEWS CONDUCTED

The questions in each interview guide were aimed to be discussed in a limited time of about an hour to an hour and a half. The participants gave the author a limited period to conduct the interviews because they had a busy working schedule. In addition, asking questions and talking to experienced people for an hour or more was good enough to obtain thorough grasp of the various topics. The author read textbooks regarding qualitative interviewing to have an idea of how to conduct a constructive dialogue and encourage the participants to talk. Table 6-2 shows the interviews conducted, their length of time, and the date of conducting them.

Table 6-2: Conducted Interviews in the NME Region

Interview number	Length of time	Date of interview
R1	1h 13mins	14th of November 2008
R2	1h 13mins	17th December 2008
R3	1h 14mins	27th January 2009
R4	1h 09mins	23rd of September 2009
R5	1h 32mins	1st of October. 2009
R6	1h 12mins	18th of November 2009

The author intended not to declare the names or the titles of the respondents because referring to a number of participants' titles might reveal their identities. Stating the identity of participants would contradict with the anonymity and confidentiality the author assured them of before starting the interviews.

6.5. IMPLEMENTATION OF INTERVIEWS

Before conducting each interview, the author contacted the participant by e-mail or/and telephone to set up a date and time for the interview to take place. All of the interviews took place at the interviewees' working venues for their convenience. It took the author a quite long time to arrange some of the interviews and arrange dates for them. The author encountered rejection from some people who were meant to be interviewed as they were unable to afford time to participate in this study.

Prior to the beginning of each interview, the author introduced himself, stated the aims of the current research, and gave a brief summary of the interview guide content. In addition, the author assured the confidentiality of the data provided and made it clear that their names or title would not be stated in the research project. Moreover, the author obtained permission from each respondent to audio tape the interview. Recording the interviews helped the author to avoid any possible bias in interpreting the participants' ideas. Furthermore, the author made it explicit that respondents were free to add any additional information that was useful to answer the interview questions.

In the interviews, the author tried to create a constructive dialogue between him and the participants instead of having question-and-answer based interviews. To achieve this, the author used different types of questions; for instance, after asking general questions to introduce the topic, the author used follow-up questions in order to give the chance to the participant to elaborate his/her ideas (Bryman & Bell 2007). Probing questions were also asked to get details about certain topics the author thought were important. Additionally, the author did not interrupt the participant most of the time and he used pauses to encourage the participant to add details to the point s/he was making. Non-verbal cues were also important such as nodding the head, facial expressions, and the eye contact to show interest and indicate the importance of what was being discussed.

At the end of each interview, the author showed a written report of the analysis of previously conducted interviews to obtain the participant's feedback and comments on some points discussed in the analysis. This helped the author to double check his understanding of major points relevant to the implementation of LORENZO. For example, R3 discussed the Deployment Units methodology and presented a diagram, which illustrates the various components of LORENZO's releases. The analysis of the R3 interview was shown to R5, who in turn added more information that elaborates the development methodology. The author aimed by checking the findings of the interviews analysis with other participants to construct a theory or themes, which are rooted in the data collected.

Moreover, the author transcribed each interview and sent a full copy to the corresponding participant via e-mail. Participants were asked to confirm the accuracy of the transcription and send any additional comments or rejections on any part of the interview. The author received consent from all the participants to use their quotes in the final PhD thesis and agreed on the accuracy of the transcripts.

6.6. CONCLUSION

This chapter presents the main methodological decisions made to plan the research design of the existing study. The decisions related to the research design are concerned with the determination of the design strategy, data collection method, and sampling procedures. A single embedded case study was the design strategy adopted in this study in order to focus on the implementation of LORENZO in the NHS in the NME region. The decision to adopt the case study design was because the implementation of LORENZO as an integrated HCIS is unique and revelatory. This entails focusing on this system in particular to gain deep understanding of the main issues related to its implementation and acceptance by end users. In this study, the author conducted semi-structured interview with the individual users in the NHS and people from the designing company (CSC).

The author aimed to collect qualitative primary data, which was obtained by way of face-to-face semi-structured interviews. A separate interview guide was prepared for each interview in order to remind the author of the questions/topics to be discussed during the interviews. The questions of each guide were modified according to the analysis of the previous interviews.

Regarding the sampling design, a non-probability snowball sampling technique was adopted to collect the primary data. The fundamental criterion for interviewing the participants was their possession of the required knowledge and expertise in the development and implementation of LORENZO. Due to the fact that there are no rules of determining the sample size, the author adopted the underlying principle of theoretical sampling that to meet as much as necessary until he author have answers to his research questions.

The author presented the general format of the interview guide by discussing its main three parts. In addition, the author gave an overview of the number, dates and length of each interview conducted. Moreover, the author gave a considerable account of the actions undertaken during the interviews that describe the interaction occured between he author and his participants.

Chapter Seven

7. QUALITATIVE DATA ANALYSIS DESIGN

7.1. INTRODUCTION

After the interviews had been conducted and transcribed in a Microsoft Word document format, they were entered into the NVivo software for analysing. In this chapter, the author shows how the data collected was analysed according to grounded theory techniques and principles.

The amount of data generated in qualitative research can be vast (Patton 2002), messy, unwieldy and discursive (Ritchie & Lewis 2003). Having six, approximately hour-and-a-half-hour interviews with expert people, who had so much information to impart, generated dozens of transcribed pages. This situation caused difficultly for the author in terms of managing and analysing the data. The mission of analysing this voluminous data required careful attention to be paid to the approach that was adopted in analysing and deriving meaningful results from the data gathered.

This chapter highlights various **Q**ualitative **D**ata **A**nalysis (QDA) strategies that researchers can use in their qualitative studies. However, the author focuses his discussion on one strategy that was chosen in the current research, which was the Grounded Theory (GT).

The author starts this chapter after the introduction with a section that discusses the heterogeneity in QDA strategies and pinpoints the common characteristics that exist in the assortment of QDA strategies. Then, the author narrows down the discussion to GT, which is the QDA strategy under consideration. In the GT section, some related issues are discussed such as the underlying principles of GT, its major components, how to apply GT in the current study, and its limitations.

7.2. QDA STRATEGIES (APPROACHES)

Due to the enormous amount of data that qualitative research generally generates, it became obvious that the main challenge to the author was how to make sense of the raw data collected and translate the patterns and relationships between the chunks of data into useful findings, which enriched the author's comprehension of LORENZO's implementation in the NHS. In addition, the author stresses the fact that qualitative research poses another challenge, which is the difficulty in replicating the findings. This means that there are many ways to look at the data from many different perspectives and thus, different interpretations can come out of the same data. Therefore, it is crucial to consider how data will be analysed by choosing an appropriate strategy to do so.

When the author started reviewing the literature regarding the QDA in order to understand how the data should be analysed properly, he reached a conclusion that there was no standard approach that can be adopted in qualitative research. To choose the appropriate approach for analysing the data, the author decided to search the literature with the purpose of identifying the array of the available approaches and use the one that suits the nature of the data gathered, the purpose, and questions of the current research.

7.2.1. Heterogeneity in QDA Approaches

In almost all qualitative research textbooks, authors highlighted the diversity in QDA methods and discussed them to show when and how they should be used. In this chapter, the author does not intend to explain each approach in detail, but to show the variety in the approaches. For instance, Ritchie and Lewis (2003) noted that there are many approaches, which have been developed to analyse qualitative data. Amongst the approaches are ethnographic accounts, life histories, narrative analysis, content analysis, conversation analysis, discourse analysis, policy and evaluation analysis, analytic induction and grounded theory.

Despite the assortment of QDA approaches, Ritchie and Lewis (2003) claimed that very few of these approaches explain how the theory or the hypotheses are generated from the data. The author believes that this might result from the fact that qualitative research is unique (Punch 1998) and thus, researchers would find it difficult to follow strict rules and procedures of analysis. Instead, researchers may adopt a particular approach with some modifications in how the process of analysis will be carried out.

Moreover, Punch (1998) claimed that qualitative research is concerned with studying the social phenomenon in its natural settings and thus, incorporates richness and complexity in terms of the various ways of looking at the phenomenon under consideration and consequently, various techniques of analysing qualitative data can be adopted. These techniques are: analytic induction, grounded theory, abstracting and comparing, narratives and meaning, discourse analysis, semiotics, documentary and textual analysis, ethnomethodology and conversation analysis, and the Miles and Huberman framework for QDA.

Bryman and Bell (2007) claimed that in spite of the data richness obtained from the qualitative research, there are few accepted guidelines and rules to conduct qualitative analysis. However, they identified two major strategies (approaches) that qualitative researchers can use in analysing the data; these strategies are grounded theory and analytic induction. The author thinks that these QDA approaches are considered as strategies because each one of these strategies contains tactics or steps that instruct researchers how to perform the analysis. The next section of this chapter (the GT section) explains how these tactics were implemented in the current research.

7.2.2. Common Features of QDA Approaches

Despite the heterogeneity in QDA approaches, they share common features (van den Hoonaard & van den Hoonaard 2008). The tradition of writing memos and coding the interview transcripts are two common features of QDA strategies. The third feature is the simultaneous data collection and analysis; below, the author explains how this feature was reflected in the way the data was analysed in the current study.

The author stresses the fact that the analysis started as soon as the author began the collection of the data. This means that data collection, analysis, and the writing of the findings were simultaneous stages that the author does not consider as separate and sequential stages.

To explain how data collection and analysis coexist, the author started taking notes and creating themes (concepts) as the data collection was in progress. As more data was collected, the author started linking these themes to have a preliminary view of the theory that would come out from the analysis of all the interview transcripts. Moreover, instead of starting the analysis when all the interviews had been conducted, the author started the analysis after the first interview was conducted and continued the analysis as more interviews accumulated. This strategy was beneficial because it enhanced the author's understanding of the topic under research and thus, the questions that were asked in the one interview were not only drawn from the literature, but also reflected the critical views and/or ideas that were mentioned by the people who were interviewed previously.

Moreover, van den Hoonaard and van den Hoonaard (2008) claimed that a common feature can be found in QDA strategies, which is the use of writing as a tool of analysis. The author wrote documents regarding the resulting concepts and relationships between the various categories, which emerged from the first few interviews and continued writing more findings that resulted from the rest of the interviews. When the author completed the data collection stage, he reviewed the documents that were written during the phase. The review of these documents helped the author to make use of some ideas from the previous analysis and incorporated them in the writing of the final analysis document.

Although the transcription of the interviews recording was time consuming, the author argues that it let him be more familiar with the data in hand and thus, the author gained more confidence. This confidence stemmed from the fact that the process of repeated listening and reading of the transcripts helped the author to judge whether the collected data was sufficient/enough to extract the main blocks of the theory (concept and categories) or not. Furthermore, the repeated reading of the coding helped the author to be more careful in refining the concepts that led to better theory building.

The author stresses van den Hoonaard and van den Hoonaard's view that the QDA approaches have a shared feature that the analysis should be linked to the existing literature concerning the social phenomenon of interest (van den Hoonaard & van den Hoonaard 2008). The author's aim for the analysis was creating a theory that showed which factors that mostly influence, and will continue influencing, the implementation of LORENZO, as well as relating the generated theory to the literature review to see whether it falsifies or confirms the influence of the various variables, which were mentioned in the models of Health Information Systems (HIS) adoption.

7.2.3. The Nature of the QDA Process

Writers in the qualitative research field have discussed the nature of the QDA. Some authors, for instance Ritchie and Lewis (2003) describe the data analysis in qualitative research as challenging and exciting stage of the qualitative research process. Others, for example Silverman and Marvasti (2008) describe the analysis process as fun since researchers chop up the data gathered into different themes and concepts, and bring them together as a coherent work or theory generated from the data. Others, for example Berg (2004) claim that although QDA is one of the most difficult stages in qualitative research, it is also one of the most creative stages. Whatever the view is about QDA, the author claims that the analysis stage is crucial in the current research because it provides the root source of the theory the author aimed to generate from the data collected, and consequently it had to be performed professionally and scientifically.

The author's view of QDA is that it is time consuming, needs experience and intellectual ability. Intellectual ability is described as the creativity to continuously question and think of the relationships (Tan 2010), within and between major categories (see Analysis of the Collected Data chapter). To be open minded to the emerging concepts and to try to establish links between them was strictly the author's responsibility. The author's responsibility in analysing the interview transcripts confirms the idea, which was mentioned in section 8.3 of the Analysis of the Collected Data chapter (The Stages of Data Analysis). The idea is that the use of NVivo does not replace the researcher because the system just helps the researcher to store and retrieve the coded texts, the concepts and categories, and show the relationships that were determined by the researcher him/herself. In summary, human factor/intervention is a vital part in QDA approaches conducted with or without the assistance of computer software.

Moreover, the author believes that QDA requires collaborative efforts from the research team. In the current research, collaborative effort or teamwork was a critical success factor in analysing the interview transcripts. These efforts were represented in the regular meetings, which took place between the author and his supervisors. In these meetings, the author discussed with his research supervisors the various themes generated from the analysis, and obtained advice and constructive suggestions of how to link the bits of data and present them clearly. In addition, these meetings were seen as essential in enhancing the validity of the findings by performing addition, deletion, and merging of some themes.

The author assigned the current chapter to the QDA to denote the pivotal role of the data analysis in the qualitative research. The importance of the analysis stems from the fact that systematic and planned analysis leads to meaningful findings that can answer the research questions. Therefore, this chapter aims to highlight how the analysis was conducted and on which methodological basis the analysis stands.

7.3. GROUNDED THEORY (GT)

In this section, the author discusses the main data analysis technique (approach) used in this research, which is Grounded Theory (GT). The discussion encompasses the principles of GT that were adopted as a systematic process for conducting the analysis, the process of analysing the data (coding process), the outcome of GT, and the limitations of using the GT that were either mentioned in the literature review or concluded by the author when he used the GT in this research.

7.3.1. What is Grounded Theory?

GT was originally developed by two sociologists, Barney Glaser and Anselm Strauss in 1967 in their book, *The Discovery Of Grounded Theory* (Strauss & Corbin 1998). According to Strauss and Corbin (1998: 12), grounded theory is *"the theory that was derived from data, systematically gathered, and analysed through the research process"*. This definition of GT implies that the theory is created from the data gathered without any specific commitment to any data, line of research or theoretical interests (Douglas 2003).

Additionally, Charmaz (2006: 2) defines GT methods *"consist of systematic, yet flexible guidelines for collecting and analysing qualitative data to construct theories "grounded" in the data themselves"*. Charmaz's definition of GT is based on the fact that GT is a method rather than a research methodology. Here the author recalls that the use of GT was meant to be the tool for analysing the collected case study data. In addition, the flexibility of GT and the fact that it contains guidelines instead of strict rules gives the author the chance to modify the way by which the data was analysed, and at the same time, adhering to the principles of GT.

Furthermore, in GT, data gathering, analysis and the resulting theory stand in close relationship. This means that there is systematic data gathering and analysis in a form of iterations. Each iteration yields clearer theory or concepts and consequently, clearer characteristics of the emerging theory. Grounded theory aims at building a theory from the analysis of the data collected without being affected by preconceived literature or theory in mind (Strauss & Corbin 1998). One point to bear in mind is that the author did not follow strictly the principles of GT since he reviewed the literature before the process of data collection and analysis. This is because it was necessary for the author to rely, to some extent, on the existing literature, his understanding and interpretations of the data collected for establishing the relationships connecting the various concepts. Moreover, the author considers the existing literature review as a valuable source for enhancing his theoretical sensitivity, refining the scope and identifying the gap of the current study, increasing his understanding about the topic in general, and clarifying some concepts resulted from the data analysis. The author presents a detailed discussion of the reasons for using the literature review in section 7.4 of this chapter (Coding Procedures).

In the first edition of their textbook, Strauss and Corbin (1990: 24) defined the GT approach as *"Research method that uses a systematic set of procedures to develop an inductively derived grounded theory about a phenomenon"*. Moreover, they mentioned the fact that GT aims at illuminating the area under study as the resulting theory is grounded in the data collected from the field researchers are interested in.

The author argues that because the emerging theory is based on the data gathered from the people, who had enough experience and knowledge to talk about LORENZO implementation and the various related issues, GT as an analytical tool for analysing the data and building a theory was a good choice. It is a good choice since the author aimed at understanding the implementation of LORENZO from the NHS people's point of view, rather than from preconceptions based upon the existing literature.

Tan (2010) stated that GT has been applied in many fields such as nursing, education, psychology, accounting, business management, public health, social work and library IS (LIS). The application of GT in the IS field is not an exception as it has been routinely used to investigate numerous IS phenomena (Rangarirai & Irwin 2008).

7.3.2. When Can Researchers Use GT?

Tan (2010) identified three common cases in which GT can be applied. The first case is when researchers aim to create a theory about issues of importance in people's lives. The author argues that the current research aims to understand **how** LORENZO development methodology affected clinicians' acceptance of the various deployment units, and **what** factors enhance successful deployment of the system.

Because LORENZO is the end outcome of the NPfIT, which was initiated to improve clinicians' performance, it is essential to study LORENZO in its real settings by talking to people face-to-face. Direct interaction with end users helps in articulating what causes them to reject the system (LORENZO) and thus, to avoid its failure. The author argues that avoiding the failure of LORENZO or determining the causes of failure is important to the NHS and to clinicians in particular. This importance stems from the fact that failure means wasting the public funds, which were invested in the NPfIT since 2002. In summary, one can conclude that looking at the human factor of the implementation process of LORENZO is pivotal, as clinicians are the people who are meant to use it, and consequently understanding their perspectives about the system is necessary.

The second case where researchers can use GT as a method of QDA is when researchers aim to study new socio-technical phenomena (Fernández 2004). The author thinks that the current study is an example of studying a socio-technical phenomenon where applying LORENZO in the NHS (the technical system) influences the NHS' people (the social system), and the working environment as well. The interaction between the social and the technical system implies that people in the NHS are going to be affected either positively or negatively. To grasp knowledge about how the adoption of LORENZO affected them, the author thought of grounded theory as an appropriate analytical tool to extract a theory, which has to be grounded in the data collected.

The author thinks that the flexibility and openness of the qualitative interviewing adopted in the current study provided a space for the interviewees to talk freely and thoroughly about their perspectives and shed light on topics that the author had not thought about before conducting the interviews. Here, the author would endorse Fernández's point that a researcher who uses interviews (mainly in-depth interviews) for collecting data, should be a very active listener, and stimulate his/her audience to talk more about their personal experiences in the field under consideration (Fernández 2004).

The third situation where researchers can use GT is when the area of interest is new and developing; this means that there is not enough literature about the phenomenon. The author did not find academic articles or books that explain how the development methodology of LORENZO affected clinicians' usage and how to enhance it in the case of resistance. For instance, the analysis revealed that Deployment Units, which is the adopted methodology for building the system, had a profound impact on clinicians' behaviour toward using LORENZO, as one can see in section 9.2.6.5 of the Theory Building chapter (System Related Factors). The notion of deployment units was absent in the literature. In addition, the interviewees were willing and co-operative in clarifying issues related to the development methodology. Thus, the author's choice of GT as a way of analysing the data derived from the data collection tool, which facilitated the collection of considerable amounts of rich data, was again correct.

7.3.3. The Outcome of Using GT

Researchers use GT to construct theories (Strauss & Corbin 1998); most of these theories are substantive in nature (Charmaz 2006). Flick (2002) claimed that theory is a version of the world and this version passes through constant stages of revisions, evaluations, constructions and reconstructions. In addition, he (Flick) suggested that theories are not wrong or right representations of a given fact; rather they are perspectives through which the world is seen.

Collis and Hussey (2003: 122) define theory as "*A set of interrelated variables, definitions and propositions that presents a systematic view of phenomena by specifying relationships among variables with the purpose of explaining natural phenomena*". Berg (2004: 15) defines theory as "*A general and, more or less, comprehensive set of statements or propositions that describe different aspects of some phenomenon*" . Silverman (2005: 98) defines theory as "*A set of concepts used to define and/or explain some phenomenon*". (Bryman and Bell (2007) define theory as an explanation of observed regularities. In other words, theories are means for explaining how things operate or relate to each other.

Strauss and Corbin (1998) used the term *theorizing* to describe the process of constructing the theory throughout the research process. They defined theory as

> "*A set of well-developed categories (e.g. themes, concepts) that are systematically interrelated through statements of relationships to form a theoretical framework that explains some relevant social, psychological, educational, nursing, or other phenomena*" (Strauss & Corbin 1998: 22)

One can notice from the above definitions of theory that authors used certain words to describe the composition of the theory. For instance, most of the definitions used the term *variables*, which can be operationalised, *relationships*, which link the variables together to propose causality and *explanation* as the objective of the constructed theory. The author believes that the above common features of the theory are driven by the philosophical underpinning of the research. Because researchers can design their studies based on two main philosophical paradigms (Positivistic and Interpretivistic paradigm), the way researchers look at the theory's components or objectives vary and thus, would create disagreement among grounded theorist about how the theory should look like (Charmaz 2006)

Charmaz (2006) differentiates between the Positivistic and Interpretivistic definitions of theory. On the one hand, positivists view concepts as variables that are linked with each other through specified relationships. The role of theory is to predict and explain them. In addition, positivists undertake the verification of these relationships through hypotheses testing to achieve generality and universality. On the other hand, Charmaz (2006) claims that interpretivistic theorists aim at understanding more than explaining. The understanding of the social phenomenon is based on the researcher's ability to interpret it. The researcher's interpretation of the topic under consideration relies on his/her ability to create patterns and connections, rather than linear reasoning and causality.

Furthermore, proponents of interpretive theories emphasise the fact that there are multiple and emergent realities. In the current study, the existence of multiple realities is represented in the numerous views and perceptions people hold about the deployment units. People's views and perspectives are generally affected by their backgrounds, professional experiences, etc. Consequently, talking to people from different organisations allowed the author to gain broader and richer knowledge and that was the justification of meeting the different stakeholders of LORENZO implementation.

The author applies the principles of the interpretivistic approach. The aim is to construct a theory of how to improve the take up of LORENZO in the NHS that could be tested by others for generalisability within the NHS. This theory is grounded in the data gathered, rather than relying on secondary data sources or collecting structured data to test existing theories. This means that the theory emerged throughout the entire process of data collection, analysis, and interpretation of the findings.

Another classification of social theories is whether they are substantive or formal (Strauss & Corbin 1998). The difference between the two types of theories is that, formal theories are less specific to the place and the group of people studied. The substantive theory is best defined as the theory that is built in a particular domain (Hussey & Hussey 1997). Most of the theories constructed by using GT method are substantive (Charmaz 2006) that are produced inductively (Glaser 2004).

In the current research, the author thinks that the theory produced is **substantive** as he is interested in studying a certain case study, which is LORENZO implementation in the NHS in the NME region. The aim of the current study's substantive theory is to understand how LORENZO's development methodology and other issues influenced users' acceptance, and to identify the factors that significantly affect LORENZO's success.

7.4. CODING PROCEDURES

In this section, the author shows the process of analysing the data, which refers to the coding process (Strauss & Corbin 1990). Tan (2010: 102) described coding as *"A fundamental analytical process, which plays a vital role in analysing, organising and making sense of textual data"*. Additionally, Darlington and Scott (2002: 144) define coding as *"the process of creating categories and assigning them to selected data"*.

In qualitative research, analysts refer to coding as **Indexing** and in both qualitative and quantitative research it is called **coding**. In the current study, the author decided to use the term coding to denote the process of breaking down the text into segments.

Coding is perhaps the most important canon of GT. The importance of coding stems from the fact that the emerging theory is composed of concepts, which are defined as *"The basic blocks of theory"* (Strauss & Corbin 1998: 101). One can think of concepts as similar data that are grouped and given conceptual labels; these labels are related by relationships (Strauss & Corbin 1990). Subsequently, to extract concepts from the transcripts and link them together by statements of relationships, GT requires that the author go through the process of coding. The author aims to present the Grounded

Theory Method (GTM) that was adopted in the current research, as well as to explain the primary terms that are usually used when applying GTM.

GTM is described as *"A set of procedures and techniques for gathering and analysing data"* (Strauss & Corbin 1998: 3). These procedures are beneficial because they offer some sort of standardisation and rigour to the process of analysis (Strauss & Corbin 1998). Moreover, the coding process facilitates the handling of large amounts of data, helps in identifying, developing and relating the concepts of the theory and finally, gives the chance to consider the alternative meanings of the phenomenon (Strauss & Corbin 1990).

The author thinks that the benefits of GTM are of great importance because they enabled him to better interpret the participants' themes. The author perceives coding as flexible because one may give numerous labels to the same data every time s/he breaks down the transcripts into concepts. Each label yields a distinct meaning and here, one can determine which one of these alternative meanings (concepts) best matches the meaning, which was meant by the participants. Flexibility of the coding process yields this sort of better interpretation of the phenomenon under consideration.

While these procedures provide rigour and a standardised process of analysis, they might be seen as flexible guidelines (Charmaz 2006, Strauss & Corbin 1998). Due to the flexibility in GTM, the author argues that applying certain analysis techniques does not mean sticking to certain strict rules, instead, the author proposed a set of stages to analyse the interview transcripts, as one can see in section 8.3 of the Analysis of the Collected Data chapter (The Stages of Data Analysis).

In this chapter, the author discussed the coding stages from a theoretical point of view and applied them more pragmatically in the Analysis of the Collected Data chapter. The author stresses the fact that the stages of analysis conducted in the current research took into account the principle of emergence (Rangarirai & Irwin 2008), which characterises GTM. The principle of emergence symbolises the fact that theory should evolve during the research process and be seen as a result of the interplay between the data collection and analysis (Goulding 1999). In this sense, the author did not allow preconceived concepts or any theoretical framework to influence the construction of the theory and let the data *"speak for itself"* (Rangarirai & Irwin 2008).

The notion that the author did not allow any literature framework to influence the analysis of data does not mean entering the field or start the analysis with a blank slate. Instead, the author used the existing literature before the collection and analysis of the data. Tan (2010) claimed that reviewing the existing literature enables researchers to refine the research focus and better determine the research problem or gap.

The author agrees with Tan's notion because social researchers usually use GT when the topic of interest has been ignored in the literature or given little consideration (Goulding 1999). Due to this situation, the author read extensively two main streams of literature, which were the intra-organisational IS acceptance and the IS development methodologies to understand how these literature streams could be applied in the substantive area of research. Moreover, the author's lack of the professional experience in the field forced him to look at the literature or any possible sources to gain comprehension of the topic and try to locate the gap/problem of the research.

Strauss and Corbin (1998) also encouraged the use of existing literature because it allows researchers to update themselves with new theoretical trends in the field. Besides, they stressed the fact that reading the literature can be seen as an analytical tool and an aid to think of more theoretical questions.

To follow Strauss and Corbin's recommendation of having the literature as an analytical tool, the author transcribed and conducted an initial analysis of each interview to extract the emerged concepts. Some of these concepts were not clear enough to the author and thus, the literature was used to gain richer understanding. In addition, the author had used the literature before the data collection stage began, as well as before every interview conducted, with the purpose of formulating theoretical questions regarding the emerged concepts, and relating the secondary sources of data with the analysis (Tan 2010). This procedure was useful in either confirming or falsifying the existing literature.

Furthermore, reviewing the literature enhanced the researcher's *theoretical sensitivity* (Tan 2010, Fernández 2004, Douglas 2003, Goulding 1999, Strauss & Corbin 1998). Theoretical sensitivity is a term that is used repeatedly in GT (Strauss & Corbin 1990) and refers to

> *"The researcher's knowledge, understanding, skills and ability to see data with analytic depth, be aware of the Grounded theory in practice subtleties of meaning of data, generate concepts from data, relate these concepts, and develop theory"* (Tan 2010: 101).

The author thinks that reviewing the existing literature improved his theoretical sensitivity, made him more confident and able to understand the various issues that were highlighted by the participants. In addition, reviewing the existing literature (i.e. the relevant IT adoption models and theories) enabled the author to construct a preliminary conceptual framework. This initial framework was the starting point from which the author began his first interview.

Although GT was originated in Glaser and Strauss' 1967 *The Basics of Grounded Theory*, both of them modified the original version of the GT in significantly different ways. These differences appeared in Glaser's approach, which was explained in his books published in 1978 and 1992 and Strauss' approach, which was published in Strauss and Corbin's texts in 1990 and 1998 (Heath & Cowley 2004). Despite the differences in their versions of GT, Heath and Cowley (2004) advise that qualitative researchers may cautiously mix both of the approaches. Despite these differences, the author kept to the main principles of the GT. These principles are constant comparative analysis, emergence of concepts, and theoretical saturation. These principles were highlighted while discussing the coding procedures. The author's choice of the coding process reflects both his own understanding of the coding techniques, which were discussed in the literature, as well as his way of thinking and explanation of the analysis. It is worth mentioning that the author did not rely on the original publication of Glaser and Strauss in 1967 *Discovery of Grounded Theory* because they (Glaser and Strauss) did not pinpoint in an obvious way the stages (types) of the data analysis process (Tan 2010).

Glaser divided the coding process into two levels, substantive and theoretical coding (Tan 2010, Heath & Cowley 2004). Whereas, Strauss and Corbin (1998, 1990) mentioned three types of coding; open, axial and selective coding. The author used a mix of coding levels, which led to a substantive theory grounded in the data collected. One point to bear in mind is that the author aimed to build a theory that could explain what is going in the NHS regarding LORENZO implementation, not for the sake of just creating a theory.

7.4.1. Open (initial) Coding

The author started analysing the data with open coding, which is also termed as **substantive coding** in the Glaserian approach (Heath & Cowley 2004). Open coding is defined as *"The analytic process through which concepts are identified and their properties and dimensions are discovered in data"* (Strauss & Corbin 1998: 101). In addition, Coyne and Cowley (2006) described open coding as **fracturing** or **deconstruction** of the data because interview transcripts are fragmented into meaningful coded texts. These two definitions of open coding refer to the process of breaking down the transcript into distinct units of meaning (Goulding 1999). Fragmenting the transcript is an essential tool for researchers because it enables them to identify the categories, which constitute the main blocks of the emerged theory (Douglas 2003).

According to Charmaz (2006), initial coding is called "open" because the researcher should be open to any possible theoretical direction indicated by the reading of the transcripts. Moreover, Charmaz states that coding starts with an initial naming (labelling) of data (i.e. word, line, or segment of data), then, researchers conduct focused and selective coding, which entails the use of the most significant/frequent core categories to build the theory.

One of the greatest advantages of open coding as was indicated by Charmaz (2006), is that it enables researchers to realise the gaps/holes in the data. The author agrees with Charmaz's notion because the initial coding phase assisted the author to determine what data was required or missing, which needed collecting in the next interviews.

The analysis of the data in the current research started after the first interview had been conducted. The interview transcripts were coded for any possible ideas or facts that looked relevant and important. After each interview, the author read carefully the transcript line-by-line and paragraph-by-paragraph in order to extract relevant concepts. At this stage of the analysis, the author used two types of codes; the **"in vivo"** and **"researcher-constructed"** codes (Douglas 2003). "in vivo" codes represent the actual phrases used by the participants, whereas, "researcher-constructed" codes represent the author's own description of the idea or event mentioned in the text.

Strauss and Corbin (1998) claimed that once concepts emerge from the open coding phase, the researcher should group these concepts into categories. Categories are beneficial as they have more analytic power than standalone concepts. In addition, categories help researchers to deal with less number of units (concepts) that are easier to remember and think about. Due to these benefits, the author broke down the data in each interview transcript into discrete incidents or ideas and each of these was given a name (open coding). After that, the author conducted **comparative analysis** to find similarities and differences between concepts and group them into categories (Charmaz 2006, Strauss & Corbin 1998). One point to bear in mind is that the author relied on the literature to label most of the researcher-constructed codes.

The author stresses the fact that conducting comparative analysis requires the author to compare the codes or concepts, not the data itself (Coyne & Cowley 2006). Moreover, the author compared the concepts in each interview transcript (internal comparison) and then he compared the concepts in one transcript with those in previous and/or proceeding transcripts (external comparison).

Bryman and Bell (2007) stated that a category encompasses two or more concepts. Because the category includes various concepts and, since each one of these concepts indicates an event, idea or a characterisation of the phenomenon, categories tend to be at a higher level of abstraction than stand-alone concepts (Bryman & Bell 2007). Based on Bryman and Bell's description of categories, the author intended to group two or more concepts, which represent the same theme, into a single category. The categorisation of concepts led to various categories in each interview. Section 8.3.5 of the Analysis of the Collected Data chapter demonstrates the various categories (so called tree nodes in NVivo software).

7.4.2. Focused Coding

Focused coding entails using the most frequent (repeated) earlier codes to sift through a large amount of data (Charmaz 2006: 57). As the author finished the open coding of the entire transcripts, the author gained richer and broader understanding of the topic under consideration. Thorough and repeated reading of the concepts and examination of the categories led the author to be more aware of implicit ideas that he did not think about. The author agrees with Charmaz's notion that the *"Aha! Now I understand"* experience prompts analysts to study earlier data more afresh and explore topics that had been dismissed or ignored (Charmaz 2006).

Moreover, the author would mention the notion that focused reading of the emerged concepts resulted in the emergence of more concepts or caused existing concepts to be merged with other concepts. The author explained in section 8.3.3 of the Analysis of the Collected Data chapter (Coding the Transcripts) how focused coding was used.

7.4.3. Theoretical Coding

After having coded all the transcripts, written memos, and compared the various concepts, the author entered an advanced level of coding, which aimed at relating the various categories and sub-categories with relationships. Tan (2010) stated that analysts who adopt GT face three major questions. The first question is how to code the data once gathered; the answer to this question is straightforward as both Glaser and Strauss suggested open/substantive coding for creating categories through constant comparative analysis (Tan 2010).

The second question that GT users face is how one can relate the categories and their sub-categories. The connections between categories are termed hypotheses, which symbolise the analyst's hunches about the relationships between the concepts (Bryman & Bell 2007). The answer to the second question can be attained by following either **axial** coding (STRAUSSian approach) or **theoretical** coding (GLASERian approach). The author was inclined to use theoretical coding (GLASERian approach) rather than axial coding because of the following.

- The GLASERian approach is suitable for case studies that involve organisational and political phenomena that interact with technology issues (Lehmann 2001). This represents the area of research of the current study.

- The GLASERian approach focuses on abstract conceptualisation instead of full description, which was offered by Strauss and Corbin. Conceptualisation is concerned with the substantive area of inquiry not with people and time (Fernández 2004). Because the author aimed at studying a phenomenon within a substantive area of research, which is LORENZO implementation (HIS) in the NHS, he was more interested in understanding the substantive issues affecting the phenomenon instead of studying the people themselves.

If the purpose of open coding is breaking down the data into meaningful segments (**conceptualisation**), axial coding aims to **re-conceptualise** categories in new ways (Strauss & Corbin 1990). It is termed axial coding because coding occurs around the axis of a category (Rangarirai & Irwin 2008), and the attributes of such a category are explained by the sub-categories (Bryman & Bell 2007). Axial coding is defined as *"The process of relating categories to their subcategories"* (Strauss & Corbin 1998: 123). According to Strauss and Corbin (1998), the role of subcategories is to provide more explanatory power to the analyst by answering "when", "where", "how", "who", "why", and "with what consequences" questions.

However, the author did not use axial coding to dimensionalise the categories. Instead, the focused coding phase enabled the author to create subcategories from the categories. Subcategories yielded more explanation and/or description of their corresponding categories. Theoretical coding was the author's choice for establishing the interrelations between the concepts within each category and across the categories.

Theoretical coding is defined as *"Conceptualizing how the substantive codes may relate to each other as hypotheses to be integrated into a theory"* (Glaser, 1978: 72, cited in Charmaz 2006). According to Fernández (2004), these relationships can be perceived when concepts and memos accumulate during the analysis process. The author agrees with Fernandez's view that theoretical coding resulted from open and focused coding.

Moreover, the written memos were also important because the author used them to document the relationships between the emerged concepts and thus, they were a valuable source of relationships. Moreover, the author thinks that it is worth mentioning that theoretical coding may exclude a need for axial coding (Charmaz 2006) because theoretical coding *"weaves a new story from the fragmentation of open coding"* (Fernández 2004: 50).

The author used theoretical coding to identify not only the relationships between the concepts in each core category, but also the relationships among the seven core categories. The determination of the connections was conducted in two stages. The first stage took place when the author established connections within and between the categories in each interview. The second stage occurred when the author combined the similar categories from the six interview transcripts in unified core categories (merged NVivo project). This means that the connections between and within the categories in each interview were imported to the merged NVivo project. Then, the author established additional connections as the combination of all the connections and concepts in core categories gave the author better understanding in the problem in question.

The author emphasises the fact that open and theoretical coding (developing concepts, categories, and identifying connections among them) should not be seen as sequential and "Do it only once" process. Instead, the author went back and forth in the coding process after each interview was analysed. As the author progressed in developing more codes, his theoretical sensitivity was enhanced. The author's better understanding of the phenomenon in question enabled him to revise the previously developed connections and codes. The author went back to the previous interview transcripts and looked for new emerged concepts.

One may wonder when the researcher should stop collecting more data for coding; **theoretical saturation** is the answer. One can describe a category as theoretically saturated when no more codes seem to emerge from additional new data (Strauss & Corbin 1998), or when further sampling does not add significant value, which stems from the creation of additional categories and connections (Fernández 2004).

7.4.4. Selective Coding

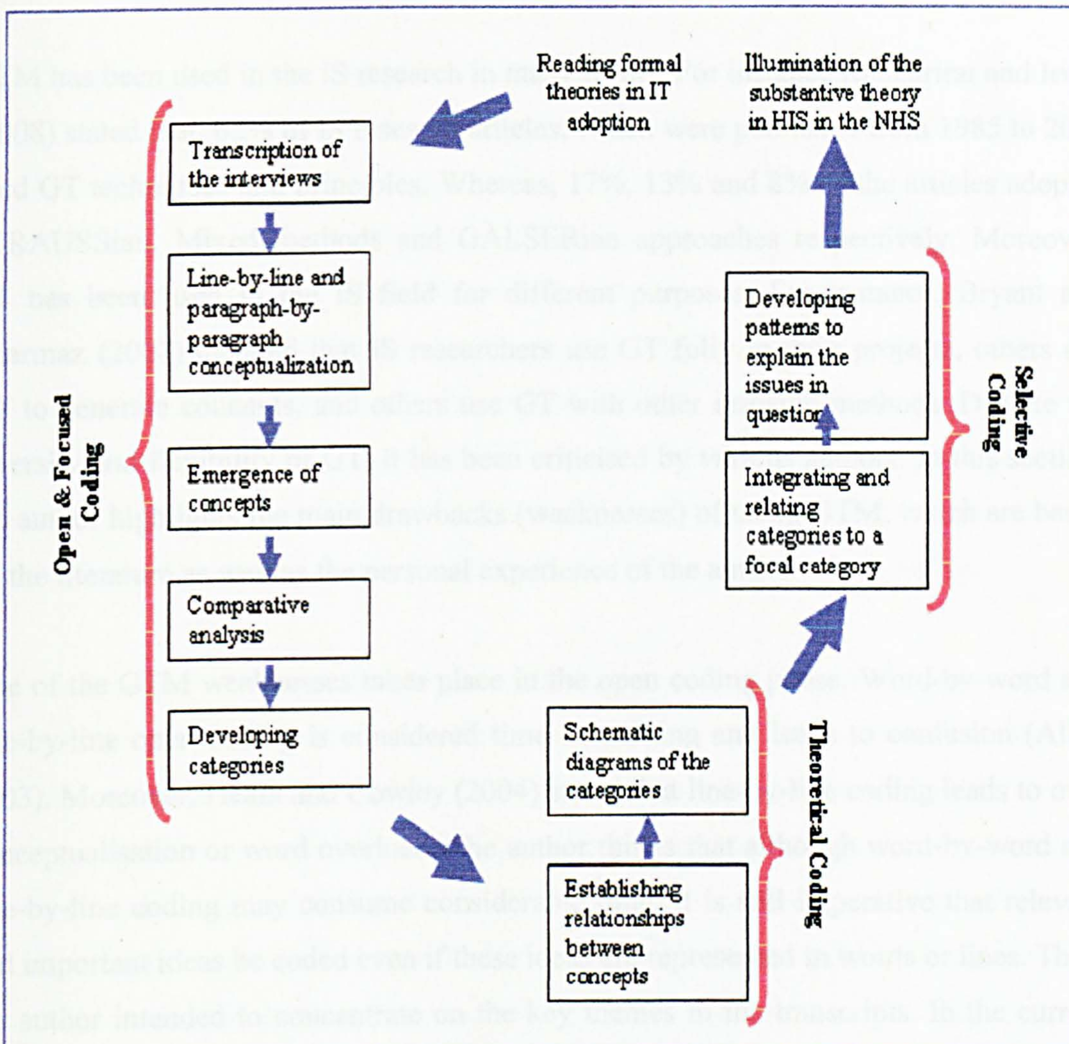
Until now, the author has discussed two main issues/questions that qualitative researchers usually encounter when it comes to analysing their data. The first one is how to develop categories and the second one is how to relate these categories with hypotheses. The third issue that researchers encounter is how to create a theory out of the categories and their interrelations. **Selective coding** solves the third issue.

Selective coding is defined as *"The process of integrating and refining the theory"* (Strauss & Corbin 1998: 143). Glaser (1978: 61-72, cited in Fernández 2004) defined selective coding as *"delimiting the theory to one or two core variable(s) which act as a guide for further data collection and analysis"*. This means that the researcher should find a focal or core category and delimit the investigation around it.

The author did not follow exactly the selective coding principle, where all categories should relate to a focal category (Fernández 2004). The reason for this is that the author aimed to identify what were the factors that mostly influenced clinicians' acceptance of LORENZO, understand the nature of LORENZO's development methodology and how it affected users' usage of LORENZO's deployment units, and evaluate the suitability of TAM in predicting end users' behaviour toward the use of LORENZO. The achievement of these objectives was grounded in the data collected as the core categories were used to extract patterns in the data, which explain/answer most of the questions the author had in this study. Thus, the author did not confine the discussion just to one focal category.

After the concepts emerged, grouped into categories, and relationships established within and between them, the author entered the last stage of the coding process. At this stage, the author depicted patterns, which illustrate the interconnections between the various concepts from various core categories. The author believes that theoretical coding has analytical power that can assist researchers to explain and/or predict behaviours in the phenomenon in question. Figure 7-1 below shows how the process of coding was implemented to build the substantive theory.

Figure 7-1: The Process of Coding



According to what has been discussed so far about the coding process, the author decided to assign three separate chapters in order to illustrate the different phases of the coding process. Chapter eight (Analysis of the Collected Data) demonstrates the open and focused coding stages, where concepts emerged and were grouped into categories. One point to bear in mind is that these categories were imported from the six NVivo sub-projects and combined together to form the major core categories. Chapter nine (Theory Building) illustrates the theoretical coding stage. In chapter nine, the author shows the interrelations between the concepts in each core category and the relationships that link the concepts from various core categories. Chapter ten (Research Findings and Recommendations) discusses the selective coding phase where patterns established to propose the theory.

7.5. *WHAT DOES GT SUFFER FROM?*

GTM has been used in the IS research in many forms. For instance Rangarirai and Irwin (2008) stated that, 62% of IS research articles, which were published from 1985 to 2007 used GT techniques and principles. Whereas, 17%, 13% and 8% of the articles adopted STRAUSSian, Mixed methods and GALSERian approaches respectively. Moreover, GT has been used in the IS field for different purposes. For instance, Bryant and Charmaz (2007) claimed that IS researchers use GT fully in their projects, others use GT to generate concepts, and others use GT with other research methods. Despite the diversity and flexibility of GT, it has been criticised by various authors. In this section, the author highlights the main drawbacks (weaknesses) of using GTM, which are based on the literature as well as the personal experience of the author.

One of the GTM weaknesses takes place in the open coding phase. Word-by-word and line-by-line open coding is considered time consuming and leads to confusion (Allan 2003). Moreover, Heath and Cowley (2004) stated that line-by-line coding leads to over conceptualisation or word overload. The author thinks that although word-by-word and line-by-line coding may consume considerable time, it is still imperative that relevant and important ideas be coded even if these ideas are represented in words or lines. Thus, the author intended to concentrate on the key themes in the transcripts. In the current study, paragraph-by-paragraph was the most used open coding procedure.

Bryman and Bell (2007) stated that using GTM is time consuming. The interplay and iterative process of data collection and analysis is the main cause of the long period researchers usually take to analyse and build their theories. The author encountered tight deadlines in conducting the current study for his PhD. The fact that the author was a full-time PhD researcher helped him to bypass time pressure and collect the required data that took more than a year. Furthermore, the author has mentioned the fact that GTM was mainly used to generate substantive theory. Focusing on substantive rather than formal theories may limit the generalisation of the findings in this research.

7.6. CONCLUSION

After presenting an array of techniques used for ODA, the author adopted the grounded theory as a method, not as a design strategy, for analysing the case study data. GT aims at building a theory that is grounded in the data. This data represents the views/perspectives of the participants in this situation. The author had the sort of involvement in the current study that made it possible to obtain a thick description of the implementation of LORENZO in the NHS. This involvement represented in the direct interaction with the participants, and the author's interpretations of the resulting variables. By applying the principles of GT, an interpretivistic approach was adopted in this study to construct inductively an extended TAM that predicts and evaluates end users' behaviour toward the use of LORENZO in the NHS in the NME region.

The coding process was presented at length in this chapter. The coding process was implemented step-by-step to make it clear and easy for the reader to understand how the variables were extracted from analysis of the textual interview data. The first step is represented in the open coding, which entails fragmenting or fracturing the interview transcripts into coded texts. The author thinks that the open coding is a crucial initial step that enables researchers to be familiar with their primary (raw) data, and to learn about unexplored trends or ideas related to the study under consideration. However, this process is time consuming as the author had to pursue line-by-line, and paragraph-by-paragraph indexing of the textual data. The second step of the coding process is focused coding in which thorough and repeated reading of the interview transcripts enabled the author to be more aware of implicit ideas he did not think of, and re-arrange the concepts into hierarchical categories.

Theoretical coding was used as the third type of coding to establish various connections between the generated variables. The proposed linkages were determined based on the author's own understanding, which was enhanced as more participants were interviewed because of the insightful knowledge they provided about the implementation of LORENZO, and the existing literature. Although selective coding was not strictly used, this type of coding was presented as a way to combine some major categories resulted from the analysis to one focal category as one will see in the Research Findings and Recommendations chapter.

Chapter Eight

8. ANALYSIS OF THE COLLECTED DATA

8.1. INTRODUCTION

In this chapter, the author analyses the data collected from conducting face-to-face qualitative interviews with people involved in the development, deployment, and implementation of LORENZO in the NME area. The interview transcripts were analyzed using NVivo, which is widely used software for qualitative data analysis.

This chapter starts with an introduction to qualitative data analysis in general, and the NVivo software in particular. The introductory section provides the reasons for and the benefits of using NVivo software. After that, the author moves on to describe how NVivo was used for analysing the interview transcripts. The description encompasses the systematic stages that were adopted to analyse the data, starting from transcribing the interview recordings, creating NVivo projects, coding and developing concepts (i.e. free nodes), and writing memos to developing categories (i.e. tree nodes).

8.2. USING COMPUTERS IN QUALITATIVE DATA ANALYSIS

The author reviewed the literature that pertains to qualitative data analysis tools, and concluded that there were no standard procedures telling researchers how to conduct the analysis (Ritchie & Lewis 2003). However, there was a common agreement on how to filter and separate significant data from trivial data. Thus, the objective was reducing the amount of data by focusing on significant data, grouping ideas related to the same concepts, and linking the various concepts together through relationships, which are derived from the author's understanding of the topic and the current literature review, in order to shape theoretical categories.

The author relied on computer-based analytical tools to assist the achieving of the objective of storing, coding, retrieving, and linking data (Bryman & Bell 2007, Patton 2002). The software that was used to analyse the data refers to Computer-Assisted Qualitative Data Analysis Software (CAQDAS) (Patton 2002).

The use of CAQDAS assisted the author in performing the analysis more efficiently, and quickly. Furthermore, helped the author to discuss and share the findings with multiple coders as they had already installed the software in their computers. Despite the efficiency and speed of analysing the data by using CAQDAS, the author stresses the fact that most of the tasks involved in the analysis were performed by the author. For instance, coding, labelling, and linking of the various themes that came out of the analysis were performed by the author, not by the software. Yet, the tremendous capacity of computers for dealing with large volume of data and comparing different chunks of data encouraged the author to use such software. The author chose to adopt NVivo, which is one of the popular software packages used in qualitative research (Bryman & Bell 2007).

The selection of NVivo as the main computer-assisted software package for analysing the interview transcripts stems from the fact that NVivo is based on coding which is best described as extracting text from the interview transcript to represent an idea or a concept and then, retrieving text (Bryman & Bell 2007). The use of NVivo, as one of the CAQDAS, enhances the transparency of qualitative data analysis. NVivo offers useful features in that researchers can think of multiple ways to establish relationships among the concepts developed.

Moreover, there were other reasons that stimulated the author to use the NVivo software. The ease of importing Word documents into the software, the storage options

NVivo offers for various documents to be saved as internal or external sources, the flexibility and ease associated with coding, re-coding and deleting codes, the ease and speed of navigating, searching codes and texts, the ability of attaching annotations and memos with coded text and nodes, which is useful to communicate the author's thoughts and comments on the analysis with the other investigators and finally, the graphical capabilities of presenting the findings. All of these reasons suggested that NVivo be the software used for analysis.

8.3. *THE STAGES OF DATA ANALYSIS*

The use of NVivo does not mean that the data entered into the software has ready explanatory potential. Instead, the author followed certain steps/stages to assure the full usage of data with its descriptive and explanatory power. These stages are:

8.3.1. Transcription of Interviews

The first step of the data analysis was the transcription of the digital audio-recorded interviews. Although the author had limited resources, experienced and professional transcribers were used. The author contacted the transcribers to inform them of the level of detail required in transcribing the interviews. In addition, the author checked the transcripts for accuracy by listening to the digital audio recorder, with the transcripts in hand, in order to fill in inaudible texts. Checking the transcripts was a necessary procedure that helped the author in overcoming any possible guessing in transcribing the recordings. This is because the interviewees used some abbreviations and terminologies related to LORENZO that transcribers might not be aware of.

Additionally, the author included comments in the transcripts that were related to non-verbal materials such as gestures and facial expressions. Given the fact that the transcribers were cautious about confidentiality of the transcripts, the author stressed this point and required that all transcripts be deleted from transcribers' databases.

After receiving the transcripts, the author listened to each interview recording at the same time reading the corresponding transcript in a printed form without taking notes. This step was useful to enable him to take notes and write down the primary themes of the interviews, as well as having a preliminary grasp of the whole interviews. The author intended to record the interviews and transcribe them instead of using voice recognition software packages as they have not been proved to be effective due to the fact that they require long setup times and the inadequacy of their transcription as well.

8.3.2. Creating NVivo Projects

To use NVivo, a project must be created. A project contains the data, which are mainly the interview transcript and any other related documents, the nodes, and the links between the various nodes. The author decided to create a project for each single interview transcript and thus, six projects were created. Each project contains the transcript, lists of free and tree nodes, links between the nodes, memos, schematic diagrams of the tree nodes, as well as some proposed causal diagrams for some of the nodes in the project.

8.3.3. Coding the Transcripts

Coding is the starting point of qualitative data analysis using NVivo, as well as the most important phase of almost all of qualitative research (Bryman & Bell 2007). The author coded the transcripts while browsing the corresponding interview transcript copied to NVivo.

The coding process of the interview transcripts resulted in various nodes, which may be concepts or categories (Tappe 2002). The concepts were derived from the data itself rather than the author's preconceived ideas, theories or models (Bringer, Johnston & Brackenridge 2006). The author coded the interview transcripts by marking the texts that belong to the same conceptual theme and then each piece of the marked text (called "reference" in NVivo) was kept in the node. Creating free nodes (concepts) in NVivo is equivalent to the Open (Initial) coding in grounded theory (Charmaz 2006).

To have rigorous findings, the author discussed the resulting concepts with his research supervisors to assure the validity of the emerged concepts and categories. The supervisors' knowledge and experience were very useful to the author in terms of re-labelling, deleting, and re-assigning concepts to different categories (Strauss & Corbin 1998).

Repeated readings of the interview transcripts represent focused coding. The author opened each free node on the node viewer and read carefully all the referenced texts to enable him to, if necessary, assign texts into other categories, or to create (additional) subcategories. Accordingly, the concepts in each projects is a list of variables which came out of the open and focused coding, to facilitate deeper analysis of them, to shape hierarchical and structured nodes (Tree nodes). Table 8-1 to Table 8-6 show the concepts of each project. To protect confidentiality and anonymity of interviewees' identities, the author assigned the character "R" to denote to the respondent in each interview. For instance, "R1" stands for the first participant and so forth.

Table 8-1: The Concepts in Project 1 (R1)

#	Name	Memo Link	References
1.	Ambiguous, ill-defined Business Processes		2
2.	Changing Nature (emerging) of the Project	Yes	4
3.	Clinical Engagement Systems		1
4.	Diversity of IT applications		4
5.	Dynamics of Contractual Arrangements		6
6.	Dynamism of the Project	Yes	1
7.	End Users' Autonomy & Power		1
8.	End Users' Training (inappropriate)	Yes	2
9.	Generational Gap		2
10.	Individualistic Nature of the Practice		2
11.	Lack of HIS development experience (IT companies)		1
12.	Lack of Medical Input	Yes	3
13.	Lack of Technical Support		1
14.	Lack of Understanding of Clinical Processes - LSPs		2
15.	Lack of Uniformity (standardised) Clinical Processes		1
16.	Large scale of the project		1
17.	Non-Practising Clinicians	Yes	2
18.	Patient Safety	Yes	3
19.	Resistance to Usage		2
20.	Technological Problems		2
21.	Tension within and between end users groups		2
22.	The Importance of End Users' Role		3
23.	The Newness of the Contract		1
24.	The Newness of the Project		1
25.	Top Management Support and Championship		2
26.	Variation in IT familiarity or Experience		1
27.	Various Users Groups and Specialties		5
28.	Work Pressure	Yes	1

Table 8-2: The concepts in Project 2 (R2)

#	Name	Memo Link	References
1.	Changing (Creeping) Requirements		1
2.	Clinical Safety (reducing Patient's Risk)	Yes	5
3.	Complexity of the Software		1
4.	Difficulty in Reaching Consensus	Yes	3
5.	Generational Gap		1
6.	Lack of Clinical Input	Yes	5
7.	Lack of Interaction between the LSP and the Local NHS		2
8.	Lack of NHS Trusts' Involvement	Yes	4
9.	Lack of Senior Level's Medical Expertise		1
10.	Lack of Standardised Clinical Processes		7
11.	Lack of Top Management (NHS) Support		1
12.	Legal Implementation of Procedures vs. Guidance	Yes	2
13.	Limited Influence to Facilitate Software Usage	Yes	1
14.	Need for Enthusiastic People		1
15.	The Technological Nature of the Program	Yes	1
16.	Undocumented Tacit Knowledge - Absence of Externalisation		2

Table 8-3: The Concepts in Project 3 (R3)

#	Name	Memo Link	References
1.	Busy Clinicians (Lack of Time)		2
2.	Clinical Documentation		5
3.	Complexity of the Software	Yes	3
4.	Developer-User Communication Gap		1
5.	Difficulty in Realising the System's Benefits		2
6.	Existence of Workarounds		2
7.	Generational Gap		2
8.	Inability to Understand End Users' Requirements		2
9.	Inflexible Design of iPM (the old system)		2
10.	Innovativeness		2
11.	Integration and Information Sharing	Yes	3
12.	Unresponsiveness to End Users' Needs		3
13.	Lack of clinical Interaction between the System Developer and End Users		2
14.	Lack of End Users' Informatics Experience		3
15.	Lack of Representative Core Group	Yes	1
16.	Leadership and Championship		2
17.	Limited Time Scale for Deploying the System		2
18.	Long Time to Login (iPM)		1
19.	Morale of the Teamwork		1
20.	Need for Enthusiastic People		1
21.	Negative Perceptions about iPM		3
22.	Parallel Conversion Strategy		3
23.	System Development Methodology		2
24.	Teamwork		1
25.	Threat to System Security		2

Table 8-4: The Concepts in project 4 (R4)

#	Name	Memo Link	References
1.	Assigning Values for the Data Items (Schema)		1
2.	Cerner System		2
3.	Changing (Emerging) Nature of the Programme	Yes	3
4.	Clinical Decision Making		1
5.	Clinical Safety		4
6.	Clinical Standardistion and Documentation	Yes	1
7.	Creating Data Items (Schema)		3
8.	Critical Mass of system deployment wards		4
9.	Easiness of Engaging Wards in Deploying the System		1
10.	Focus on Single Organisations for Deployment (absence of Critical Mass)		1
11.	Highly Configurable System	Yes	6
12.	Intensity and Busyness ward's Working Day		2
13.	Lack of Benefits Realisation		1
14.	Lack of Clinical Input		2
15.	Lack of Local NHS (Bottom Level) Involvement		2
16.	Lack of NHS seniors' Understanding		1
17.	Lack of Practising Clinicians		2
18.	Lack of Top Management Support		2
19.	Limited Completion Time		2
20.	Need for a single Trust's Organisational Structure		1
21.	Need for strategic Partner (Service Providers)		2
22.	Political Influence on System Deployment		1
23.	Predictability of the System Deployment Environment		2
24.	Problem Recognition and Definition	Yes	2
25.	Representative Core Group of Users	Yes	2
26.	Rewards for Adopting the System		1
27.	Various System Deployment Environments		1

Table 8-5: The Concepts in Project 5 (R5)

#	Name	Memo Link	References
1.	Achievement of Long-term System Benefits		4
2.	Anxiety around Change		1
3.	Anxiety around System's Future Functionality		2
4.	Anxiety to using the System		0
5.	Bottom-Up Approach		3
6.	Compatibility of the System		1
7.	Determination of system's Strategic Objectives	Yes	2
8.	Fear of PC's replacement of people		1
9.	Generational Gap		1
10.	Lack of End Users' Early Involvement	Yes	13
11.	Lack of End Users' IT Experience		4
12.	Lack of Organisational Readiness		7
13.	Lack of Technical Support		2
14.	Measurement of System Benefits		2
15.	Newness of the System		5
16.	NHS Organisational Structure		1
17.	Non-Supportive NHS organisational Culture	Yes	9
18.	Political Influence		1
19.	Realisation of Benefits	Yes	3
20.	Stakeholders and Communications Management	Yes	6
21.	System Development Methodology		5
22.	System Requirements	Yes	2
23.	System's limited Functionality		2
24.	Top Management Support and Championship		3
25.	Top-Down Approach		3
26.	No realisation of Short-term System Benefits		3
27.	Various End User Groups		1

Table 8-6: The Concepts in Project 6 (R6)

#	Name	Memo Link	References
1.	Busy Clinicians	Yes	1
2.	Clinical Safety	Yes	4
3.	Configurability of LORENZO		5
4.	Disingenuous Importance of Clinical Safety		6
5.	Dynamics of the Contract	Yes	13
6.	Lack of Clinical Input		1
7.	Lack of End Users' Involvement		2
8.	Lack of Integrated Communications between DoH and CfH		1
9.	Lack of LSP's HIS Development Expertise		1
10.	Lack of Senior Level's Awareness of the Project		2
11.	Lack of Task-Technology Fit	Yes	1
12.	Local Ownership of Risk	Yes	4
13.	Reliance on LSPs to Standardise Clinical Processes		5
14.	Reporting System of Safety Issues		3
15.	Risk Assessment		7
16.	The Nature of the Programme		1
17.	The Old System	Yes	3
18.	User Acceptance Testing		5
19.	Variation in (Unstandardised) Clinical Process between and within NHS Organisations	Yes	5

8.3.4. Writing Memos

Strauss and Corbin (1998: 110) define memos as *"The researcher's record of analysis, thoughts, interpretations, questions, and directions for further data collection"*. Memos are written documentation of the researcher's impressions and description of the situation (Goulding 1999). Memo writing is essential for the development of theory (Bringer, Johnston & Brackenridge 2006).

As one can see from the tables above, memo links were attached to some concepts and each memo was tagged with exactly the same label that was given to the corresponding concept. The author intended to use memos as a way of prompting the analysis of data in the early research stage and guiding him to think of ways of connecting and comparing data. Memos were used as an analytical tool, for specifying potential linkages between categories and subcategories that can be utilised for conducting theoretical coding. memos were short and spontaneous as Charmtaz (2006) proposed. In addition, these notes were written after each interview conducted. The author intended to utilize memos as the means of documenting the non-verbal signals that express the interviewees' reaction.

By looking at the concepts in each project, one can notice that some of these concepts were repeated in more than one project with slight differences in labelling. For instance, "Non-Practising Clinicians" in project 1 (R1) is the same as "Lack of Practising Clinicians" in project 4 (R4). "Lack of End Users' Involvement" in project 6 (R6) is similar to "Lack of End Users' Early Involvement" in project 5 (R5) but, the word "early" denoted the engagement of end users from the beginning of determining the system's expected objectives. Moreover, "Lack of NHS Trusts Involvement" indicates the involvement of local NHS organisations at the trust level rather than the involvement of end users themselves, even though it could be considered as part of end users' involvement process.

The author intended not to unify the labelling of the same concepts, which were listed in more than one project, to reflect the spontaneity and speed of coding the transcripts. Spontaneity was essential to stimulate more free flow of thoughts and insights without being affected by the preconceived conceptual definitions of variables derived from the literature review. In addition, the author was aware of the fact that tagging nodes should be attached as much as possible to the data collected, which reflects the interviewees' own words and perspectives. This helps in deriving a theory, or new linkages of variables that are more grounded in the data collected (Strauss & Corbin 1990).

8.3.5. Creating Tree Nodes

The author transferred to a more advanced stage of data analysis by creating hierarchical, structured tree nodes (i.e. categories) that were analytical rather than merely descriptive. To create these categories, the author reviewed the free nodes (i.e. concepts) in each project, grouped the similar concepts into categories, developed subcategories, and finally showed the relationships (i.e. the linkages) within and between the categories and/or subcategories. Chapter 9 (theory building) shows these relationships, and how they were used to build the proposed theory. Table 8-7 to Table 8-12 below show the categories in each project.

Table 8-7: The Categories in Project 1 (R1)

Tree Node	Name
Clinicians' Attributes	End Users' Autonomy & Power End Users' Training (inappropriate) Generational Gap Variation in IT familiarity or Experience
Departmental Factors (The Nature of Working Environment)	Diversity of IT applications Individualistic Nature of the Practise Tension within and between end users groups Various User Groups and Specialties Work Pressure Non-Practising Clinicians
Dynamics of the Project	Changing Nature (emerging) of the Project Large scale of the project The Newness of the Project
The Nature of Clinical Processes	Ambiguous, ill-defined Business Processes Lack of Understanding of Clinical Processes - LSPs

	Lack of Uniformity (standardised) Clinical Processes
LSP Related Factors	Lack of HIS development experience (IT companies) Lack of Technical Support

Table 8-8: The Categories in Project 2 (R2)

Tree Node	Name
Clinicians' Attributes	Difficulty in Reaching Consensus Generational Gap
LSP Related Factors	Lack of Clinical Input Lack of Interaction between the LSP and the Local NHS Limited Influence to Facilitate Software Usage
Organisational Factors	Lack of Clinical Input Lack of NHS Trusts Involvement Lack of Senior Level's Medical Expertise Lack of Top Management (NHS) Support Legal Implementation of Procedures vs. Guidance Undocumented Tacit Knowledge - Absence of Externalisation
The Nature of the Programme	Changing (Creeping) Requirements Complexity of the Software The Technological Nature of the Programme

Table 8-9: The Categories in Project 3 (R3)

Tree Node	Name
Clinicians' Attributes	Busy Clinicians (Lack of Time) Generational Gap Lack of End Users' Informatics Experience
System Development	Parallel Conversion Strategy System Development Methodology
Teamwork	Innovativeness Leadership and Championship Morale of the Teamwork
System Related factors	Complexity of the Software Integration and Information Sharing Limited Time Scale for Deploying the System
The Old System (iPM)	Existence of Workarounds Negative Perception about iPM • Inability to Understand End Users' Requirements • Inflexible Design of iPM • Lack of Clinical Interaction between the System Developer and End Users • Long Time to Login (iPM) • Unresponsiveness to End Users' Needs Threat on System Security

Table 8-10: The Categories in Project 4 (R4)

Tree Node	Name
Clinical Standardization and Documentation	Assigning Values for the Data Items Creating Data Items (Schema)
Departmental Factors	Lack of Benefits Realisation Lack of Clinical Input Lack of Practising Clinicians Various System Deployment Environments • Critical Mass of system deployment wards • Easiness of Engaging Wards in Deploying the System • Intensity and Busyness of ward's Working Day • Predictability of the System Deployment Environment
Organisational (NHS) Factors	Focus on Single Organisations for Deployment (absence of Critical Mass) Lack of Local NHS (Bottom Level) Involvement Lack of NHS seniors' Understanding Lack of Top Management Support Political Influence on System Deployment Rewards for Adopting the System
Project Related Factors	Changing (Emerging) Nature of the Programme Highly Configurable System Limited Completion Time Problem Recognition and Definition

Table 8-11: The Categories in Project 5 (R5)

Tree Node	Name
Clinicians' Attributes	Anxiety in Using the System • Anxiety around Change • Anxiety around System's Future Functionality • Fear of PC's replacement of people Generational Gap Lack of End Users' IT Experience
NHS Organisational Structure	Bottom-Up Approach Top-Down Approach
Organisational Factors	Lack of End Users' Early Involvement Lack of Organisational Readiness NHS Organisational Structure Non-Supportive NHS organisational Culture Stakeholders and Communications Management Top Management Support and Championship
Departmental Factors	Realisation of Benefits • Achievement of Long-term System Benefits • Measurement of System Benefits • No Realisation of Short-term System Benefits Various End User Groups
System Related Factors	Compatibility of the System Determination of System's Strategic Objectives Newness of the System System Development Methodology System's Limited Functionality

Table 8-12: The Categories in Project 6 (R6)

Tree Node	Name
Clinical Safety	Disingenuous Importance of Clinical Safety Local Ownership of Risk Reporting System of Safety Issues Risk Assessment
LSP Related Factors	Lack of LSP's HIS Development Expertise Reliance on LSPs to Standardise Clinical Processes
Organisational Factors	Lack of Clinical Input Lack of Integrated Communications between DoH and CfH Lack of Senior Level's Awareness of the Project Lack of End Users' Involvement
The Nature of Clinical Processes	Lack of Task-Technology Fit Variation in (Unstandardised) Clinical Processes between and within NHS Organisations

One can see from the categories drawn that each participant discussed LORENZO implementation and highlighted the major issues s/he perceives important from his/her perspective, which, in turn, reflected the participant's position, background, and understanding of LORENZO. The various views were obtained by letting the participants talk freely about what they thought was important for LORENZO to succeed in practice.

8.3.6. Bringing all the Projects Together

To facilitate the analysis of data and capture all the relationships between the categories, the author decided to combine all of the six NVivo projects into one project, which was named "Merged Projects". To do so, NVivo offers an option of importing projects' concepts (free nodes), categories (tree nodes), memo links, and linkages between the concepts to one combined project. One point to bear in mind is that the author double-checked that the same categories were combined to form a comprehensive hierarchical category. The resulting core categories were illustrated in schematic diagrams (Models). These models enabled the author to see how the various concepts are linked together, and to read beyond participants' words to understand LORENZO implementation and to shed light on issues related to it.

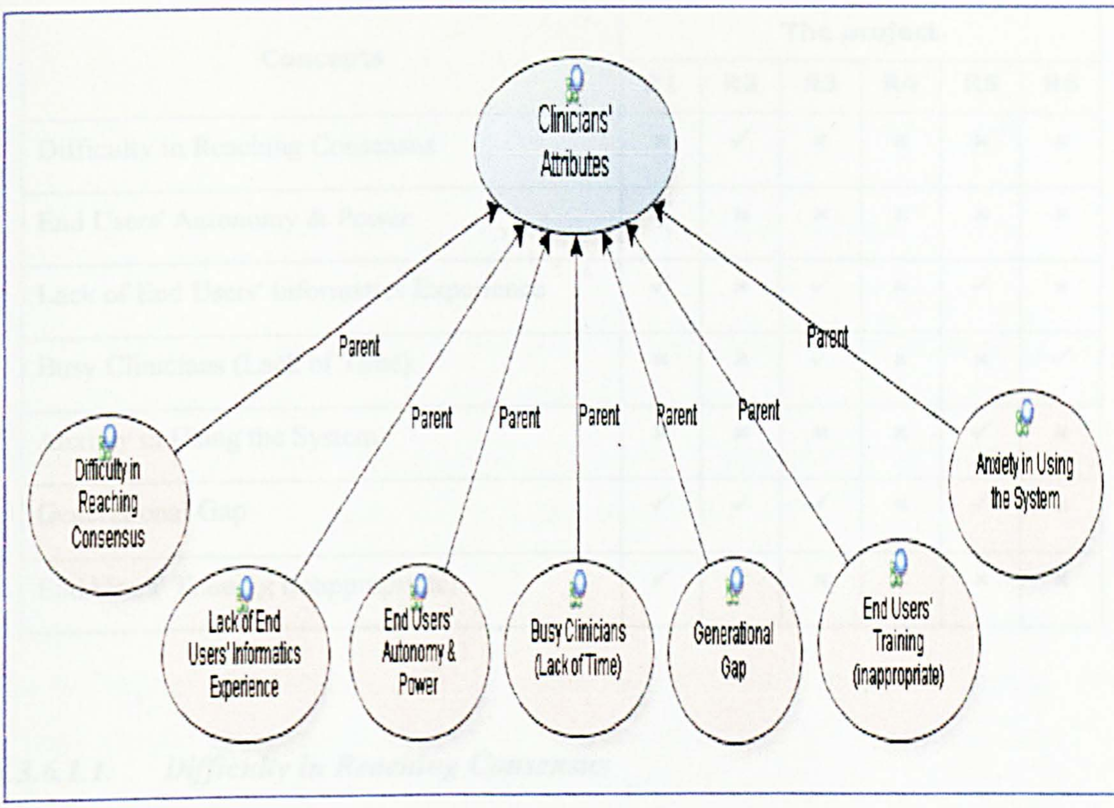
The author decided to include seven major (core) categories. These were *"Clinicians' Attributes"*, *"Departmental Factors"*, *"Organisational Factors"*, *"LSP Related Factors"*, *"System Related Factors"*, *"The Nature of Clinical Processes"*, and *"Clinical Safety"*. Each core category encompasses various concepts, and each one of these concepts provides partial representation of the category. In addition, the author explained, from the interviewees' point of view, all the concepts mentioned in the core categories supported/evidenced by references (i.e. coded texts or quotes). The build up of the categories and the explanation of the various concepts represent the first wave of the data analysis. The second wave of the analysis is discussed in the next chapter (theory building).

8.3.6.1. The First Category: Clinicians' Attributes

The first category is *"Clinicians Attributes"*. This category occurred in four projects. *Clinicians' attributes* category highlights how end users' traits influence and/or explain their acceptance of/resistance to using LORENZO. The author used clinicians to denote end users who are entitled to use LORENZO in the NHS. "Clinicians' Attributes" as a label of this category was given by the author and confirmed by his research supervisors.

Below, the author discusses the various concepts that emerged during the data analysis. Figure 8-1 demonstrates the concepts that were included in clinicians' attributes category without showing the links between them or the links between this category's concepts, and the other concepts from the other categories.

Figure 8-1: Clinicians' Attributes Category



The author emphasises the notion that the lower seven concepts, which are shown in the bisque colour in Figure 8-1, are not parents of the upper concept, which is illustrated in the blue colour. Instead, the lower seven concepts are sub-nodes (i.e. second order level 1) of the upper node (i.e. first order level 0). Despite the confusion one may have from this diagram, the author could not change the way the concepts are represented as these figures were produced by NVivo not by the author himself.

To have a clear picture of where the seven concepts came from, and how they were included in the *clinicians' attributes* category, Table 8-13 shows the source of each concept. The author would mention that different labelling was given sometimes to the same conceptual theme, yet, the author decided to use the tags of the concepts as shown in both Figure 8-1 and/or Table 8-13.

Table 8-13: The Sources of the Concepts in Clinicians' Attributes Category

Concepts	The project					
	R1	R2	R3	R4	R5	R6
Difficulty in Reaching Consensus	×	✓	×	×	×	×
End Users' Autonomy & Power	✓	×	×	×	×	×
Lack of End Users' Informatics Experience	✓	×	✓	×	✓	×
Busy Clinicians (Lack of Time)	×	×	✓	×	×	✓
Anxiety in Using the System	×	×	×	×	✓	×
Generational Gap	✓	✓	✓	×	✓	×
End Users' Training (inappropriate)	✓	×	×	×	×	×

8.3.6.1.1. *Difficulty in Reaching Consensus*

This concept was mentioned by R2 as shown in Table 8-13. This concept indicates the notion that the LSP faces a problem when dealing with the NHS in that there is no common agreement on what standardised practice is, or what should go into the system in terms of clinical content. The quotes R2 [1] and R2 [2] in the Appendices section illustrate this concept.

8.3.6.1.2. *End Users' Autonomy and Power*

Users' autonomy and power was mentioned by one respondent (R1) as shown in the quote below.

> *"The reality was the clinicians were being very very autonomous and we still had not got this within the groups themselves how to achieve consensus"* R1 [1]

Users' autonomy was represented in their tendency to refuse to use the new system (i.e. LORENZO). Users' authority led to difficulty in reaching consensus between users in terms of what should go into the system of data objects.

8.3.6.1.3. *Lack of End Users' Informatics Experience*

The labelling of this concept implies that NHS users lack experience of dealing with computers and IT in general. R3 and R5 mentioned this feature as shown in the quotes R3 [1] and R5 [1].

> *"In terms of clinicians, clinicians are trained to do clinical work and a lot of them say "We're not trained to work with computers" R5* (!)

R1, R3, and R5 stressed that most clinicians lack understanding of technology. This causes clinicians not to be aware of the software's limitations, what it can do or what it cannot do, and thus influenced negatively LORENZO implementation as people were required to deal with advanced IT-based medical solutions. R1 [2], R3 [2], and R5 [2] illustrate this view. The author discussed in section 2.3.3.3.2.2 of the Information Technology in the Healthcare Sector chapter (Organisational or Behavioural Barriers), that healthcare organisations lack the employees who are capable of dealing with technology, and managing successfully the implementation of EHR systems. Therefore, it is not surprising to find most clinicians in the NHS lack the required IT skills, and in turn leads clinicians to have concerns about, or fear of using such EHR systems.

However, lack of users' ability and understanding of the technology does not occur in all NHS organisations. Instead, R1 pointed out that in primary care, they had already used IT-based medical systems, whereas the problem lay in secondary care. He characterised this situation as 'feast or famine'. The quote R1 [3] symbolises this fact.

Despite the notion that most of NHS staff lack IT experience, R5 revealed that clinicians already had the chance to use IT-based medical solutions such as iPM, a PAS system that was introduced by CSC, and designed by iSOFT. The use of previous technologies might enable NHS staff to be more receptive to LORENZO. The quote R5 [3] indicates R5's view.

8.3.6.1.4. *Busy Clinicians (Lack of Time)*

The fourth theme that was included in *Clinicians' Attributes* category is the fact that clinicians are busy workers. R3 and R6 state the notion of busy clinicians as shown in the quotes R3 [3] and R6 [1].

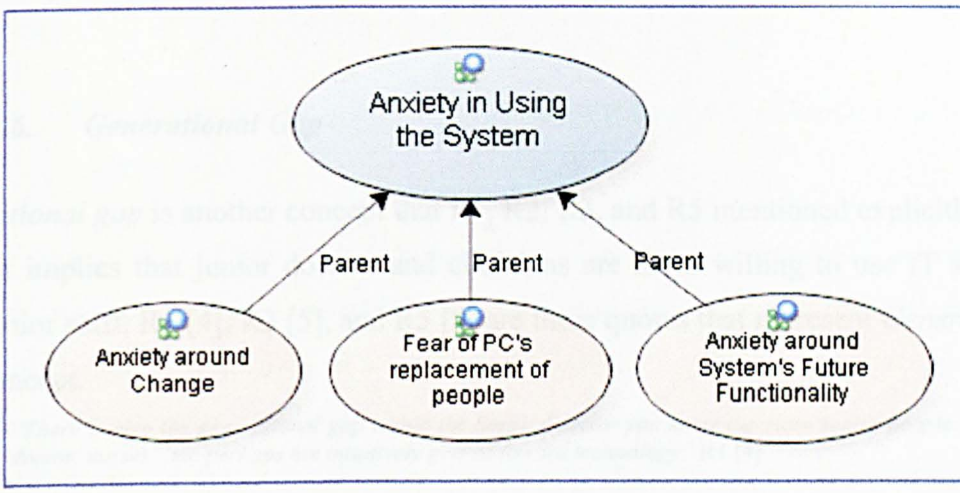
The author noticed that the busy nature of clinicians' work was mentioned by R3 and R6, who serve in the same early adopter NHS trust. This implies that when it comes to using the system in a real medical environment, people become more aware of the hindering factors to successful deployment of LORENZO or they were not prepared to. This fact led the author to argue that real users were not involved in the discussions and determination of the system's requirements because they hardly had enough time to do so, and consequently, senior (administrative) people, and supervisors were the only people who could afford time for seminars and meetings regarding LORENZO design and implementation.

Moreover, end users in the NHS may be reluctant to use a new IT system because they do not have enough time. This notion supports the idea that was discussed in section 2.3.3.3.2.2 of the Information Technology in the Healthcare Sector chapter (Organisational or Behavioural Barriers), that implementing EHR systems brings about changes in the way health service is provided, and as a result organisational changes (e.g. work redesign) should take place in healthcare organisations. These changes take enormous time from both administrative and clinical staff to perform, who thus may refuse to use EHR systems. This had already occurred in the NHS when people refused to use iPM. Their refusal was based on the premise that people took too long logging on to the system as shown in the quote R3 [4].

8.3.6.1.5. Anxiety in Using the System

Only R5 mentioned the fact that NHS users have anxieties about the use of LORENZO. Users' anxieties stem from the newness of LORENZO. The author conducted focused coding and categorised further the references in *Anxieties in Using the System* concept, into three separate sub-concepts as demonstrated in Figure 8-2. One point to bear in mind is that the concepts, which form the *Anxieties in Using the System* subcategory, are considered as third level (level 2) in the *Clinicians' Attributes* core category.

Figure 8-2: Anxiety in Using the System Subcategory



The first concept is *Anxiety around Change*; change is strongly associated with the deployment of LORENZO. The newness of the system caused uncertainty in end users' minds, as they were not aware of the future consequences of the new system. It is obvious from quote R5 [4] that, end users had not been informed enough in order to reduce their anxieties.

The second concept is *Anxiety around System's Future Functionality*. The author argues that the methodology by which LORENZO was developed (Deployment Units), caused suspicions regarding the potential of LORENZO in solving users' problems. Suspicions stem from the incompleteness of the system's deployment units. The quotes R5 [5] and R5 (6) reflect this notion.

The third concept is *"Fear of PCs Replacement of People"*. The fear of using IT was caused by the fact that computerising clinical processes in the NHS will displace end users, as their jobs will be performed electronically and there will be no requirement to keep end users as the quote R5 [7] reveals. Furthermore, as we saw in section 2.3.3.3.2.3 of the Information Technology in the Healthcare Sector chapter (Technical Barriers), end users in healthcare organisations feel that technology will replace, or outperform them, and thus they feel insecure when interacting with computer systems. In addition, the author discussed in section 2.3.3.3.1.4 of the Information Technology in the Healthcare Sector chapter (Cultural Barriers), that clinicians may not feel comfortable with using IT systems because these systems are still new in medicine, and can cause privacy problems. As a result, health professionals are intimidated by the use of IT.

8.3.6.1.6. Generational Gap

Generational gap is another concept that R1, R2, R3, and R5 mentioned explicitly. This concept implies that junior doctors and clinicians are more willing to use IT systems than senior staff. R1 [4], R3 [5], and R5 [8] are three quotes that represent *Generational Gap* concept.

> *"There is also the generational gap within the hospital sector you know the more senior people doctor, nurses...etc perhaps not intuitively geared toward technology"* R1 [4]

The author has discussed in section 3.3.3 of the Successful Implementation of IT Projects chapter (IS Failure and User Resistance), that the internal characteristics of users, such as age and gender cause resistance to using computer systems. Furthermore, research scholars for instance (Ajzen 1991, Davis 1989, Ajzen & Fishbein 1980, Fishbein & Ajzen 1975), have emphasised the impact of users' ages and generations on the adoption of innovation. Thus, the generational gap can be seen as a barrier to LORENZO acceptance.

However, the author should mention the fact that people in the NHS who plan training programmes should not be affected by the negative stereotypes and prejudices regarding older workers. This is because field research did not identify a relationship between age and employee productivity (Waldman & Avolio 1986, Rhodes 1983).

8.3.6.1.7. End Users' Training (inappropriate)

End users' Training is another concept the author thought it was imperative to mention, which may explain end users' resistance to using LORENZO components. The references R1 [5] and R1 [6] represent this concept.

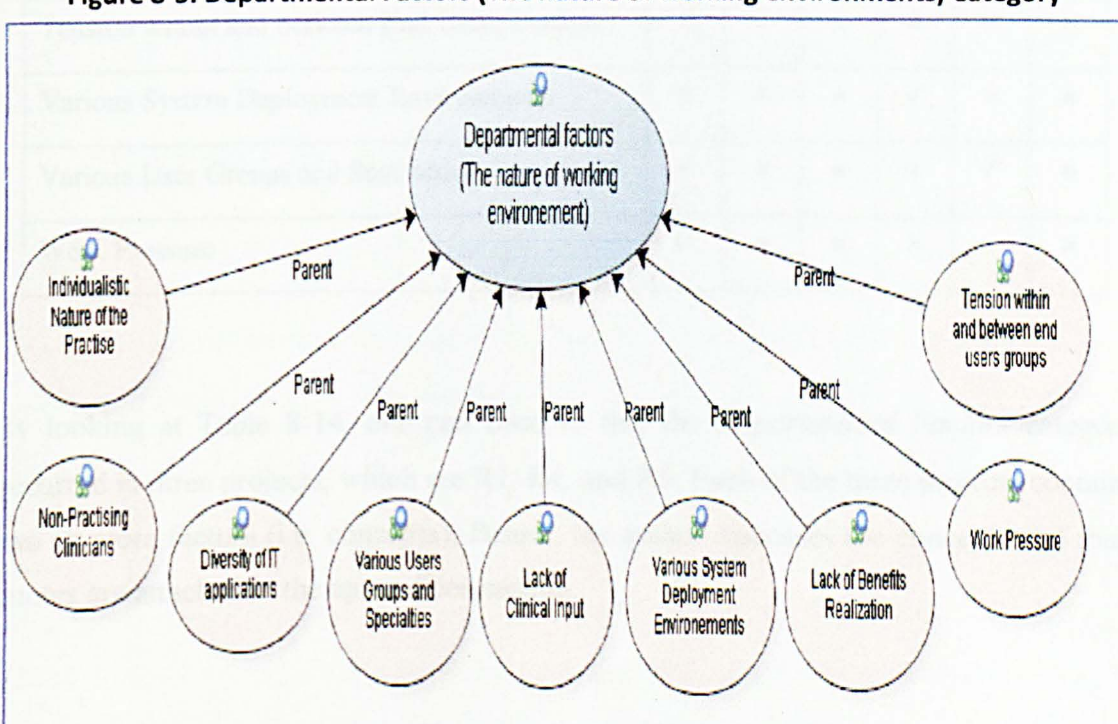
> *"Training has to be made simple"* R1 [6]

We saw in section 3.5.4 of the Successful Implementation of IT Projects chapter (User Training), training is the responsibility of organisations and thus, is considered as one of the organisational related factors. Yet, the author decided to include *End Users' Training* concept in the *Clinicians' Attributes* category, because the skills end users normally gain from training sessions are transferable and associated with end users themselves.

8.3.6.2. The Second Category: Departmental Factors (nature of working environment)

The second major category is *Departmental Factors*. This category encompasses concepts that describe the nature of the working environment in the bottom line of the NHS. For instance, the wards in a certain hospitals or the various medical specialities that compose a medical journey, through which patients pass to get health care. The reason for assigning this label was to distinguish it from the organisational factors that will be discussed later on in this chapter. Organisational factors are broader than departmental factors in the sense that they are closely attached to the top hierarchical levels of the NHS. Organisational factors stem from a trust, a **S**trategic **H**ealth **A**uthority (SHA) or the NHS **C**onnecting **f**or **H**ealth (NHS CfH) level, whereas departmental factors are work practises, or factors influencing the working environment at the local level of the NHS, where there is direct contact with patients and consequently, the real users of the system. Figure 8-3 displays the nine concepts of the *Departmental Factors* category without showing the relationships between the concepts. The author discusses these concepts and identifies the source of each one of them as shown in Table 8-14.

Figure 8-3: Departmental Factors (The nature of working environments) Category



The high number of departmental factors was expected by the author as most of the participants were ex-NHS workers or still working in the NHS. This fact contributed in highlighting issues that they thought were imperative for enhancing users' understanding and acceptance of LORENZO. Table 8-14 shows, in which interview transcripts the nine concepts were mentioned. The author emphasises that some of the concepts were listed in multiple core categories. For example, *Lack of clinical input* is a concept that was mentioned in the *Organisational Factors*, *Departmental Factors*, and *LSP Related Factors*. *Lack of clinical input* means that the development of the system (i.e. LORENZO) was not enough clinically driven. Therefore, to obtain better understanding of this issue the author assigned this concept to different core categories.

Table 8-14: The Sources of the Concepts in the Departmental factors Category

Concepts	The project					
	R1	R2	R3	R4	R5	R6
Diversity of IT Applications	✓	×	×	×	×	×
Individualistic Nature of the Practise	✓	×	×	×	×	×
Lack of Benefits Realisation	×	×	✓*	✓	✓	×
Lack of Clinical Input	✓*	✓*	×	✓	×	✓*
Non-Practising Clinicians	✓	×	×	✓	×	×
Tension within and between End Users Groups	✓	×	×	×	×	×
Various System Deployment Environments	×	×	×	✓	×	×
Various User Groups and Specialties	✓	×	×	×	✓	×
Work Pressure	✓	×	×	×	×	×

By looking at Table 8-14, one can observe that the *Departmental Factors* category occurred in three projects, which are R1, R4, and R5. Each of the three projects contains two or more factors (i.e. concepts). Below, the author discusses the concepts and their quotes are attached in the appendices section.

8.3.6.2.1. Diversity of IT Applications

Diversity of IT applications or solutions was mentioned by R1. He stated that under the NPfIT programme, there were various IT solutions such as Choose and Book and PACS. These systems were different from NHS Care Records Service (NHS CRS) in terms of their simplicity and scope. The author has discussed the NPfIT systems in section 4.4 of The NPfIT in the NHS in England chapter (Components of the NPfIT). Thus, taking into account the success of PACS as an indication of users' acceptance was misleading. The quotes R1 [7] and R1 [8] illustrate this concept.

The author considered this concept as one of the departmental factors because these IT solutions were applied in the various departments, for instance, PACS is used to store, retrieve, and transfer images between GPs or doctors to offer health service to patients. These departmental systems were diverse and the challenge was how to integrate/unify them. The challenge stems from the administration side of PAS as indicated in the quote R1 [9].

8.3.6.2.2. Individualistic Nature of the Practise

The individualistic nature of medicine is crucial in understanding the context, within which people work. This autonomy causes difficulty in reaching consensus among clinicians, that might also cause difficulty in standardising clinical processes by setting Standard Operating Procedures (SOPs). The quotes R1 (10) below and R1 (11) indicate this concept.

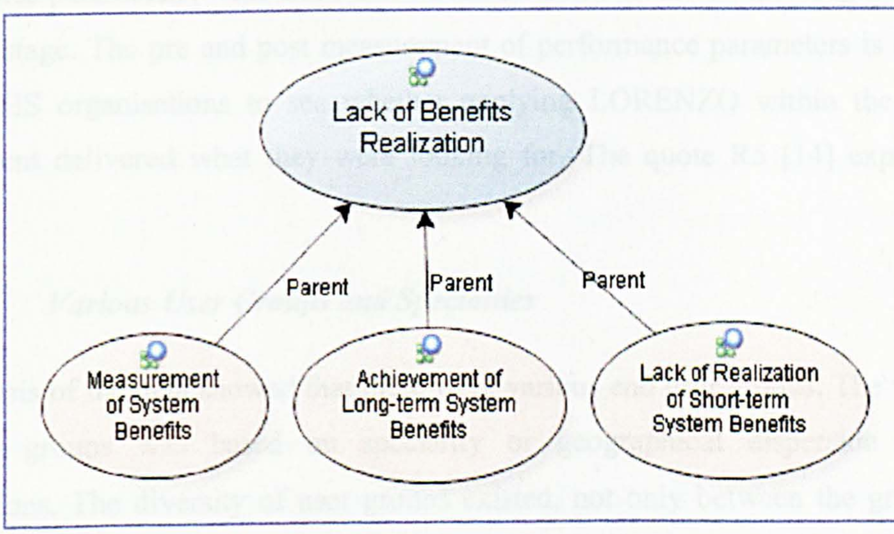
> *"Medicine does not work through protocol guidelines, it is very very individualistic and to achieve consensus among different groups of clinicians is very difficult"* R1 [10].

8.3.6.2.3. Lack of Benefits Realisation

Lack of Benefits Realisation is a concept within the *Departmental Factors* category. It is related to the advantages end users get from using the system. R3, R4, and R5 highlighted this theme. The star on the top of the check mark in R3 column relates to the fact that this concept was not included under a category labelled departmental factors in R3. The author decided to categorise concepts into hierarchical categories when there were two or more concepts representing the same notion, and for this reason; lack of benefits realisation was not included under the departmental factors category in R3. Realising system's benefits is important as it encourages end users to use the system. However, this seemed not to be an easy task as mentioned by R3 and R5. The author believed that this concept should be included under the *Departmental Factors* category because realising the benefits takes place in medical and surgical wards when real users apply the system in their daily operations. R3 [6] and R6 [2] indicates the Lack of Benefits Realisation concept.

The analysis of the data revealed that there were three main themes regarding the realisation of benefits. Figure 8-4 illuminates the concepts comprising realisation of benefits category.

Figure 8-4: Lack of Benefits Realisation Category



R5 explained that the implementation of LORENZO occurs in two main phases, the first phase when an NHS organisation decides to deploy one of LORENZO's deployment units in a contained, limited environment. The second phase takes place when that organisation decides to roll out this deployment unit in other parts of the organisation. The first phase of the implementation prevented end users from realising immediate (short-term) benefits. For more details about how LORENZO deployment units are deployed in the NHS organisations, see section 4.6.2 of The NPfIT in the NHS in England chapter (Deployment Process of LORENZO). R5 [9] and R5 [10] shows the process of LORENZO implementation and its consequence on benefits realisation by end users.

Another issue that faced end users in terms of realising the benefits was that LORENZO's development methodology made it difficult for NHS users to see the full potential of LORENZO and to plan for future benefits. This difficulty was because the system had not been fully implemented (functional), in terms of deploying the whole set of deployment units, and thus resulted in the incapability of deployment units to communicate with each other. The quotes R5 [11], R5 [12], and R5 [13] illustrate the influence of LORENZO development methodology on benefits realisation.

R5 claimed that any NHS organisation that wanted to deploy LORENZO had to have a formal measurement of benefits, in order to be able later on to compare the current performance parameters, with those that would be achieved after deploying LORENZO at a later stage. The pre and post measurement of performance parameters is crucial to enable NHS organisations to see whether applying LORENZO within the working environment delivered what they were looking for. The quote R5 [14] explains this notion.

8.3.6.2.4. Various User Groups and Specialties

The analysis of the data showed that there were various end user groups. The variety of end user groups was based on speciality or geographical dispersion of NHS organisations. The diversity of user groups existed, not only between the groups, but also within the groups themselves. This might be caused by the fact that the practise of medicine is very individualistic, and thus, it would be difficult to reach consensus between end users within the same speciality. R1 and R5 referred to this theme in their discussion about LORENZO implementation as shown in the quotes R1 [12], R1 [13], and R5 [15].

> *"To achieve consensus among different groups of clinicians is very difficult... Diversity was between those groups, within those groups"* R1 [13]

8.3.6.2.5. Tension within and between End User Groups

R1 argued that because medicine is individualistic in nature, which causes heterogeneity in user groups, there was tension between the various specialities or the geographically dispersed NHS organisations. He also confirmed the fact that tensions existed, not only between the groups but also within the same group. Group tension took place at the same level between the users themselves, or between the hierarchical levels of the group, such as the user and his/her manager. The quotes R1 [14], R1 [15], and R1 [16] highlighted this notion.

8.3.6.2.6. Non-Practising Clinicians

This concept relates to the fact that LORENZO's specifications were believed to be better negotiated or determined by people practising clinical work at the local level of NHS organisations, who have full knowledge of the operational design of clinical processes.

> *"I mean these systems can't be specified by IT people or informatics people, you have got to have real-time practising clinicians involved in that whole requirement stage"* R4 [1]

Despite LSPs' assertion that it employed clinical people in their staff, who are capable of articulating system requirements from a clinical point of view, it lacked the sharp focus as they were isolated from the practical day-to-day operations in the NHS organisations. Thus, to overcome this dilemma, R4 suggested that clinicians should be able to practise their work in the NHS, and allocate some of their time for discussions and meetings regarding LORENZO's specifications. R4 [2] and R4 [3] indicate this view.

The lack of these contracts (part time contracts) in the NHS led staff to abandon either the NHS or the LSP's company in order that people maintained a focused and broad understanding of what they were doing. R1 is an example of those people who left LORENZO's LSP to return to the NHS to be better informed of NHS' operational practices as one can notice from the quote R1 [17].

8.3.6.2.7. Work Pressure

R1 stressed the notion that NHS clinicians are not only busy, but also working under pressure. The quote R1 [18] denotes this concept.

It can be noticed that *Work Pressure* is closely related to the *Non-practising clinicians* (see 8.3.6.2.6), and *Busy Clinicians (Lack of Time)* (see 8.3.6.1.4). The idea behind this relation is that work pressure, and the very demanding and busy nature of work in the NHS does not allow clinicians to work in the supply side of the programme (i.e. in the LSP company).

8.3.6.2.8. Lack of Clinical Input

The *Lack of Clinical Input* concept was mentioned in the *Departmental Factors* category in R4. In R1, lack of medical input was represented as a tree node that combined all of the categories in R1. Lack of clinical input was mentioned also in R2 as a concept in *LSP Related Factors* category, and the *Organisational Factors* category. In R6, it was mentioned in the *Organisational Factors* category. In this section, the author explains *Lack of Clinical Input* within the context of *Departmental Factors.*

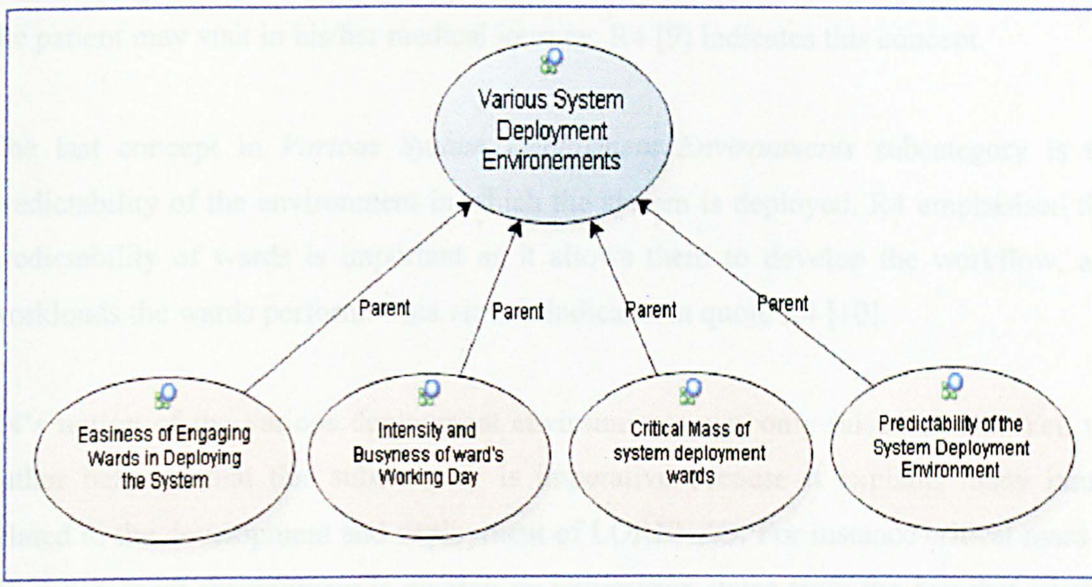
In the beginning of the NPfIT, LORENZO was not sufficiently clinically led or driven. This did not mean that there were no initiatives aimed at engaging clinicians in the determination of system's specifications, but their influence was minor. This notion was confirmed by both R4 and R6 who stated that 80 clinicians as the core representative clinical group was not enough for the enormous scale and complexity of the programme. R4 [4] and R6 [3] illustrate this notion.

Despite the fact that clinical input was insufficient, representative advisory groups were appointed by CSC, NHS CfH, and iSOFT to design most of the system's capabilities. These three groups designed 80% of the capability for end users and the rest was left for the local NHS organisation in the form of local customisation to accommodate the individual differences in work practises between NHS organisations as shown in quote R4 [5].

8.3.6.2.9. Various System Deployment Environments

The last, but not the least subcategory, *Various System Deployment Environments* is about the fact that there are multiple environments within which LORENZO could be piloted, and tested before rolling it out. This notion was mentioned by R4 who is the head of health informatics in one of the NHS trusts. His thorough knowledge and experience in health informatics helped in forming a four-concept subcategory to obtain better understanding of the *Various System Deployment Environments* concept. Figure 8-5 demonstrates the subcategory.

Figure 8-5: Various System Deployment Environments Subcategory



R4 mentioned that any NHS organisation intending to deploy LORENZO should consider the nature of the ward(s) in which LORENZO will be operating. He claimed that there were criteria that should be taken into account before choosing the ward(s) in order that the benefits of the system are maximised. In this context, he stressed on the distinction between medical and surgical wards, and he preferred to deploy LORENZO in the surgical wards rather than the medical wards as illustrated in the quote R4 [6].

R4's choice of wards that will be considered as LORENZO's deployment environments is based upon the ease of engaging them in the deployment of the system. R4 [7] denotes this criterion.

Additionally, the busyness of wards is of importance when it comes to deploying LORENZO. Busyness refers to the nature of the working day in that ward, is it busy all the time, or does the workload have peaks and troughs? The quote R4 [8] exemplifies this view.

The third criterion that R4 perceived essential is the critical mass of the wards. When the author asked R4 what he meant by critical mass, he stated that critical mass refers to the coverage of the medical journey. For instance, surgery in R4's hospital covers three main wards and all of them were engaged in LORENZO. This indicates that the system supports the teams' medical decisions regarding patient health in the various wards that the patient may visit in his/her medical journey. R4 [9] indicates this concept.

The last concept in *Various System Deployment Environments* subcategory is the predictability of the environment in which the system is deployed. R4 emphasised that predictability of wards is important as it allows them to develop the workflow, and workloads the wards perform. This view is indicates in quote R4 [10].

R4's notion of the various deployment environments was only raised by R4. Yet, the author believes that this subcategory is imperative because it explains many issues related to the development and deployment of LORENZO. For instance critical mass of the deployment environment is pivotal; its importance stems from the fact that when a patient's journey is covered by the system, this will assist users in realising the benefits of the system, such as tracking and retrieving information about a patient who may need to travels between different wards to get health care.

8.3.6.3. The Third Category: Organisational Factors

The third core category is *Organisational Factors*. The *Organisational Factors* category has the lion's share in terms of the number of the concepts that comprised this category. Figure 8-6 exhibits the concepts of the *Organisational Factors* category without showing the relationships between these concepts.

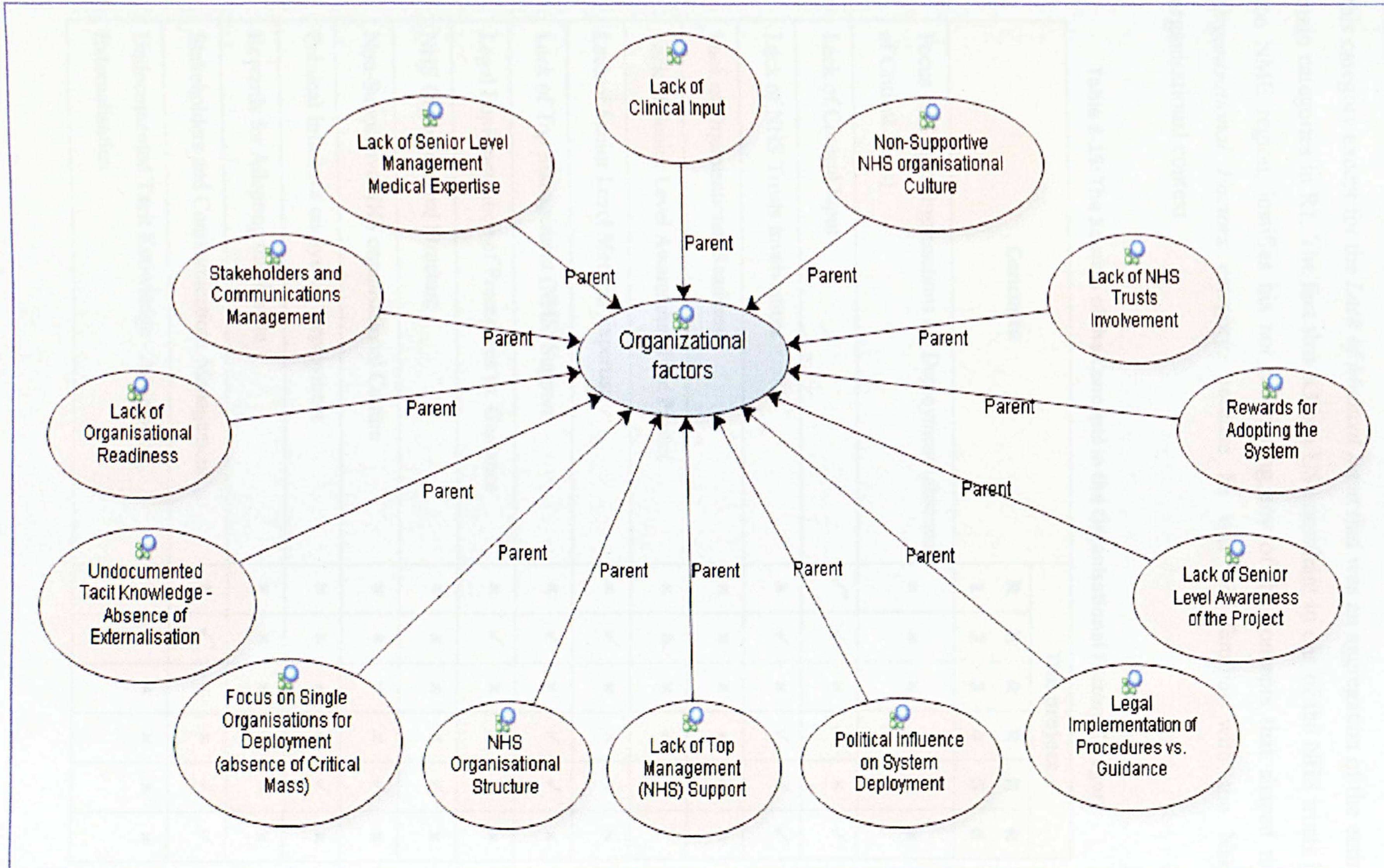


Figure 8-6: Organisational Factors Category

By looking at Table 8-15, one can notice that the *Organisational Factors* category was mentioned in four projects, which are R2, R4, R5, and R6. R1 and R3 did not mention this category except for the *Lack of Medical Input* that was an aggregation of the entire main categories in R1. The fact that R3 is a US consultant in one of the NHS trusts in the NME region, justifies his not mentioning any of the concepts that shaped the *Organisational Factors* category, because he was not familiar with the NHS organisational context.

Table 8-15: The Sources of the Concepts in the Organisational Factors Category

Concepts	The project					
	R 1	R 2	R 3	R 4	R 5	R 6
Focus on Single Organisations for Deployment (absence of Critical Mass)	×	×	×	✓	×	×
Lack of Clinical Input	✓*	✓	×	✓*	×	✓
Lack of NHS Trusts Involvement	×	✓	×	✓	✓	✓
Lack of Organisational Readiness	×	×	×	×	✓	×
Lack of Senior Level Awareness of the Project	×	×	×	✓	×	✓
Lack of Senior Level Medical Expertise	×	✓	×	×	×	×
Lack of Top Management (NHS) Support	×	✓	×	✓	✓	×
Legal Implementation of Procedures vs. Guidance	×	✓	×	×	×	×
NHS Organisational Structure	×	×	×	×	✓	×
Non-Supportive NHS organisational Culture	×	×	×	×	✓	×
Political Influence on System Deployment	×	×	×	✓	✓	×
Rewards for Adopting the System	×	×	×	✓	×	×
Stakeholders and Communications Management	×	✓*	×	×	✓	✓
Undocumented Tacit Knowledge - Absence of Externalisation	×	✓	×	×	×	×

The author discusses the 14 concepts that were mentioned in the *Organisational Factors* category.

8.3.6.3.1. Focus on Single Organisations for Deployment (Absence of Critical Mass Factors

This concept was merely mentioned by R4, who stressed the fact that the deployment of LORENZO is still confined to a limited number of organisations. This fact prevented the NHS' staff from seeing the full potential of LORENZO as one can see from quote R4 [11].

Even with the early-adopter project, few NHS organisations were able and willing to try the system on-site. For instance, R4 mentioned that Morecambe Bay, South Birmingham, and Blackburn had deployed LORENZO. Deploying the system in limited sites is not enough to realise the benefits of LORENZO.

> *"I think what the NHS needs to do is learn from what is happening in places like Morecambe Bay, Blackburn, South Birmingham"* R4 [12].

8.3.6.3.2. Lack of Clinical Input

Lack of Clinical Input was discussed as a variable in the *Departmental Factors* category as one can see in section 8.3.6.2.8 (Lack of Clinical Input8.3.6.2.8). Analysis of the data also showed that the lack of clinical input took place within the organisational context. For instance, R2 revealed that lack of clinical input took place at SHA level, and clinicians were not influential as shown in the quotes R2 [3], R2 [4], and R2 [5]. *Lack of Clinical Input* also occurred in the LSP side and thus, the author discusses it later, when it comes to explaining the LSP related factors tree node.

8.3.6.3.3. Lack of NHS Trusts' Involvement

Lack of NHS Trusts' Involvement is the most frequent concept in the *Organisational Factors* category. This concept was mentioned in four projects: R2, R4, R5, and R6. *Lack of NHS Trusts' Involvement* indicates that there is a lack of engagement and involvement by users, who are situated in the bottom line or the local NHS organisations.

There is a misconception in the NHS about LORENZO, which assumes that it is only an IT initiative that is designed to digitise clinical processes. Instead, LORENZO is an IT-based medical solution, which is supposed to drive change in the way NHS runs its services as was described by R5 (see quote R5 [16]). In order for change to occur end users should be involved enough, and participate in re-designing clinical processes as was suggested by R5 (see R5 [17] and R5 [18]).

Thus, one can see an increased importance of the role of end users in the NHS under the NPfIT. The importance of end users was mentioned by R1 (see R1 [19]). The quote R1 [19] indicates that the system's complexity and scale necessitate the NHS undertake an incremental approach for implementing the project. This needs the involvement of the lower levels of NHS organisations. However, one should bear in mind that user involvement affects positively the IS success if, and only if, users share agreed upon system requirements as one can see in section 3.5.2 of the Successful Implementation of IT Projects chapter (User Involvement).

The author stresses the fact that end users involvement should be present from the outset of determining the expected outcomes of the system. As this is considered as a strategic step in deploying the system, senior people in NHS organisations were mostly engaged in the numerous discussions. Accordingly, end users did not have a clear idea about the system's goals and benefits. The quote R5 [19] exhibits this aspect.

The author believes that, one of the possible reasons that involvement is confined to the upper levels of NHS organisations is that when it comes to discuss strategic issues regarding the development of the system, most probably people who participate are in senior positions as was mentioned by R6 (see the quote R6 [4]). Additionally, the real users who provide health care to patients are busy and do not have enough time to discuss system's requirements as we saw in section 8.3.6.1.4 (Busy Clinicians (Lack of Time)).

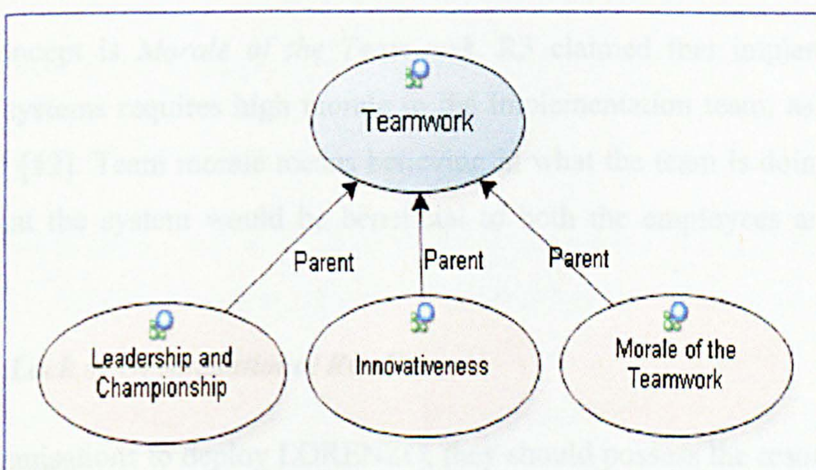
Moreover, end users must have the enthusiasm to take their roles in determining system specifications. The notion of enthusiastic users was highlighted by R2 and R3, as shown in the quotes R2 [6] and R3 [7].

Regarding the involvement of the bottom-level NHS organisations, R2 suggested that Primary Care Trusts (PCTs) should be considered to play a greater role in the determination of the system requirements, as they are the commissioners of health services (see the quote R2 [7]), and as we saw in section 4.1 of The NPfIT in the NHS in England chapter (Background of the NHS). Therefore, PCTs are more informed about information requirements of their NHS organisations.

R5, who had had the chance to work in the NHS, postulated that the NHS does not have a working environment that encourages teamwork, which is beneficial for the NHS people to share/exchange their experiences. The quote R5 [20] shows this notion.

R3 suggested that certain characteristics be available in teams to enable them to succeed in their representation and contribution of setting the system's requirements. For simplicity, the author constructed a separate subcategory called *Teamwork*, which encompasses three sub-concepts. The concepts are *Innovativeness*, *Morale of the teamwork*, and *Leadership and Championship*. Figure 8-7 depicts these concepts.

Figure 8-7: Teamwork Subcategory



As we saw in section 2.2.4.2.1 of the Information Technology in the Healthcare Sector chapter (Rapid Application Development (RAD), teamwork is one of the most important pillars, on which information system development methodologies stand, especially the phase-based IS methodologies such as prototyping. R3 emphasised the importance of having teamwork that has special characteristics to enable end users and management to succeed in systems implementation (see the quote R3 [8]). R3 declared that although having a professional team is essential/desirable, this type of team is rarely found in the NHS.

The first concept in the *Teamwork* subcategory is *Leadership and Championship.* The IT adoption literature considers good leadership and the existence of a "champion" crucial as we saw in section 3.5.6 of the Successful Implementation of IT Projects (Championship). The champion is the one who initiates the implementation of innovation, and pushes the company toward more successful implementation of IT (Kamal 2006). The quotes R3 [9], and R3 [10] indicates the first concept in *Teamwork* subcategory.

Innovativeness is the second concept, which measures the degree to which an individual, group, or an organisation is early, or late in adopting the new idea (Rogers 2003). Perceived innovativeness in the domain of IT as Agarwal and Prasad (1998b) labelled it, may give some indication regarding the risk people are willing to take to be early adopters of the system. R3 emphasized the role of innovativeness in enhancing successful deployment of the system as indicated in the quote R3 [11].

The third concept is *Morale of the Teamwork.* R3 claimed that implementing new information systems requires high morale in the implementation team, as indicated in the quote R3 [12]. Team morale means believing in what the team is doing, and being convinced that the system would be beneficial to both the employees and the entire organisation.

8.3.6.3.4. Lack of Organisational Readiness

For NHS organisations to deploy LORENZO, they should possess the resources needed for systems deployment. Readiness of NHS organisations entails having not only the physical resources such as the IT infrastructure, but also the skills, competencies, and the reservoir of knowledge. The notion of organisational readiness in terms of the availability of resources was mentioned by R5 as shown in the quote R5 [21], and in section 3.5.5 of the Successful Implementation of IT Projects chapter (Availability of Resources).

Despite the fact that organisational readiness is essential for NHS organisations to succeed in their system deployments, there is a lack, and underestimation of competencies and resources, which are needed to host the system and use it as stated by R5 [22].

This lack or underestimation of resources is caused by, as stated by R5, the fact that people inside the NHS look at LORENZO as an IT initiative rather than a business change aiming at improving the efficiency of clinical processes. R5 [23] indicates this notion.

8.3.6.3.5. Lack of Senior Level Awareness of the Project

Both R4 and R6, see the quotes R4 [13] and R6 [5] respectively, stated that there is a lack of awareness, which takes place at the higher levels of the NHS, in terms of the nature of the programme, and what benefits the system delivers to its users.

8.3.6.3.6. Lack of Senior Level Management Medical Expertise

R2, as one can see from the quote R2 [8], pointed out that the senior level management in the NHS lacks medical experience, which restricts their understanding of either the nature of the system, or the clinical processes carried out by clinicians.

8.3.6.3.7. Lack of Top Management (NHS) Support

As one can notice from Table 8-15, *Lack of Top Management (NHS) Support* occurred in R2, R4, and R5. Top management support is considered as a key issue in deploying new IT systems (Jeyaraj, Rottman & Lacity 2006, Kim & Bretschneider 2004) as we saw in section 3.5.1 of the Successful Implementation of IT Projects chapter (Top Management Support). This support is provided in terms of encouragement, sponsorship, or engagement in the system being deployed by informing the bottom organisational layers about the expected benefits of the programme through top-down communication channels. The quotes R4 [14], R4 [15], and R2 [9] reveal this view.

> *"I do not think that the NHS actually put in as much support as they should be doing into the deployment"* R2 [9]

Even though top management support is a key in deploying LORENZO, it has not been shown that NHS provided enough support to the programme or encouraged end users to be involved in the deployment process. Lack of top management support, as stated by R2, is a consequence of the newness of the programme, and due to the LSPs' lack of understanding of clinical processes, in particular and the NHS as an organisation in general. The quote R2 [10] indicates this notion.

8.3.6.3.8. Legal Implementation of Procedures vs. Guidance

R2 stated that people in the NHS are not forced to follow standard operating procedures or instructions, as end users are the source of knowledge in the NHS have authority and power, and are qualified enough to do the job of accomplishing clinical processes.

Moreover, the notion of either having legal procedures of implementation, or just constructing guidance that assists end users in implementing their work, is similar to the notion of what is mandatory, or optional in terms of system usage. The similarity is based on the ground that clinicians in the NHS used to have just guidance rather than "must be done" rules of performing. This might have become a basic and transferable rule applied in the implementation of LORENZO. Clinicians did not perceive the use of the system as mandatory; instead, they were given the choice of using either the old or the new system. This also applied to NHS organisations that decided on the use of the system, whether they are going to use the system or not based on their readiness. R4 [16] supports the notion of optional usage of LORENZO.

The notion of what is optional or compulsory usage of the system was mentioned by the chief clinical officer Michael Thick (NHS Connecting for Health 2007a). In this sense, R4 suggested that the NHS should encourage clinicians to use the system instead of forcing them to use it, by showing them the benefits of the system.

8.3.6.3.9. NHS Organisational Structure

The structures of NHS organisations have a direct influence on LORENZO implementation. Most NHS organisations are characterized by having hierarchical, top-down structures as stated by R5 and evidenced in quote R5 [24].

> *"In terms of standard organisational bureaucracy and the shape of an organisation, they're all hierarchical, you know, they're all triangles"* R5 [24].

R5 emphasised the two major types of organisational structures that she thinks affect the implementation of LORENZO. These types are top-down and bottom-up organisational structures. In addition, R5 linked the success of the deployment of LORENZO to the type of the organisational structure that exists in the adopting organisation. A bottom-up organisational structure assumes that clinicians at the bottom level of the organisation should be more involved in stating their information needs through open communication channels as one can see from the quote R5 [25].

In contrast, the top-down triangle-like organisational structure is dominant in the NHS. This type of organisational structure limits the success of systems deployed, and inhibits clinicians from being an influential part in the determination of the system's requirements as one can see from the quote R5 [26].

8.3.6.3.10. Non-Supportive NHS organisational Culture

R5, as shown in the quotes R5 [27] and R5 [28], stated that the NHS encompasses a variety of cultures that exist in its dispersed organisations. The type of the organisational culture is determined by the top level of the organisation.

> *"...different NHS organisations are very different in terms of their culture"* R5 [28].

R5 distinguished between two types of cultures (see the quote R5 [29]). The first one is the *"blame culture"* where end users at the front line do not share information, are not engaged in the decision-making process, and communication channels go from the top to the bottom as stated in the quote R5 [30].

The other type of organisational culture is more encouraging for end users to be involved, share information, participate, and communicate freely and openly with the higher managerial levels to express their opinions. For this culture to exist, R5 claimed that teamwork, as a philosophy of working is needed, so people can develop through teamwork, as indicated in the quote R5 [31].

In terms of sharing the vision, end users become more aware of the direction of their organisations, and understand how the new systems will improve them and the organisation as a whole, as indicated in the quote R5 [49].

From this discussion, one can conclude that most of NHS organisations fall into the blame culture category, where there is little impact of end users upon the implementation of LORENZO as teamwork and end user involvement were not present in most of NHS organisations. Additionally, for organisations to accept risk, they should encourage open communications that cross departmental boundaries and link the top level with the bottom level of the organisation. This situation did not exist in the NHS organisational culture. Thus, one can notice that NHS organisational culture contributed to the limited success of LORENZO, and accordingly, the resistance to using it as was indicated in the quote R1 [32].

8.3.6.3.11. Political Influence on System Deployment

Both R4 and R5 stated the notion that deploying LORENZO is surrounded by political forces or pressures, which may limit its success. Political pressure may be, for instance, in a form of setting a time scale for completion, which might not be helpful for NHS organisations deploying the system. This is because these organisations might not be ready enough when they reach the deadline. The quote R4 [17] reveals this view.

R5 pointed out, as stated in the quote R5 [32], that the programme is subject to political influence, particularly within a General Election year. This may indicate that politicians are not aware of the nature of NHS organisations, and thus setting up a completion time, or interfering with the implementation of the system can have negative consequences that, for the most part the local level of the NHS would be required to handle.

The author decided to have political influence as an organisational factor because is pursued on locus of decision making in the NHS, which is represented in the NHS CfH and the SHAs to accelerate the completion of the project. This means that NHS CfH and SHAs will consequently respond to the political pressure through the local organisations (trusts).

8.3.6.3.12. Rewards for Adopting the System

R4 revealed that the NHS should work toward encouraging clinicians to use the system, instead of forcing external IT systems on people who are generally reluctant to use IT. In addition, R4 proposed that the NHS provide rewards (e.g. financial incentives) to the

NHS organisations that are able, in terms of infrastructure, resources, and skills of deploying the system. Providing financial rewards to encourage organisations to adopt IT was discussed in section 2.3.3.3.2.1 of the Information Technology in the Healthcare Sector chapter (Financial Barriers), that lack of incentives is considered as one of the barriers to Electronic Health Records (EHR) adoption

> *"I think compulsory is difficult, but encouraging, they should be more encouragement... perhaps even rewards" R4* [18].

The author included *Rewards for Adopting the System* in the *Organisational Factors* because incentives or rewards should be provided from the top management of the NHS or the SHA level to stimulate taking up LORENZO.

8.3.6.3.13. Stakeholders and Communications Management

Lack of open, bottom-up communications in the NHS, which reflects most of its organisations' culture affected adversely the implementation of LORENZO, in that, end users were only moderately involved due to the fact that it was difficult to communicate with the top levels. Additionally, end users were not involved from the early stages of the programme as the LSP of LORENZO used to initiate their first communications with the high level of the organisation, and end users were engaged only as the programme moved on. R5 [33] indicates this notion. This might constrain end users' understanding of the nature of the programme as was mentioned by R2 as shown in the quote R2 [11]. Lack of communication did not take place only within the NHS but also between the NHS and its stakeholders. For instance, lack of communication was revealed between the medical royal colleges and the NHS, as stated by R2 in the quote R2 [12].

R6 pointed out, as one can see in the quote R6 [6], that the duality in authority between the NHS and CfH caused complications in the communication networks, and influenced negatively both NHS and CfH in their dealing with the LSP of LORENZO.

There was a lack of communication between the LSP and service commissioners who were not involved enough in the discussion of system's implementation. Furthermore, NHS commissioners were not utilised properly by the LSP, for instance to find out what the information needs of NHS local organisations were. R5 [34] points out this notion.

8.3.6.3.14. *Undocumented Tacit Knowledge - Absence of Externalization*

The last concept of the *Organisational Factors* category relates to the fact that clinicians who possess medical knowledge were used to carrying out clinical processes with implicit standards. **S**tandard **O**perating **P**rocedures (SOPs) were kept as accumulated knowledge in their minds (Implicit Knowledge) and the challenge in the NHS was how to externalise implicit knowledge more explicitly. R2 stated (see the quote R2 [13]) that clinicians' knowledge is embedded from their early training of medicine, and it is difficult for them to change what they are used to doing.

8.3.6.4. The Fourth Category: LSP Related Factors

The fourth major category is *LSP Related factors.* Figure 8-8 exhibits the various concepts of this category, without showing the relationships between the concepts.

Figure 8-8: LSP Related Factors Category

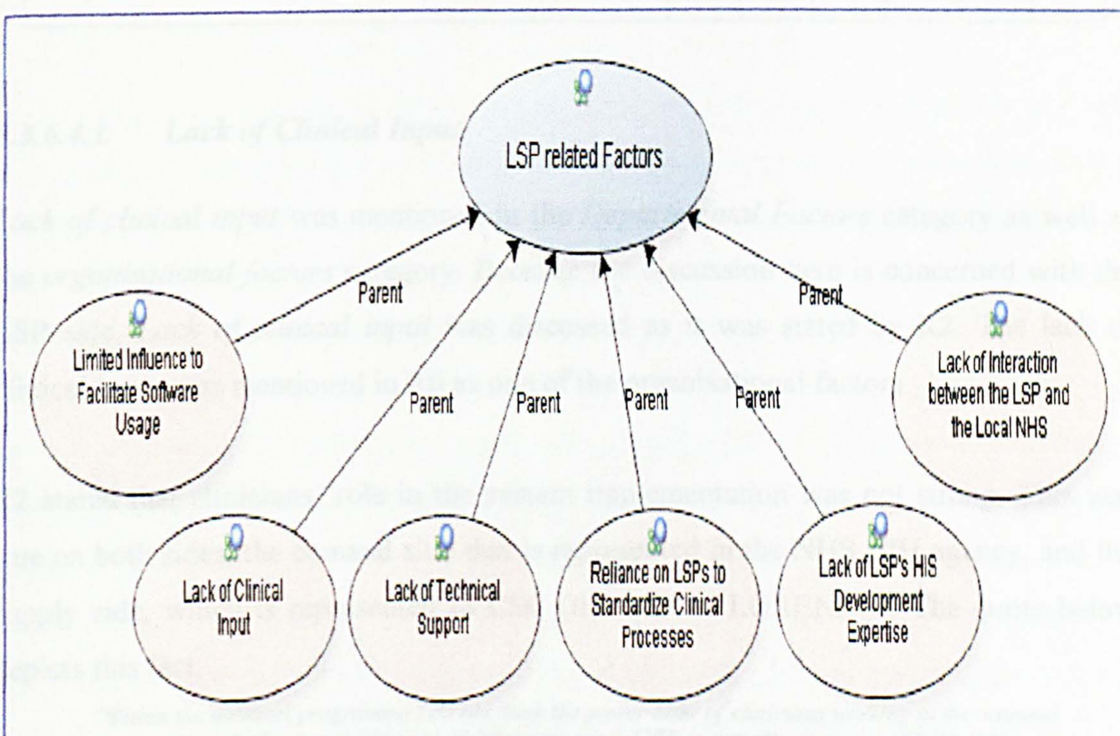


Table 8-16 shows that *LSP Related Factors* category occurred in three projects, which are R1, R2, and R6. Analysis of the data revealed six concepts. Interviewees' professional backgrounds and expertise of working in the LSP' company assisted the author to compose this major category. It should be mentioned that three (R2, R5, and

R6) work with the LSP of LORENZO, and R1 had experienced working with the LSP of LORENZO. The six concepts are discussed below.

Table 8-16: The Sources of the Concepts in the LSP Related Factors Category

concepts	The project					
	R1	R2	R3	R4	R5	R6
Lack of Clinical Input	✓*	✓	×	✓*	×	✓*
Lack of Interaction between the LSP and the Local NHS	×	✓	×	×	×	×
Lack of LSP's HIS Development Expertise	✓	×	×	×	×	✓
Lack of Technical Support	✓	×	×	×	✓*	×
Limited Influence to Facilitate Software Usage	×	✓	×	×	×	×
Reliance on LSPs to Standardize Clinical Processes	×	×	×	×	×	✓

8.3.6.4.1. *Lack of Clinical Input*

Lack of clinical input was mentioned in the *Departmental Factors* category as well as the *organisational factors* category. Because the discussion here is concerned with the LSP side, *Lack of clinical input* was discussed as it was stated by R2. The lack of clinical input was mentioned in R6 as one of the organisational factors.

R2 stated that clinicians' role in the system implementation was not strong. This was true on both sides, the demand side that is represented in the NHS CfH agency, and the supply side, which is represented in CSC (the LSP of LORENZO). The quote below depicts this fact.

> *"Within the national programme I do not think the power-base of clinicians working in the national programme, whether we are here or whether you are in CfH, is actually strong at all"* R2 [14].

8.3.6.4.2. *Lack of Interaction between the LSP and the Local NHS*

The author believes that lack of interaction between the NHS and the local NHS organisations contributed to the lack of clinical input into the deployment of LORENZO from the LSP side. R2 [15] indicates this notion.

8.3.6.4.3. Lack of LSP's HIS Development Expertise

It was not only in the NHS that clinicians did not have enough health informatics experience to deal with the deployment of the system, but also the LSP side did not have sufficient knowledge and expertise in designing and developing HCIS for the NHS environment. R1 [20], and R6 [7] illustrate this notion.

Both R1 and R6 stated that LSPs that had contracts with the NHS are big commercial organisations, which had specialized in designing IT systems with very little or no health informatics experience. The author thinks that the lack of understanding of clinical processes by systems developers, which is one of the barriers to EHR adoption as one can see from section 2.3.3.3.2.2 of the Information Technology in the Healthcare Sector chapter (Organisational or Behavioural Barriers), was a reason for the LSP's lack of HIS development expertise.

8.3.6.4.4. Lack of Technical Support

User support is considered as an imperative factor for Information Systems to succeed in boosting an organisation's performance as we saw in section 3.5.3 of the Successful Implementation of IT Projects chapter (User Support). Assistance is provided to users in terms of technical support and guidance of using the system. In the context of providing technical support to clinicians, it was revealed by R1 (see the quote R1 [21]) that LORENZO's LSP was responsible for only the first 45 days of deploying the system. R5 (see the quote R5 [35]) who works with LORENZO's LSP confirmed this fact. Providing technical support for only 45 days symbolises the notion that was discussed earlier in section 2.3.3.3.2.3 of the Information Technology in the Healthcare Sector chapter (Technical Barriers), that EHR systems vendors provide limited support and at high cost. The lack of technical support was not included under a hierarchical category in R5 because no other concepts were found to shape the LSP related factors. The quotes below show this notion.

> *"The contract is structured in such a way that LSPs are responsible for only 45 days of deployment and implementation that NHS supposed to pick it up"* R1 [21]

> *"...nothing to do with me really because 45 days after deployment, I've gone out the door anyway"* R5 [35]

8.3.6.4.5. Limited Influence to Facilitate Software Usage

R2 stated (see the quote R2 [16]) the view that LORENZO's LSP has a limited influence on the NHS clinicians in terms of encouraging them to utilise the system. This is because the NHS employs around 1.3 million people as one can see in section 4.3 of The NPfIT in the NHS in England chapter (The Aim of the NPfIT), the majority of whom are clinical/medical workers. This means that it would definitely be difficult to affect their views and attitudes toward the use of the system with only 30 clinicians who are working with the LSP.

8.3.6.4.6. Reliance on LSPs to Standardise Clinical Processes

Reliance on LORENZO's LSP to standardise the NHS' clinical processes was a view mentioned by R6 (see the quotes R6 [8], and R6 [9]). This theme reminds us of the notion that the provision of technical support was seen as the responsibility of the LSP without the NHS having any role to initiate such programmes or workshops that aimed at enhancing clinicians' understanding and acceptance of LORENZO.

There is a problem, which is that the LSP did not have adequate amount of knowledge and experience to deal with health informatics. Moreover, the lack of medical input that was caused by the fact that clinicians were not involved, and did not have time, made it enormously difficult for the LSP to communicate effectively with the NHS to obtain full consensus from the variety of user groups on the system's specifications. In this situation, relying on the LSP to standardise NHS' clinical processes would not be viable option for those who are calling for change, which should take place and stem from the bottom of the NHS.

8.3.6.5. The Fifth Category: System Related Factors

The fifth major category is *System Related Factors*. Figure 8-9 depicts the concepts of the *System Related Factors* category. Analysis of the data revealed some factors that are related to the system, which is LORENZO (the NHS CRS) that has been deployed in the NME region. Some of these factors are related to LORENZO as well as the NPfIT in general, because NPfIT (the context) within which LORENZO was developed influenced LORENZO implementation either, directly or indirectly.

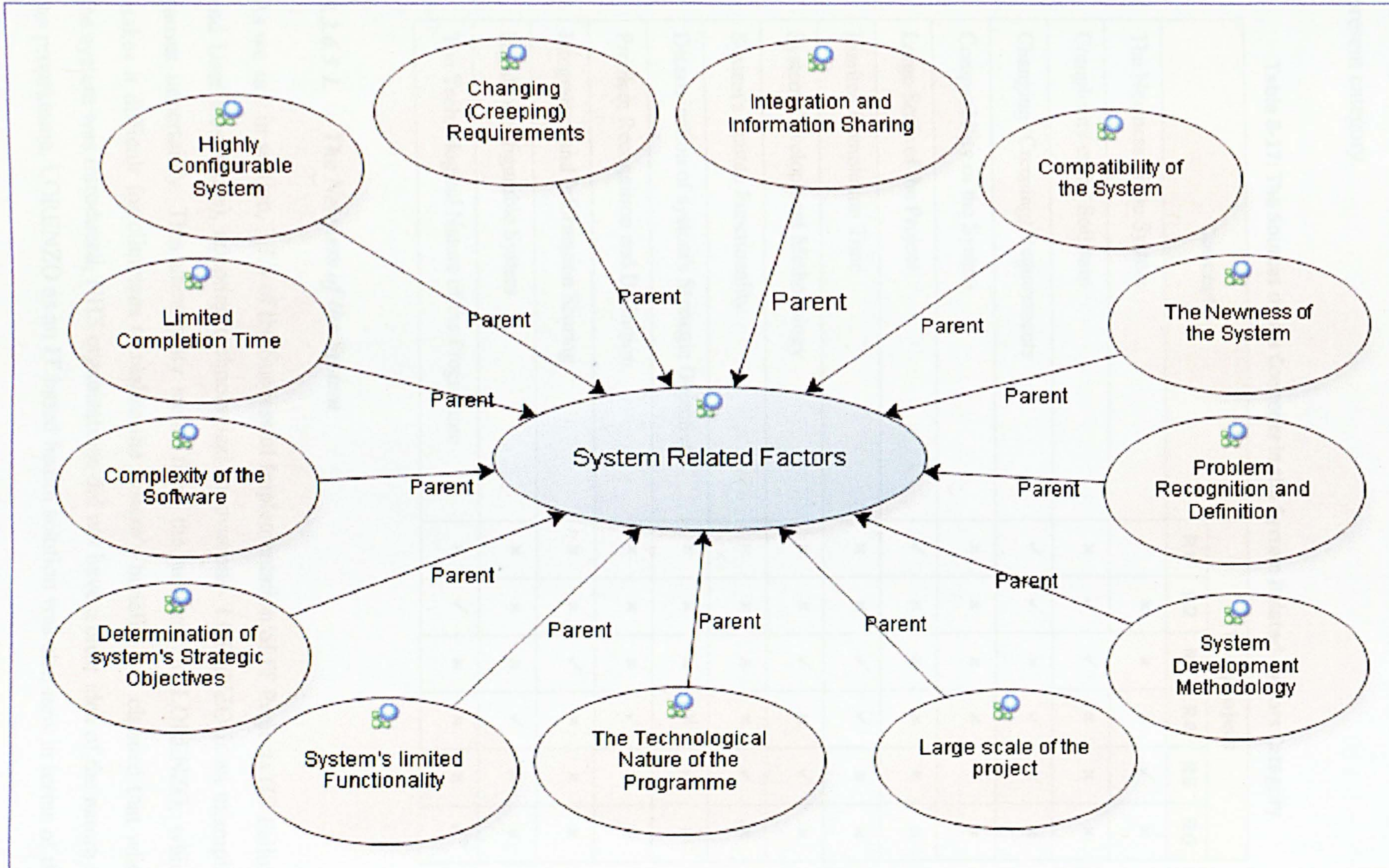


Figure 8-9: System Related Factors Category

Table 8-17 shows that System Related Factors category was repeated in five projects, R1, R2, R3, R4, and R5. Analysis of the data revealed 13 concepts that shape the present category.

Table 8-17: The Sources of the Concepts in the System Related Factors Category

Concepts	The project					
	R1	R2	R3	R4	R5	R6
The Newness of the System	✓	✗	✗	✗	✓	✗
Complexity of the Software	✗	✓	✓	✗	✗	✗
Changing (Creeping) Requirements	✓	✓	✗	✓	✗	✗
Compatibility of the System	✗	✗	✗	✗	✓	✗
Large Scale of the Project	✓	✗	✗	✗	✗	✗
Limited Completion Time	✗	✗	✓	✓	✗	✗
System Development Methodology	✗	✗	✓	✗	✓	✗
System's limited Functionality	✗	✗	✗	✗	✓	✗
Determination of system's Strategic Objectives	✗	✗	✗	✗	✓	✗
Problem Recognition and Definition	✗	✗	✗	✓	✗	✗
Integration and Information Sharing	✗	✗	✓	✗	✗	✗
Highly Configurable System	✗	✗	✗	✓	✗	✗
The Technological Nature of the Programme	✗	✓	✗	✗	✗	✓*

8.3.6.5.1. The Newness of the System

As we saw in section, 3.3.3 of the Successful Implementation of IT Projects (IS Failure and User Resistance), adopting technological innovations- LORENZO is an example- causes uncertainty. This uncertainty stems from the newness of LORENZO, which makes it difficult for clinicians to realise the system's benefits. R1 claimed that when the system was introduced, NHS organisations did not have a clear idea of the nature of the programme. LORENZO as an IT based health solution was also new in terms of the way it was developed, via the so-called Deployment Units methodology as one can see in section 4.6.1 of The NPfIT in the NHS in England chapter (Deployment Units Approach). Deployment units caused more difficulty and anxiety for people as the benefits were not apparent. R1 [22], and R5 [36] indicate this concept.

8.3.6.5.2. Complexity of the Software

The vision and scale of the NPfIT are wider than those of any other health IT projects, not only in the NHS but also worldwide. The complexity of the programme (mainly LORENZO) stems from the heterogeneous nature of the NHS (National Audit Office 2006). Heterogeneity is because the NHS encompasses diverse user groups and specialities each of which has its own processes and information needs. Thus, the complexity of LORENZO can be one of the hindering factors for successful implementation, as was discussed in section 2.3.3.3.2.3 of the Information Technology in the Healthcare Sector chapter (Technical Barriers). In addition, the author's discussions with the participants revealed that even within the same speciality and the same system, one can find various ways of carrying out the same clinical process. This complexity might be challenging for integrating intra-departmental processes and systems. R2 and R3 commented on the complexity of LORENZO as shown in the quotes R2 [17] and R3 [13].

> *"It is a much bigger project, incredibly more complicated, and complex"* R3 [13].

8.3.6.5.3. Changing (Creeping) Requirements

This concept refers to the notion that the NPfIT in general is an emerging programme, which started with a limited number of systems and then increased as the system moved on. The quotes R1 [23] and R1 [24] indicate this notion.

LORENZO, the CRS software is also changing in terms of its potential uses, as clinicians did not have fixed ways of dealing with the system. R2 stated that once the system had been deployed in NHS organisations, clinicians proposed various ways of using the system's features as one can see from quote R2 [18]. The author stresses the potential negative impact of the changing nature of LORENZO on its success as we saw in section 2.2.4.1 of the Information Technology in the Healthcare Sector chapter (System Development Life Cycle (SDLC)).

Quotes R3 [14] and R3 [15] show an example of iPM failure due to its inflexibility, unresponsiveness to changing requirements and end users' feedback on system functioning. iPM was developed by CSC before LORENZO. The author thinks that iPM failed because it was difficult for end users to log in. iPM's failure confirms the notion mentioned in section 3.4.2 of the Successful Implementation of IT Projects chapter (IT Adoption/Acceptance Theories) that the rate of adoption is affected by the complexity of the IS.

> *"I think the concept of flexible design, uh, didn't enter into their mind at all..."* R3 [14]

8.3.6.5.4. Compatibility of the System

The definition of compatibility that was explained in section 3.4.2 of the Successful Implementation of IT Projects chapter (IT Adoption/Acceptance Theories) implies that past experience of end users in the NHS may not be an indicator of their attitudes toward the use of IT in general. For instance, the PACS, which was discussed in section 4.4.4 of The NPfIT in the NHS in England chapter (NHS National Network (N3)), was a self-contained and simple system (see quote R3 [16]) for sharing and storing images; users found it useful and easy to use. Whereas, this positive attitude cannot be applied to LORENZO because it is much more sophisticated than PACS.

R5 stated (see quote R5 [37]) that LORENZO is based on Deployment Units development methodology. These units rest on LORENZO Patient Administration System (PAS), which is called the care management system. However, R5 claimed that not all the deployment units are compatible with the care management system. This poses a challenge for NHS organisations that need to deploy LORENZO's components in the future.

8.3.6.5.5. Large Scale of the Project

R1 commented on LORENZO's implementation by stating that LORENZO and the NPfIT in general was a large-scale project of a type that had not been implemented previously in the NHS.

> *"Technological challenge was also compounded by the scale of the project because nobody has tried to do it for a country, it was very ambitious"* R1 [25].

8.3.6.5.6. Limited Completion Time

This concept refers to the idea that LORENZO has a time limit for completion. Despite the fact that the programme is four years behind the schedule (National Audit Office 2006), R4 believed that there should not be any pressure on local NHS organisations to deploy the system because they should be prepared and ready for deployment. R4 [19] symbolises this concept.

However, R3 thought that because LORENZO is a big complex project and should be implemented gradually, rather than adopting the big bang approach, this might take time and thus, accelerating the deployment of LORENZO is useful. R3 [34] indicates R3's view.

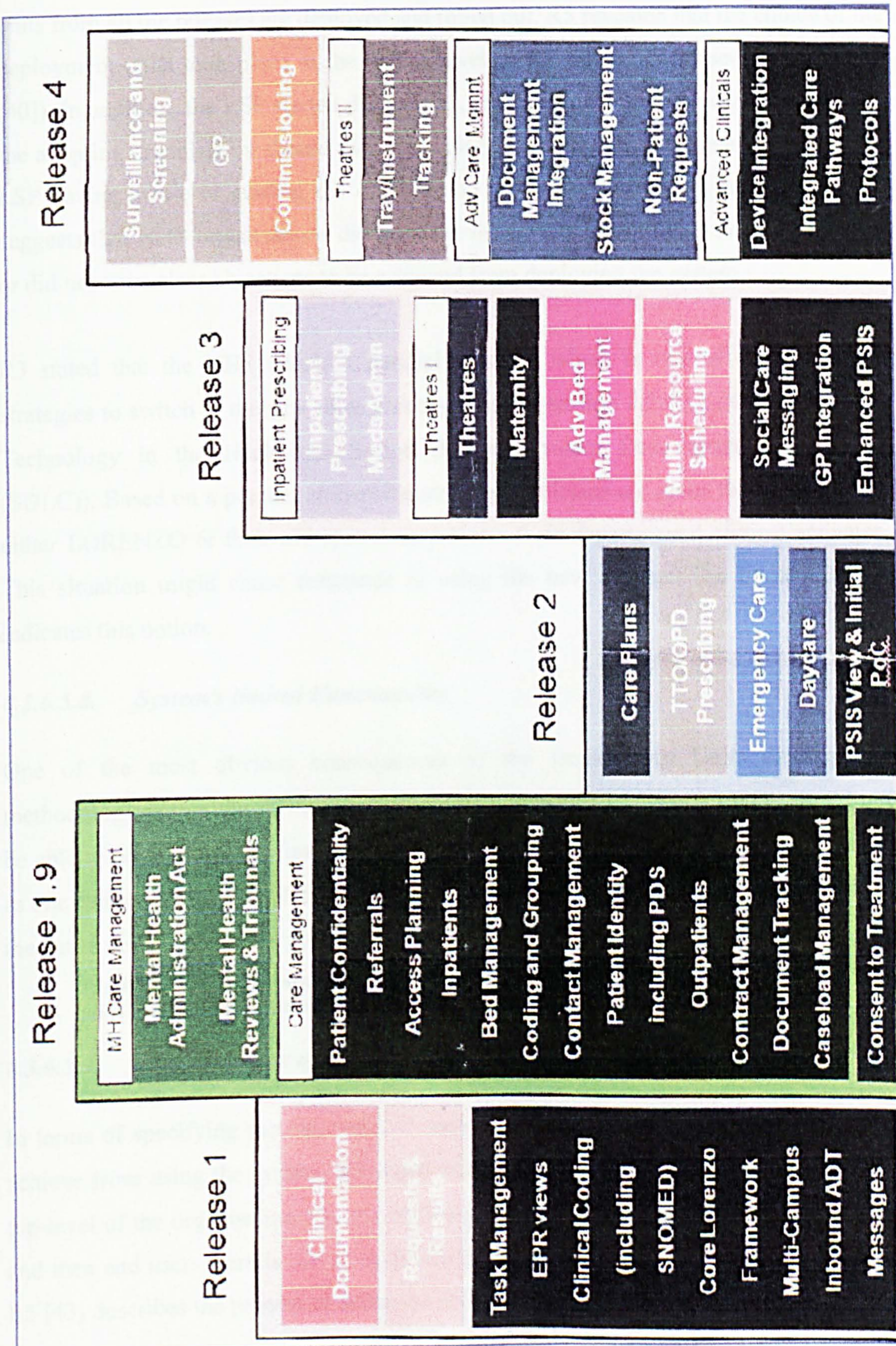
8.3.6.5.7. System Development Methodology

The *System Development Methodology* concept was mentioned by R3 and R5, which describes the nature of the approach/methodology through which LORENZO was developed. The next concepts (System's limited Functionality, Determination of system's Strategic Objectives, and Problem Recognition and Definition) are related to, or consequences of LORENZO's development methodology.

Previously, LORENZO was presented to the NHS as four major releases, and then the idea of deployment units was introduced in that each of the main releases encompasses chunks of the system (units) that perform specific tasks. Figure 4-12 in section 4.6.1 of The NPfIT in the NHS in England chapter (Deployment Units Approach) shows schematically LORENZO's units and Figure 8-10 shows the four main releases of LORENZO. The quotes R5 [38] and R5 [39] relate to the adoption of Deployment Units methodology in developing LORENZO.

> *"LORENZO itself as you're aware is a long programme, so it's not just a one hitter and it's all there, It is lots of different deployment units"* R5 [39].

Figure 8-10: LORENZO Solution Roadmap



Source: obtained from R3

Thus, the full functionality of the system will only be achieved when all deployment units from all the releases are deployed and rolled out. R5 revealed that the choice of the deployment units took place at the higher level of the organisation (see the quote R5 [40]). In addition, the LSP started discussions, regarding which of the deployment units the adopting organisation should pick up, with the top level of the organisation and the LSP having a role in guiding the organisation to the suitable deployment units. This suggests that NHS organisations did not have clear view of why they need the system, or did not have clear objectives to be achieved from deploying the system.

R3 stated that the NHS adopts a parallel strategy, which is one of the conversion strategies to switch to the new IS as was discussed in section 2.2.4.1 of the Information Technology in the Healthcare Sector chapter (System Development Life Cycle (SDLC)). Based on a parallel conversion strategy, clinicians are given the choice to use either LORENZO or their old system to perform their departmental clinical activates. This situation might cause resistance to using the new system. The quote R3 [17] indicates this notion.

8.3.6.5.8. System's limited Functionality

One of the most obvious consequences of the Deployment Units development methodology is that the NHS organisations that deployed LORENZO units would not be able to possess the full functionality of the system. R5 symbolised this as a journey, as one can see in the quote R5 [42], and people must be able to see all the benefits when the entire deployment units are deployed.

> *"LORENZO at the moment doesn't do all of that it just does this (point at the first three parts of LORENZO roadmap) so as yet we're not talking to all the systems"* R5 [41].

8.3.6.5.9. Determination of system's Strategic Objectives

In terms of specifying the outcomes or the objectives an NHS organisation wishes to achieve from using the system, R5 stated that these objectives were determined by the top level of the organisation (i.e. the NHS organisation wishing to deploy LORENZO), and then end users were involved in discussing these objectives with them. The quoate R5 [43] describes the process of determining system's objectives.

8.3.6.5.10. Problem Recognition and Definition

One of the views R4 mentioned which captured the author's attention was that for any IS to be effective it must solve a problem; this was absent from the thinking of the NHS decision makers. People inside the NHS did not know for what reason LORENZO was introduced. Moreover, the discussion with R4 regarding his trust's deployment of the system revealed that the reason they became an early adopter of LORENZO was their awareness of the problems they had encountered before introducing LORENZO. The problem was communication and information sharing among GPs in a 1000 square miles area; this necessitated them having a shared record as one can see from the quote R4 [20].

8.3.6.5.11. Integration and Information Sharing

Information sharing and integration of the system is a crucial factor especially with a sophisticated system like LORENZO. The quotes R3 [18], and R3 [19] represent this concept.

As can be seen, the author refers to integration as linking geographically scattered NHS organisations, and linking various databases. In addition, integration of various systems is also based on data, functionality, and appearance (Hussein, Abdul Karim & Selamat 2007). An Integrated system is vital for sharing information as indicated by the quotes R3 [18] and R3 [19]. It is the author's belief that information sharing is important for the dissemination and utilisation of knowledge. However, tensions that existed between, and within users group, the difficulty in reaching consensus among specialities, and other factors made it difficult for clinicians to share information especially, when they felt that data confidentiality might be threatened through sharing information.

> *"Actually the things they want to talk about are patient confidentiality, consent, the impact that it would make on their, on the doctor/patient relationship"* R2 [19].

8.3.6.5.12. Highly Configurable System

R4 stated that LORENZO is highly configurable, represented in that clinicians can customise or change the system according to their departmental/speciality needs. This might cause a negative impact on clinicians' familiarity with using the system as shown in the quote R4 [21] and R4 [22].

8.3.6.5.13. The Technological Nature of the Programme

Three interviewees asserted that there was a confusion about, or an unclear picture of the nature of NPfIT, whether it was just an IT project, or a tool to implement the NHS reform plans to improve the quality of health services provided to patients.

> *"From the early beginning, there was all these discussions whether it was about IT or about clinical services and what the role of clinicians"* R1 [26]

> *"It is been sold really as a technology programme and I think that switches a lot of people off. We haven't even got past base camp really"* R2 [20]

> *"A substantial reservoir of opinion in the NHS that sees IT as that and one of the things we spend a lot of time in this organisation doing is that this isn't an IT system, this is a clinical system that's got IT as it is underpinning infrastructure"* R6 [10]

8.3.6.6. The Sixth Category: The Nature of Clinical Processes

The sixth major category is *The Nature of Clinical Processes*. Figure 8-11 depicts the four concepts of the current category. These concepts are related to the nature of the clinical processes performed by clinicians.

Figure 8-11: The Nature of Clinical Processes Category

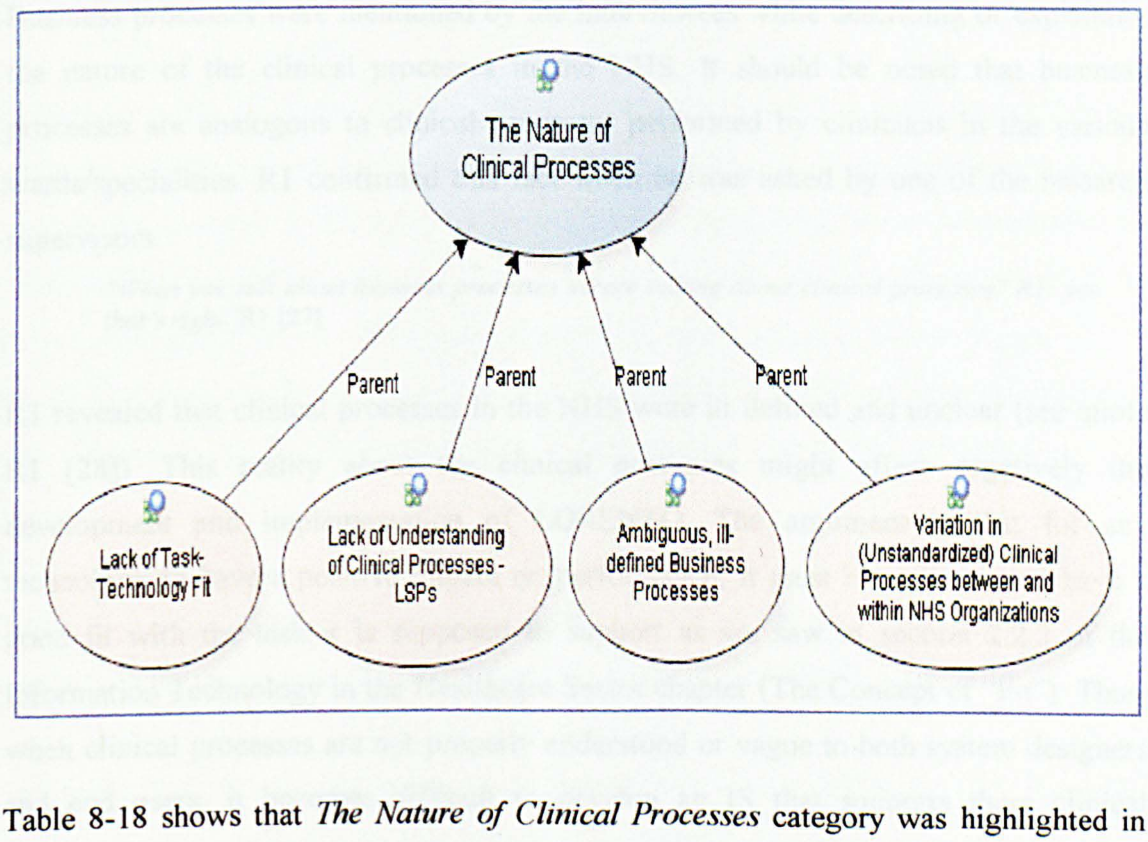


Table 8-18 shows that *The Nature of Clinical Processes* category was highlighted in two projects, which are R1 and R6. R2, R3, and R4 mentioned merely one concept that is included in this category, and therefore the author could not create *The Nature of*

Clinical Processes category in R2, R3, and R4 (the star on the top of the check mark indicates the concept that stood alone in these projects). Analysis of the data ended up with four concepts under *The Nature of Clinical Processes* category.

Table 8-18: The Sources of the Concepts in the Nature of Clinical Processes Category

Free nodes	The project					
	R1	R2	R3	R4	R5	R6
Ambiguous, ill-defined Business Processes	✓	×	×	×	×	×
Lack of Understanding of Clinical Processes	✓	×	×	×	×	×
Variation in (Unstandardised) Clinical Processes between and within NHS Organisations	✓	✓*	✓*	✓*	×	✓
Lack of Task-Technology Fit	×	×	×	×	×	✓

8.3.6.6.1. Ambiguous, ill-defined Business Processes

Business processes were mentioned by the interviewees while describing or explaining the nature of the clinical processes in the NHS. It should be noted that business processes are analogous to clinical processes performed by clinicians in the various wards/specialities. R1 confirmed this fact when he was asked by one of the research supervisors.

> *"When you talk about business processes we are talking about clinical processes? R1: yes that's right"* R1 [27]

R1 revealed that clinical processes in the NHS were ill defined and unclear (see quote R1 [28]). This reality about the clinical processes might affect negatively the development and implementation of LORENZO. The argument is that for any technology to have a positive impact on performance, it must be utilised, and have a good fit with the task it is supposed to support as we saw in section 2.2.2 of the Information Technology in the Healthcare Sector chapter (The Concept of "Fit"). Thus, when clinical processes are not properly understood or vague to both system designers and end users, it becomes difficult to develop an IS that supports these clinical processes.

8.3.6.6.2. Lack of Understanding of Clinical Processes

The lack of understanding of clinical processes was from both the NHS and the LSP's side, because they did not have enough expertise in designing HIS, and they were originally IT commercial companies. The quote R1 [29] illustrates this notion.

8.3.6.6.3. Variation in (Unstandardized) Clinical Process between and within NHS Organisations

All interviewees except R5 mentioned the fact that there is a lack of standardisation, and documentation of clinical processes in the NHS. This means that NHS organisations do not follow standardised rules for doing the same clinical practice. This is because clinical processes are performed according to what clinicians have been taught in schools, universities...etc and thus, it would be difficult to adopt a certain way of doing a certain process across NHS organisations. All the quotes R1 [30], R2 [21], R2 [22], and R6 [11] support the notion of unstandardized clinical processes. Moreover, the variety in user groups, and the fact that it is difficult to reach consensus intensifies the problem of unstandardised clinical processes. The quote R2 [23] shows this view.

Furthermore, R2 discussed the idea that standardisation and documentation of clinical practices should be seen as externalisation of knowledge. Because clinicians were the source of knowledge in the NHS as previously discussed, they had to be motivated to participate in the documentation initiatives. However, with the lack of communication, power, and authority, as well as the absence of teamwork, the author argues that it would have been challenging for the SHAs, and local NHS organisations to perform this task. The quote R2 [24] shows the notion of externalising end users' knowledge.

R3 stated that (see quotes R3 [20] and R3 [21]) the lack of standardisation of clinical practices is not confined to data input but also applies to data output, deciding on the display of the screen, and the format of how the information should look.

Standardisation of clinical processes was done by the system developer, CSC that took the responsibility of doing so. This notion was discussed previously in section 8.3.6.4.6 of the present chapter (Reliance on LSPs to Standardise Clinical Processes) that the

NHS relied on the LSP to present standardised processes, on which LORENZO operates. The quotes R6 [12] and R6 [13] indicate this view.

In conclusion, the lack of standardisation, the existence of tacit knowledge with a reluctance to document it and follow guidance, the heterogeneity of user groups, and the lack of clarity about processes, makes it challenging to think of classical IS development methodologies as the way to translate users' needs into functional system features.

8.3.6.6.4. Lack of Task-Technology Fit

The author has discussed in section 2.2.3 of the Information Technology in Healthcare Sector (Socio-technical theory) that it is important that "Fit" be achieved between individual, technology, and task, as a key driver for effective IT adoption. Therefore, an existence of clear clinical processes enhances employees' learning and achieves efficiency. In the NHS, they do not have well-defined, clear, and standardised clinical process, on which the system rests. This makes it hard to achieve fit between the tasks being performed and the system as was stated in quote R6 [14].

8.3.6.7. The Seventh Category: Clinical Safety

The last, but not the least, major category that the author considered crucial is *Clinical Safety*. Figure 8-12 depicts the concepts of *Clinical Safety* category.

Figure 8-12: Clinical Safety Category

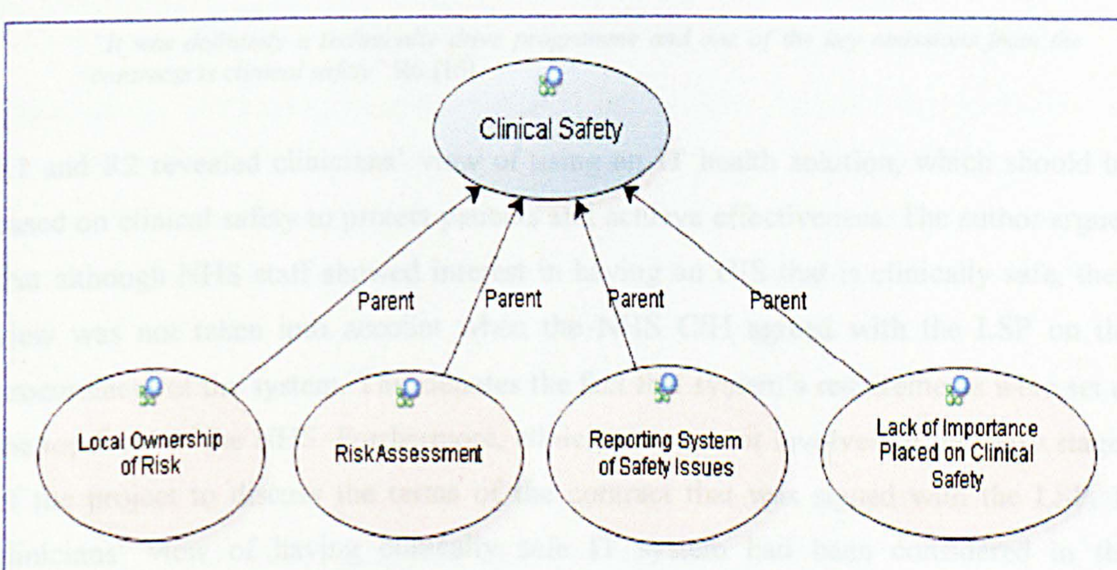


Table 8-19 shows four concepts that were mainly derived from R6. Despite the fact that *Clinical Safety* category was not repeated in other projects, R1, R2, and R4 highlighted the notion that clinical safety was of importance for LORENZO to be accepted by clinicians. Thus, their views were embedded in the concept of clinical safety rather than the concepts that formed the current category.

Table 8-19 The Sources of the Concepts in Clinical Safety Category

Free nodes	The project					
	R1	R2	R3	R4	R5	R6
Lack of Importance Placed on Clinical Safety	×	×	×	×	×	✓
Risk Assessment	×	×	×	×	×	✓
Local Ownership of Risk	×	×	×	×	×	✓
Reporting System of Safety Issues	×	×	×	×	×	✓

R6 postulated that clinical safety is the system's ability of not causing harm to patients and staff. Although this concept was phenomenally vital for any HCIS as it deals with people's lives, the commercial contract that was signed between the NHS CfH and the LSP did not place stress on clinical safety. The quotes, R6 [15] and R6 [16] below show these ideas.

> *"We are talking about the ability not to harm patients. We're also talking about the ability not to harm staff and we're also talking about, at some level, protecting reputational umm protecting ourselves and the NHS from reputational damage"* R6 [15]

> *"It was definitely a technically drive programme and one of the key omissions from the contracts is clinical safety"* R6 [16]

R1 and R2 revealed clinicians' view of using an IT health solution, which should be based on clinical safety to protect patients and achieve effectiveness. The author argues that although NHS staff showed interest in having an HIS that is clinically safe, their view was not taken into account when the NHS CfH agreed with the LSP on the procurement of the system. This denotes the fact that system's requirements were set at the top level of the NHS. Furthermore, clinicians were not involved in the early stages of the project to discuss the terms of the contract that was signed with the LSP. If clinicians' view of having clinically safe IT system had been considered in the beginning of the project, there were no standards in the NHS to apply to this crucial feature and embed it in the system. Quotes R1 [31] and R2 [25] show this notion.

Moreover, R6 stated (see quote R6 [17]) that NHS trusts did not have appropriate clinical safety assessment that examines IT system against safety standards. The author claims that this situation of the lack/absence of clinical safety standards is because NHS organisations were not used to using IT applications, and therefore, did not have the experience in dealing with IT systems.

In addition, the lack of the LSP's expertise and knowledge in developing HIS (see section 8.3.6.4.3) prevented the LSP from paying attention to the clinical safety dimension, and establishing standard for effective system testing. This notion was presented by R6 (see quote R6 [18]) who revealed that for the past three years, there had been no effective mechanism for ensuring system safety.

Experiencing lack of awareness and standards of clinical safety in the NHS organisations did not prevent one of the early adopters of LORENZO from emphasising the importance of clinical safety as one can see from quote R4 [23].

After conducting focused coding on the *Clinical Safety* category, four concepts emerged, which represent different perspectives of clinical safety assurance process. These concepts are:

8.3.6.7.1. Lack of Importance Placed on Clinical Safety

Clinicians and NHS organisations intended to deploy HCIS viewed safety as important. Yet, in reality, few had a clear plan or intention to apply safety standards in these systems. The author claims that assuring clinical safety of LORENZO should be seen as shared responsibility of both the adopting NHS organisation, and the LSP, to reach an agreement upon what is safe, and trace the impact of applying the system on both end users and patients. However, the author thinks that the limited completion time and the political power that had been exerted on the programme might have prevented NHS organisations from having clinical safety as high priority when implementing the system. R6 [19] and R6 [20] indicate the current concept.

8.3.6.7.2. Risk Assessment

This concept refers to the fact that assuring clinical safety of an HIS is based on assessing any potential risk that may threaten patients, or users, and evaluating its impact whether it could be dealt with or not. Analysis of the data shows that risk assessment did not take place in NHS organisations, even in primary care where IT systems have been used for almost three decades. R6 [21] shows this notion.

It should be mentioned that the LSP did not have clear, well-defined and rigorous clinical safety assessment. The LSP's lack of experience in developing IT systems for health organisations was one of the causes of this weak risk assessment. In addition, the lack of standardised and vague clinical processes contributed to the fact that the LSP was unable to assess those risks, which are associated with using LORENZO in the NHS context. The NHS as an organisation was not properly understood by the LSP. The quote R6 [22] embodies this notion.

R6 (see R6 [23]) highlighted four levels for risk, very low, which is the acceptable level of risk. The low level, which is the level at which the risk potential will be treated in the coming update of the release. Medium level is not allowed to be incorporated into the system and finally, high level of risk, which means that the system is very harmful to either the user or the patient and thus, the system has to be redesigned.

8.3.6.7.3. Local Ownership of Risk

From the quote R6 [24], NHS organisations that are deploying the system should own two types of risks. The first one is the risk that stems from the technical hazards that the LSP had informed the organisations about. The second risk is the one that stems from the clinical processes performed by the organisation.

The notion of local ownership of risk has two implications, the first one is that what ought to be risky, from the LSP's point of view, in terms of using one of LORENZO's deployment units is not necessarily the case from the adopting organisation's perspective. Moreover, the author argues that because clinical processes are vague and poorly defined, the question would be how they conducted risk assessment. Secondly, in the case where the NHS organisation deploying LORENZO's deployment units decided to bear the risk, it (i.e. the adopting organisation) was left alone to fix the process since it chose to own the risk. The author thinks that this seems awkward since clinical processes should have been decided previously. This brings us to the point that there was no collaborative contractual arrangements between the two parts, the LSP and the NHS. The quote R6 [25] represents what has been discussed.

8.3.6.7.4. Reporting System of Safety Issues

The fourth concept is related to the reporting system, which clinicians use to raise potential risks on the clinical safety of the adopted system. R6 claimed that the NHS seemed to have no clear infrastructure for reporting of clinical risks.

> *"There is no infrastructure, apart from the technical infrastructure around who and when issues should be raised as clinical risks"* R6 [26]

Clinical safety is an ongoing process occurs after deployment, and continues as long as clinicians use the system. R6 revealed the fact that end users did not realise the concept of clinical safety, as they considered most of the incidents they reported as major. The quotes R6 [27] and R6 [28] indicate the clinicians' inability to recognise clinical risks.

In addition, there was a problem in the NHS that people were not legitimate in terms of raising incidents of clinical risks. The author thinks that the NHS did not have structured, and organised process for reporting clinical risks. Furthermore, the reporting of clinical risks was done individually rather than negotiating them with the LSP or discussing their clinical impact at ward or departmental level with other users. Again, the lack of teamwork inside the NHS, along with the commercial contractual arrangements, prevented effective reporting taking place. The quote R6 [29] indicates this.

R6 stated that having a minimum, or an acceptable level of clinical risk might be essential to assure the system's usage. This is based on the premise that a highly safe system is not necessarily a highly usable one. This means that the LSP might design a system, which is risk free, but still causes resistance to usage by clinicians who might perceive the procedures, which were taken by the system designers to eradicate risks, as not useful, or affecting the system's functionality. Furthermore, a highly safe system might have a negative impact on usage or cause workarounds because a highly safe system might entail high system security and more restrictions on system access. One can see that the quotes R6 [30] and R6 [31] embody this notion.

8.4. CONCLUSION

In this chapter, the author discussed the use of NVivo as one of the commonly used CAQDAS in qualitative research because it enhances the transparency of the qualitative data analysis process. This chapter explains the stage-based process of analysing the data collected from the participants. The interview recordings were transcribed and each interview transcripts was entered into NVivo as a separate project. A total of six projects were created. The author coded the interview transcripts (open coding) and presented the resulting concepts. In addition, a comparative analysis was conducted to identify the similarities and differences between the concepts in order to be able to create hierarchical categories (focused coding).

The same categories form the six NVivo projects were brought and merged together in one combined project called "MERGED Projects". There were seven major categories resulted from the process of coding t he interview transcripts. These categories are:

- **Clinicians Attributes**: this category encompasses seven concepts (Difficulty in Reaching Consensus, End Users' Autonomy and Power, Lack of End Users' Informatics Experience, Busy Clinicians (Lack of Time), Anxiety in Using the System, Generational Gap, and End Users' Training (inappropriate))

- **Departmental factors**: this category comprises nine concepts (Diversity of IT Applications, Individualistic Nature of the Practise, Lack of Benefits Realisation, Lack of Clinical Input, Non-Practising Clinicians, Tension within and between End Users Groups, Various System Deployment Environments, Various Users Groups and Specialties, and Work Pressure)

- **Organisational factors**: this category consists of fourteen variables (Focus on Single Organisations for Deployment (absence of Critical Mass), Lack of Clinical Input, Lack of NHS Trusts Involvement, Lack of Organisational Readiness, Lack of Senior Level Awareness of the Project, Lack of Senior Level Medical Expertise, Lack of Top

Management (NHS) Support, Legal Implementation of Procedures vs. Guidance, NHS Organisational Structure, Non-Supportive NHS organisational Culture, Political Influence on System Deployment, Rewards for Adopting the System, Stakeholders and Communications Management, Undocumented Tacit Knowledge-Absence of Externalisation)

- **LSP Related Factors**: this category is comprised of six concepts (Lack of Clinical Input, Lack of Interaction between the LSP and the Local NHS, Lack of LSP's HIS Development Expertise, Lack of Technical Support, Limited Influence to Facilitate Software Usage, Reliance on LSPs to Standardize Clinical Processes)

- **System Related Factors**: this category encompasses thirteen concepts (The Newness of the System, Complexity of the Software, Changing (Creeping) Requirements, Compatibility of the System, Large Scale of the Project, Limited Completion Time, System Development Methodology, System's limited Functionality, Determination of system's Strategic Objectives, Problem Recognition and Definition, Integration and Information Sharing, Highly Configurable System, The Technological Nature of the Programme)

- **The Nature of Clinical Processes**: this category includes four concepts (Ambiguous, ill-defined Business Processes, Lack of Understanding of Clinical Processes – LSPs, Variation in (Unstandardised) Clinical Processes between and within NHS Organisations, Lack of Task-Technology Fit)

- **Clinical Safety**: the last category encompasses four variables (Lack of Importance Placed on Clinical Safety, Risk Assessment, Local Ownership of Risk, Reporting System of Safety Issues)

As we can see, analysis of the data resulted in seven major categories; each one of these contains a bunch of concepts. These ccategories is the result of both open and focused coding. The second wave of data analysis, as we will see in the coming chapter, explores the connections between the various concepts within and between the major categories.

Chapter Nine

9. Theory Building

9.1. INTRODUCTION

In the previous chapter, the author explored the major seven categories that resulted from the open and focused coding. In this chapter, the author conducts theoretical coding that entails linking the concepts in each major category, and showing the relationships between the seven major categories. Establishing such relationships enables the author to obtain better understanding, and to explain how these concepts influenced the implementation of LORENZO. Therefore, this makes it possible to suggest a theory, which is derived from the data, to explain clinicians' acceptance of the system.

In this chapter, the author starts with a discussion about the old PAS, iPM that has been deployed in some NHS organisations. The aim of this discussion is to show the real factors that led to the rejection of the system as was declared by some participants. The author uses the term "real factors" because those factors were derived from the people who used the system in their clinical environment, and worked with the contracted LSP that developed iPM. The author represents the failure factors in a category with relationships to enable the reader to understand how those factors led to the failure.

The author moves on to show the schematic diagram of each major category that contains the relationships between the concepts (i.e. child nodes). Each major category was discussed thoroughly by discussing and justifying the relationships between the concepts in the same category, and the links that relate the concepts of a major category with other concepts from other major categories.

9.2. *WHAT MADE iPM FAIL?*

Analysis of the data revealed that end users in the NHS showed resistance to using IT systems. From the previous discussion of the various major categories, one can conclude that this resistance was due to many reasons. For instance, LORENZO's development methodology was one of the reasons because it prevented people from perceiving the benefits that LORENZO offers to clinicians. Furthermore, we saw that the conversion strategy that the NHS adopted was based on the fact that end users were given the choice to use the old system in the case where the new system did not perform properly: this parallel conversion strategy was a cause of resistance. The technical perceptions clinicians, the NHS seniors, and the LSP held about the nature of NPfIT and LORENZO discouraged end users from using the system because they lacked IT experience and knowledge.

There were other causes of resistance; however, the author explored the above causes just to provide an evidence-based appraisal of the end users' resistance to using IT systems, which should be taken into serious consideration when deploying HCIS in the NHS organisations.

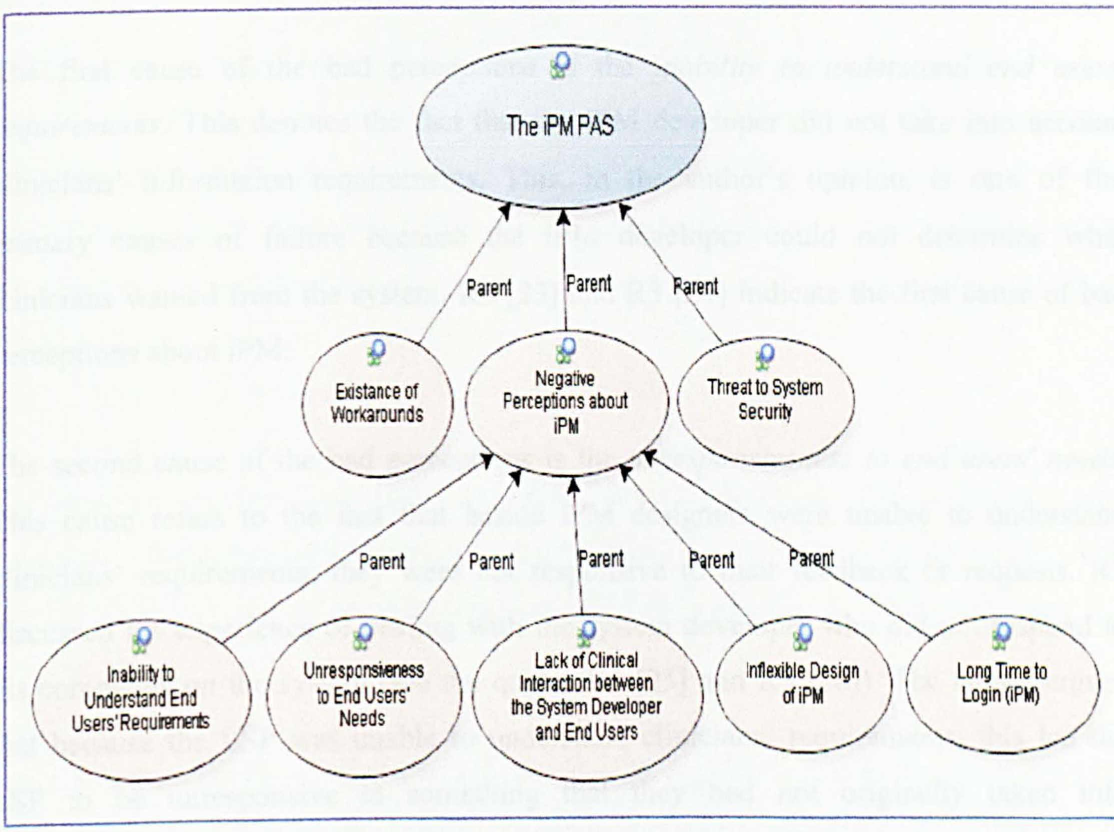
9.2.1. iPM (the Old PAS)

The discussions with the participants (mainly R3 and R5) revealed that the Patient Administration System (PAS) iPM, which was designed and launched by CSC failed to gain clinicians' acceptance. It symbolises how end users' resistance can jeopardise the entire system's success. Therefore, the author believes that having a closer look at the factors that contributed to iPM failure, would be useful for LORENZO designers and users to avoid pitfalls in the implementation of the current system (LORENZO).

9.2.1.1. The iPM PAS Category

The author represented the factors that explained and clarified iPM implementation in a separate category. The iPM PAS category, as one can see in Figure 9-1, includes three concepts that were derived primarily from R3.

Figure 9-1: The iPM PAS category



9.2.1.1.1. Negative Perceptions about iPM

Both R3 and R5 confirmed that iPM was a system that faced resistance from end users. iPM was described as tough, awful, painful, and the worst system. All of these relate to the *Negative Perception* clinicians hold about iPM. The quotes R3 [22] and R5 [44] show this notion.

The bad perceptions that end users held about iPM captured the author's attention and stimulated an investigation of the causes of clinicians' unwillingness to use it. The author's interest in highlighting the root causes of iPM failure is based on the ground that iPM is the previous PAS, which was designed, and developed by the same contracted LSP that designed LORENZO. Furthermore, most of the NHS organisations that use iPM use it as their basic PAS platform, by which clinical documentation and the requesting of results are carried out. Accordingly, it would be sensible to study iPM failure to overcome or alert NHS CfH and system designers to any potential failures. The quote R5 [45] and R6 [32] support the author's view.

> *"IPM is a patient administration system; LORENZO... is fundamentally a clinical system so it sits on top of IPM at the moment"* R6 [32]

The first cause of the bad perceptions is the *inability to understand end users' requirements*. This denotes the fact that the iPM developer did not take into account clinicians' information requirements. This, in the author's opinion, is one of the primary causes of failure because the iPM developer could not determine what clinicians wanted from the system. R3 [23] and R3 [24] indicate the first cause of bad perceptions about iPM.

The second cause of the bad perceptions is the *unresponsiveness to end users' needs*. This cause refers to the fact that beside iPM designers were unable to understand clinicians' requirements; they were not responsive to their feedback or requests. R3 discussed his experience of dealing with the system developer who did not respond to his comments on the system (see the quotes R3 [25] and R3 [26]). The author argues that because the LSP was unable to understand clinicians' requirements, this led the LSP to be unresponsive to something that they had not originally taken into consideration. Moreover, the author thinks that the LSP's inability to understand, and unresponsiveness to end users needs stem from the methodology by which iPM was developed, which was application software packages development. As we saw in section 2.2.4.3 of the Information Technology in the Healthcare Sector chapter (Application Software Packages), application software packages offer little or no customisation capability to end users. Therefore, the NHS organisation that adopted iPM could not configure the system according to their needs, and consequently they were reluctant to use it.

The third factor is *lack of clinical interaction between the system developer and end users*. The author argues that this concept caused the system designers' inability to understand end users' needs as iPM designers were away from the real working environment, in which iPM operated. R3 stated (as shown in the quote R3 [27]) that the lack of clinicians' involvement and engagement was a very critical factor that brought about the failure of iPM.

The fourth sub concept in the *Negative Perceptions about iPM* is *long time to login,* as it required almost a minute to log into the iPM PAS. This was a problem to clinicians who were busy with not enough time to spend on IT systems. This problem caused workarounds as clinicians were used to sharing their cards to log into the system, and thus threatened the entire security of the system as unauthorised people could access and view information about patients (see the quotes R3 [29] and R3 [30]). The problem that existed in iPM indicates that they did not understand the nature of end users in the NHS because they did not have communication channels through which they could hear users' voice.

> *"Three extra clicks mean a lot to a busy clinician"* R3 [28]

The last sub concept that caused *Negative Perceptions about iPM* is the *inflexible design.* R3 stated that because clinical processes are diverse and carried out differently by clinicians, the system should be designed flexibly as one can see in the quote R3 [31].

The notion of flexible design refers to the idea that, for an organisation to succeed in developing an IS, it must be able to design it efficiently and effectively. This can be done by speeding up the time it takes to develop the system from identifying end users' needs to a tangible, and usable system, In marketing, this is called **Time to Market** (TTM) (King & Sivaloganathan 1999). King and Sivaloganathan (1999) postulated that flexible design requires the organisation to think ahead and develop a product that can be used in the future. This means that a "core" design of a product can be utilised to develop numerous products. Accordingly, when the organisation uses the present design to develop different versions of the system to pursue a different function, it takes less time and resources to develop these systems. In the case of the NHS where there are various specialities and different requirements, the concept of flexible design becomes vital to accommodate users' information needs.

9.2.1.1.2. Existence of Workarounds

The second concept in the *iPM PAS* category is the *existence of workarounds*. The author discussed the notion of workarounds and related it to the long login time iPM tool as clinicians were busy and could not have the time to access and retrieve the information in the system. Randell (2007) highlighted the existence of workarounds in the NHS, and he stated that despite workarounds provide immediate clinical needs, they can pose a security threat, and have undesirable consequences for the system. Thus, one can conclude that workarounds can be as a result of dysfunctional system that can not meet users' requirements.

9.2.1.1.3. Threats to System Security

The third and the last concept in the *iPM PAS* category is *threats to system security;* the main lesson of implementing iPM in the NHS is the security issue that was caused by the existence of workarounds due to the busyness of end users. This point is crucial because the main concern of clinicians was information security and confidentiality, and thus, users resist using the system if it is perceived as jeopardising information privacy and confidentiality (see for instance the quote R2 [25]). The author argues that clinicians' concerns about system security would be intensified in LORENZO because integration and information sharing level is higher than that in iPM.

> *"So people develop workarounds, they do and that's basically is undermining the entire security aspect of the data protection act and the patient/carer guarantee"* R3 [32]

Despite the fact that iPM suffered from security problems and was rejected by clinicians, R5 stated, as can be found in the quote R5 [46], that the implementation of iPM was positive in terms of offering the chance to the end users in the NHS to use IT systems. This was helpful for LORENZO as people had already tried IT systems.

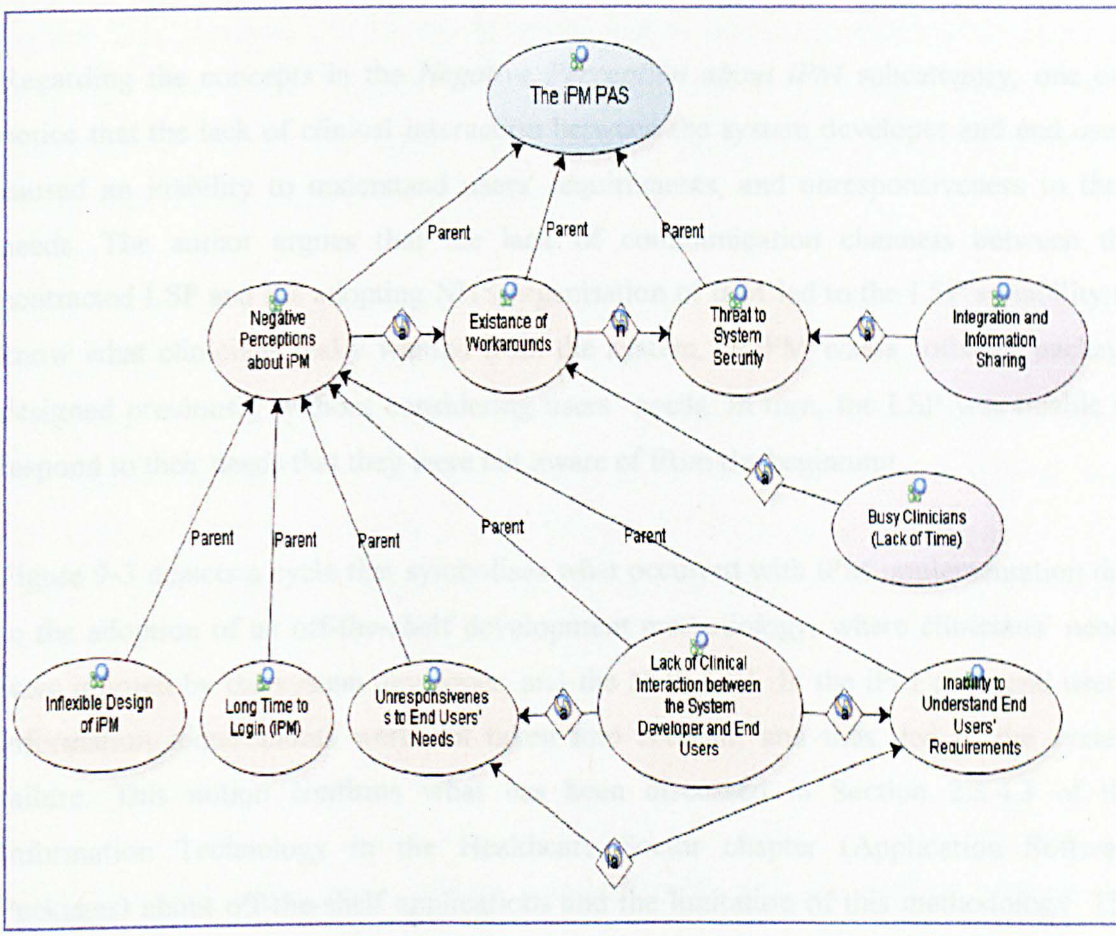
The author noticed, while talking to the participants about iPM, that there were different perspectives of how people perceived iPM. People inside the NHS looked at it as a very bad system, which did not achieve what clinicians wanted from a HCIS (e.g. R3). On the other hand, people from the supply side of the project defended the system and blamed the NHS for this failure. This failure was not caused by iPM related factors: instead it was because of technical problems associated with the infrastructure of the NHS organisations that applied iPM as was stated by R5 in the quote R5 [47].

What this implies is that talking to people who represented various perspectives about the implementation of IT systems in the NHS was useful in that the author could overcome/reduce the biases that people brought with them when discussing the implementation of IT systems under consideration. It was expected that people in the NHS would blame the LSP, and vice versa. Thus, the contradictory views of iPM implementation enhances the author's belief that it is important to adopt a multi-perspective approach to understand LORENZO's implementation, by taking the views of both sides, the supply (LORENZO's LSP), and the demand side (NHS organisations) of the project (LORENZO).

R6 claimed that (see the quote R6 [33]) iPM was a ready-to-use (i.e. off the shelf) application that performed specific tasks within a contained, and limited environment. From the quote R6 [33], one can conclude that iPM was different from LORENZO in terms of its scope and integration capability. iPM was an organisation-wide PAS whereas LORENZO was a nationwide clinical system with more sophistication. Therefore, the author argues that iPM was seen as a failure because it did not meet clinicians' aspiration of using an IT-based HIS that assured privacy and confidentiality. At the same time, clinicians required a system that would improve the efficiency of clinical processes, and provide more integration between the various departmental systems. What the author thinks is that LORENZO provides a huge capability for integration and sharing information that clinicians would probably appreciate, but at the same time, the designers of LORENZO should stress maintaining confidentiality and security within the system.

Figure 9-2 below shows the relationships in the *iPM PAS* category. As one can see, there are three different coloured nodes (i.e. concepts). The author assigned the blue colour for the level 0 concept that represents the "parent" node of the category. The bisque colour is assigned for the level 1 concepts (i.e. child nodes), which each one of them partially represents the parent, level 0 concept. The thistle colour concepts illustrate other (external) concepts from other categories that have connections with the concepts in the category of interest. NVivo offers an option that allows the user and/or the reader to distinguish the child nodes (level 1 concepts) from the parent nodes (level 0 concepts) by including the word "parent" on each headed arrow. The author thinks that assigning distinguishable colours for the concepts is useful, and can overcome the misunderstanding resulting from the way NVivo presents the categories.

Figure 9-2: The iPM PAS Category with Links



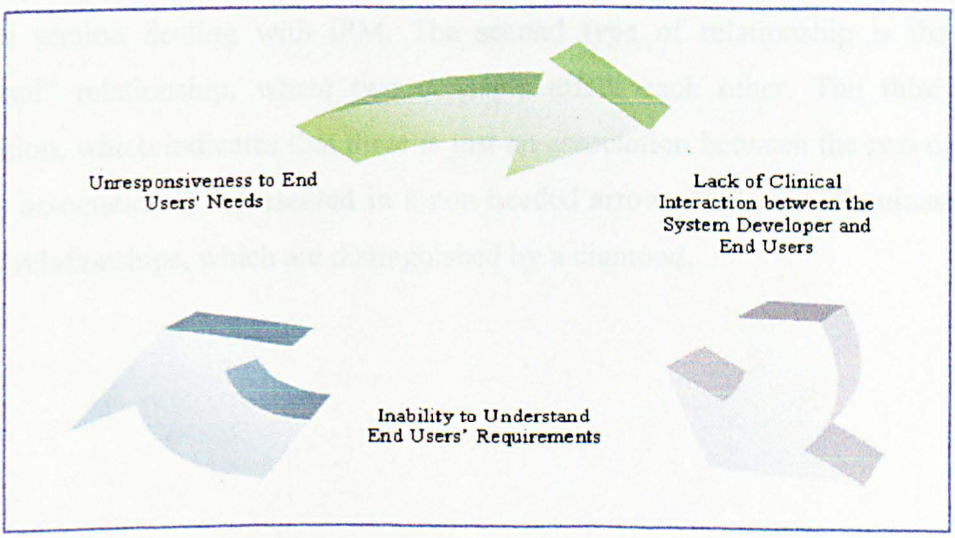
As we can see from Figure 9-2, the negative perceptions clinicians had about iPM resulted in workarounds. The existence of workarounds was also caused by the fact that clinicians were busy and did not have time to discuss the configuration of the system. Furthermore, because the existence of workarounds jeopardised information confidentiality, and privacy, the entire system's security was threatened as is represented by the links in Figure 9-2. One point to bear in mind is that the links with a diamond are causal links proposed by the author (theoretical coding).

In addition, iPM security seems also to have been threatened by the fact that information sharing might possibly breach confidentiality and privacy of information, since clinical information would be kept electronically and accessed by unauthorised people due to the existence of workarounds discussed previously. Thus, while system integration and information sharing are useful to make information available to both patients and clinicians, wherever, and whenever the information is needed they can put the system's security at risk and cause resistance to using the system.

Regarding the concepts in the *Negative Perception about iPM* subcategory, one can notice that the lack of clinical interaction between the system developer and end users caused an inability to understand users' requirements, and unresponsiveness to their needs. The author argues that the lack of communication channels between the contracted LSP and the adopting NHS organisation of iPM led to the LSP's inability to know what clinicians really wanted from the system, as iPM was a software package designed previously without considering users' needs. In turn, the LSP was unable to respond to their needs that they were not aware of from the beginning.

Figure 9-3 depicts a cycle that symbolises what occurred with iPM implementation due to the adoption of an off-the-shelf development methodology, where clinicians' needs were ignored by the system developer, and the NHS CfH. In the iPM case, end user's information requirements were not taken into account, and thus, led to the system failure. This notion confirms what has been discussed in Section 2.2.4.3 of the Information Technology in the Healthcare Sector chapter (Application Software Packages) about off-the-shelf applications and the limitation of this methodology. The cycle in Figure 9-3 is similar to the push strategy and top-down communications where systems are brought from outside with no or a little role for the real users.

Figure 9-3: The Causes Of iPM Failure



Another notion that the author thinks is pivotal to highlight is the impact of iPM's development methodology (Application Software Package) on its acceptance by clinicians. The iPM case emphasises the importance of choosing a system development methodology that considers end users' needs in the design and implementation of the system. This importance of having an appropriate development methodology becomes more significant when it comes to deploying IT-based health solutions in the NHS, where there are enormously diverse working environments in terms of different types of user groups, and unclear clinical processes.

In conclusion, the author started this chapter by explaining the issues associated with the implementation of iPM PAS in order to emphasise the importance of two critical dimensions that caused the iPM rejection. The first that considering end users' information needs should be placed on the top of the system developer's, and the NHS CfH's priorities when designing and developing IT health solutions. The second that adopting an appropriate system development methodology is essential to enable the contracted LSP to incorporate clinicians' requirements of the system.

9.3. DETERMINING RELATIONSHIPS IN THE MAJOR CATEGORIES

NVivo provides researchers with the opportunity to link the various concepts by creating different types of relationships. In this study, the author aimed to use three major types of relationships. The first one is a "One-way" directional relationship, which is a "Cause-and-Effect" that denotes to the notion that one concept affects the other, and not the other way around. The use of such links was illustrated in the previous section dealing with iPM. The second type of relationship is the "Non-directional" relationship, where two concepts affect each other. The third one is Association, which indicates that there is just an association between the two concepts, and this association is represented in a non-headed arrow. Table 9-1 illuminates these types of relationships, which are distinguished by a diamond.

Table 9-1: The Types of Relationships Used in the NVivo Projects

Name	Shape of the Arrow
Cause-and-Effect	⟶
Non-directional	⟷
Association	——

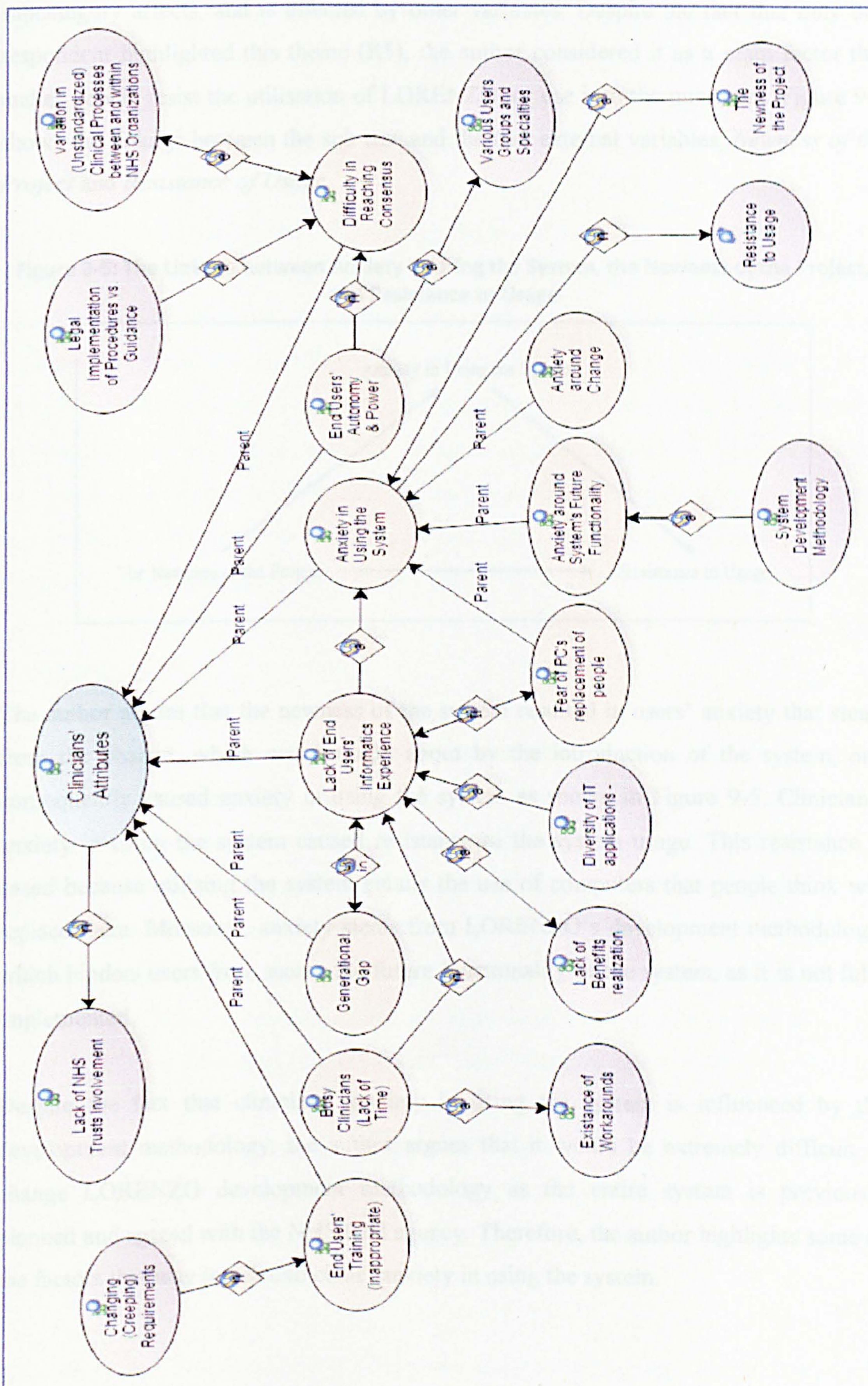
The schematic diagrams of the categories facilitated the task of showing these relationships on category and subcategory levels. Each of the major categories will be discussed separately before talking about the patterns.

The author would mention that the relationships between the various concepts in each major category were mostly based on the author's understanding and interpretation of the data. Some of these relationships were determined while coding the interview transcripts as more variables emerged. Others were highlighted when the author conducted focused coding by looking at each category in each project and tried to establish linkages between the concepts. Others again were determined in the combined (Merged) project, when all the nodes from the same hierarchical categories were joined into a single major category.

9.3.1. Clinicians' Attributes

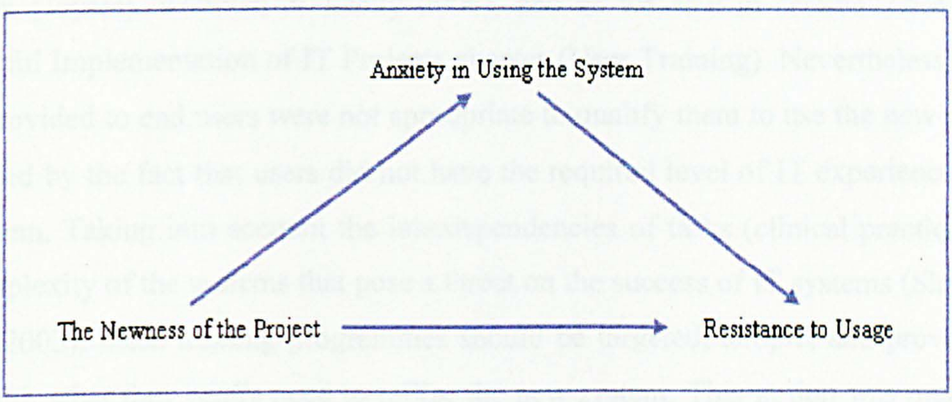
The first major category is *Clinicians' Attributes*; this category encompasses 10 concepts, seven of them represent the *Clinicians' Attributes* level 0 concept, and the rest shape the *Anxiety in Using the System* subcategory. Regarding the external nodes, there are eleven external subcategories and concepts. All of the concepts in the *Clinicians' Attributes* category are linked by 16 one-way and two way relationships. Figure 9-4 shows the clinicians' attributes tree node.

Figure 9-4: Clinician's Attributes Category with Linkages



By looking at the *Anxiety in Using the System* subcategory, one can see that this subcategory affects, and is affected by other variables. Despite the fact that only one respondent highlighted this theme (R5), the author considered it as a main factor that makes people resist the utilisation of LORENZO, or use it to the minimum. Figure 9-5 shows the linkage between the sub tree and the two external variables, *Newness of the Project* and *Resistance of Usage*.

Figure 9-5: The Linkage between Anxiety in Using the System, the Newness of the Project, and Resistance to Usage



The author argues that the newness of the system resulted in users' anxiety that stems from the change, which was brought about by the introduction of the system, and consequently caused anxiety in using the system as shown in Figure 9-5. Clinicians' anxiety in using the system caused resistance to the system usage. This resistance is based because utilising the system entails the use of computers that people think will replace them. Moreover, anxiety stems from LORENZO's development methodology, which hinders users from seeing the future functionality of the system, as it is not fully implemented.

Despite the fact that clinicians' anxiety in using the system is influenced by the development methodology, the author argues that it would be extremely difficult to change LORENZO development methodology as the entire system is previously planned and agreed with the NHS CfH agency. Therefore, the author highlights some of the factors that may lessen clinicians' anxiety in using the system.

By looking at Figure 9-4, one can see that *Users' Fear of PC's* is mutually correlated with *End Users' Lack of Informatics Experience*. The author argues that enhancing clinicians' IT skills encourages them to rely on computers in performing their daily operations, thus, reducing the fear of computers. This means that improving clinicians' informatics experience and/or IT skills may contribute to reducing users' anxiety.

To overcome clinicians' resistance to using the new system (amongst mainly the older generations of users), training becomes pivotal for successful intra-organisational IT adoption (Jeyaraj, Rottman & Lacity 2006), and as we saw in section 3.5.4 of the Successful Implementation of IT Projects chapter (User Training). Nevertheless, the IT skills provided to end users were not appropriate to qualify them to use the new system, evidenced by the fact that users did not have the required level of IT experience to use the system. Taking into account the interdependencies of tasks (clinical practices) and the complexity of the systems that pose a threat on the success of IT systems (Sharma & Yetton 2003), these training programmes should be targeted, simple, and provide end users with what they *really* need to utilise the new system. This notion was mentioned in the quote R1 [5].

Figure 9-4 shows that the diversity of IT applications affects *end users' informatics experience*. The relationship is based on the grounds that the NHS users were confronted with numerous IT solutions ranging from the simple ones, to sophisticated systems. For instance, those who used PACS, which was a simple and a self-contained system, would find it more complicated to use LORENZO, and thus, there were different attitudes toward the use of technology. Based on this, the author believes that it would be difficult to generalise the IT experience level of workers, as the NHS organisations had various systems. Therefore, understanding users' attitudes toward the use of LORENZO (for instance), would be vague because these attitudes would have been based on previously installed programmes other than LORENZO itself, as people might perceive all IT systems in the same way. Therefore, what one can conclude is that, past experience of end users in the NHS might be misleading to figure out their perceptions about the use of IT.

In summary, there were numerous IT systems under the NPfIT and accordingly people had various perceptions about the use of IT. This situation makes it hard for researchers to predict clinicians' attitudes toward the use of LORENZO based on their past IT experience. Consequently, the author aimed at understanding the real causes of users' rejection of LORENZO, in particular apart from their preconceived ideas about the other programmes.

From Figure 9-4, users' autonomy and power influences the notion that there is difficulty in reaching consensus among clinicians. The author believes that users' autonomy and power is a crucial trait because they are the knowledge owners (Knowledge workers) and therefore, have the power to decide how clinical processes should be pursued. Moreover, the notion that there are various user groups and specialities in the NHS is caused by users' autonomy and power. This linkage is based on the fact that clinicians, in each group try to force their own way of doing clinical processes, and without autonomy and power, they could not have been able to do so.

A resulting outcome of users' autonomy and power besides the existence of different specialities and user groups is the fact that it becomes challenging to reach consensus among clinicians. Difficulty in reaching consensus prevents the NHS from agreeing on a common set of standard operating procedures, and/or deploying the system properly. R2 confirmed this notion as shown in the quote R2 [26].

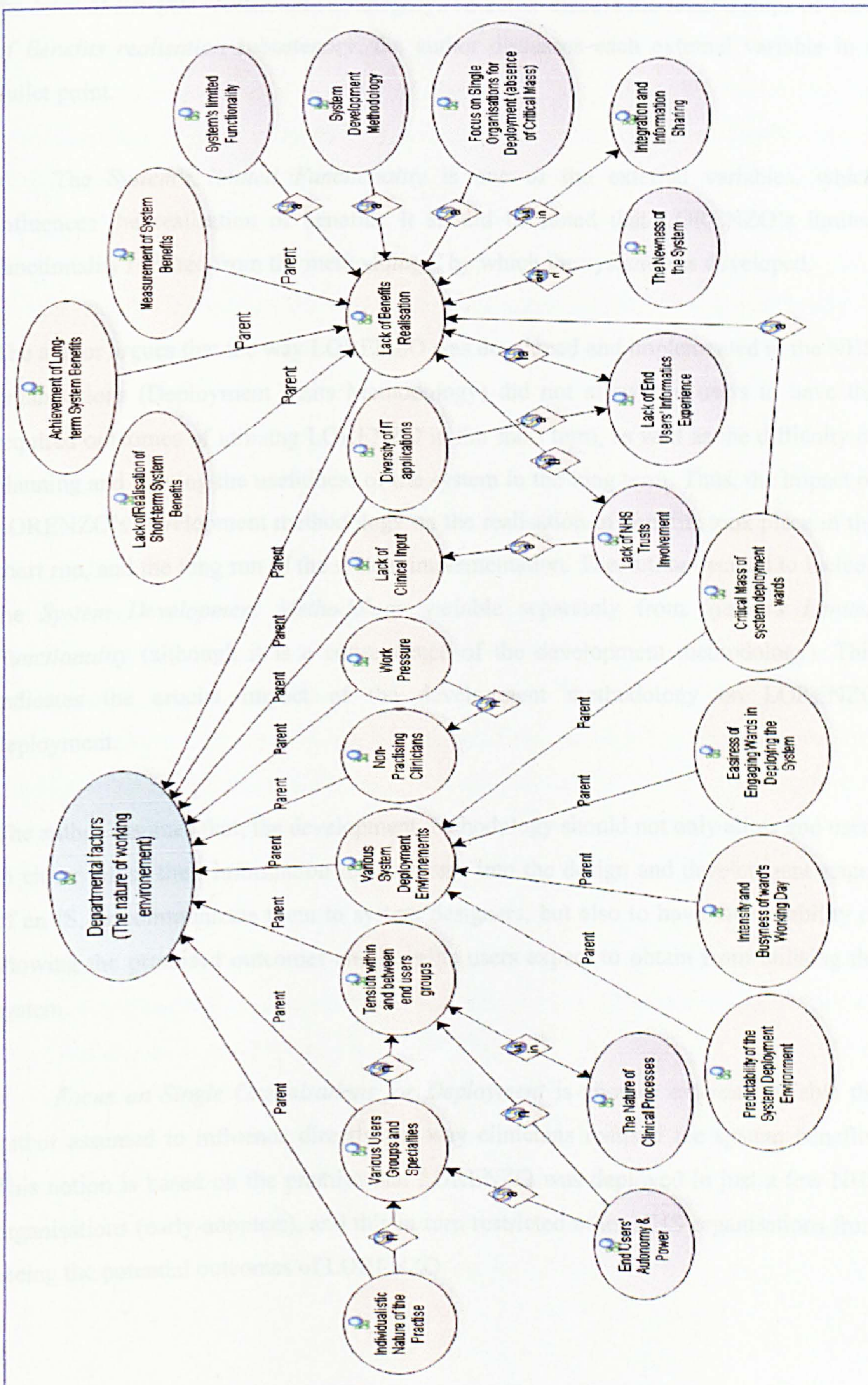
The author argues that difficulty in reaching consensus among clinicians is intensified by the existence of unstandardised, unclear, and ill-defined clinical processes as mentioned in the previous chapter. The author thinks that there is a two-way relationship, which implies that the lack of standardised clinical processes is an outcome of lack of consensus. Additionally, legal implementation of procedures versus guidance is another variable the author thinks that affects reaching consensus. Because clinicians are not required legally to apply the NHS procedures, clinicians did not agree on the way by which clinical process should be performed. Thus, one can conclude that the absence of commonly agreed standardised clinical processes in the NHS contributed to the lack of clinicians' obligation to follow standard operating procedures.

The author argues that clinicians' attributes, which have been discussed in this chapter, have a negative impact on NHS Trusts' Involvement. The busy nature of clinicians, lack of IT skills and knowledge, difficulty in reaching consensus and the anxiety clinicians have altogether prevented users from being involved in the design and implementation of LORENZO at the local level of the NHS organisations, or at the SHA level. Inappropriate training programmes and the generational gap of clinicians hindered end users from possessing the required level of IT experience, which enables them to be active participants in LORENZO implementation. Users' autonomy and power supported their choices of not being involved or using the new system.

9.3.2. Departmental Factors (nature of working environment)

The second major category is *Departmental factors (The nature of working environment*. This category encompasses 16 concepts, nine of them represent *Departmental factors*, three shape the *lack of benefits realisation* subcategory, and the rest shape the *various system deployment environments* subcategory. Regarding the external concepts, there are 10 external subcategories/concepts. All of the concepts in the *Departmental factors* category are linked by 16 one-way and two way relationships. Figure 9-6 shows the *Departmental Factors* major category with its external concepts and linkages.

Figure 9-6: Departmental Factors (nature of working environment) Major Category with Linkages



By looking at Figure 9-6, one can see that most of the external concepts are related to the *Lack of Benefits realisation* subcategory. To better discuss the relationships of *Lack of Benefits realisation* subcategory, the author discusses each external variable in a bullet point.

- The *System's limited Functionality* is one of the external variables, which influences the realisation of benefits. It should be noted that LORENZO's limited functionality resulted from the methodology, by which the system was developed.

The author argues that the way LORENZO was developed and implemented in the NHS organisations (Deployment Units Methodology) did not allow end users to have the required outcomes of utilising LORENZO in the short term, as well as the difficulty of planning and judging the usefulness of the system in the long term. Thus, the impact of LORENZO's development methodology on the realisation of benefits took place in the short run, and the long run of the system implementation. The author decided to include the *System Development Methodology* variable separately from *System's Limited Functionality* (although it is a consequence of the development methodology). This indicates the crucial impact of the development methodology on LORENZO deployment.

The author assumes that; the development methodology should not only allow end users to either infuse their information requirements into the design and development stages of an IS, or communicate them to system designers, but also to have the capability of showing the promised outcomes and benefits users expect to obtain from utilising the system.

- *Focus on Single Organisations for Deployment* is another external variable the author assumed to influence directly the way clinicians realised the system benefits. This notion is based on the premise that LORENZO was deployed in just a few NHS organisations (early-adopters), and this in turn restricted other NHS organisations from seeing the potential outcomes of LORENZO.

- *The Newness of the Project* (i.e. LORENZO) causes lack of benefits realisation, as the whole project (NPfIT) and LORENZO particularly was a brand new IT-based system, in terms of the way, by which it was developed. Moreover, LORENZO was new to the NHS in terms of its underlying principle, which was information sharing, and integration of multiple systems. This was supposed to yield more benefits to end users. However, because information sharing was something that clinicians thought might jeopardise confidentiality, and privacy of patients, they were reluctant to use the system, and thus, fewer organisations and people could perceive the benefits. One point to bear in mind is that the lack of informatics experience deepens the difficulty in realising the benefits of the system. This notion will be discussed in the later bullet points.

- *Integration and Information Sharing* is an external variable that resulted in the lack of benefits realisation. LORENZO is based on information sharing and integration between the various systems. This might have prevented people from using the system as integration and sharing were new concepts in the NHS. Clinicians' resistance stems from the fact that people in the NHS are more concerned about patient/doctor relationships, confidentiality, and information security. Thus, LORENZO might be seen as jeopardising security and privacy of patients. Accordingly, when end users perceive the system as jeopardising information privacy and security, which are the primary foundations of LORENZO, people could not see more benefits than those offered by any other IT health solution.

The author thinks that the relationship between *Integration and Information Sharing* and *Lack of Benefits realisation* is a two-way (non-directional) relationship. This means that when clinicians rejected using LORENZO because they perceived it as jeopardising the system security, they could not see the real benefits of that integration. The opposite is true in that when end users do not see the benefits of the new system (i.e. sharing of information), the NHS CfH agency can not deploy the system and force people to use it in sharing clinical information. This is because clinicians have the power to reject it, and there are no legal consequences of not using the system.

- There is also a two-way relationship between the *Lack of End Users' Informatics Experience* and *Lack of Benefits Realisation.* The author argues that when clinicians do not have the required experience of using IT-based health solutions, they will not be able to grasp the system benefits, and accordingly, will not be motivated to fully utilise the system. In the same way, when benefits are not recognised, clinicians will not be stimulated to use the system, as there is unclear and incomplete range of benefits.

- *Lack of NHS Trusts' Involvement* is an external variable that is related with *Lack of Benefits Realisation* by a two-way link. The author discussed previously the notion that lack of clinicians' involvement is caused by the nature of their working conditions (e.g. lack of time and IT experience). However, lack of clinicians' involvement in the implementation of LORENZO was also caused by the fact that they could not see the full potential of the system. The author argues that as the lack of benefits realisation caused less involvement by end users, lack of users' involvement might result in fewer committed and motivated clinicians, who wanted to apply the system and succeed in deploying it. Consequently, they were not interested in using the system and comprehending its potential advantages.

- Figure 9-6 shows that *Lack of NHS Trusts' Involvement* led to *Lack of Clinical Input.* The author argues that clinicians at the bottom level of local NHS organisations are the most crucial source of clinical input into the design and development of any IT health solution to be implemented in the NHS. This argument is based on the foundation that encouraging clinicians to participate in the determination of system's information requirements enhances their sense of commitment, as was discussed in section 2.2.4.2 of the Information Technology in the Healthcare Sector chapter (Prototyping), and makes them strong advocates of the system. It should be noted that lack of end users' involvement is not the only factor that led to lack of clinical input. Instead, other individual, departmental, and organisational factors resulted in the lack of clinical input. The other factors will be discussed later on in this chapter.

- The last external concept is *Critical Mass of System Deployment Wards.* The author argues that when an adopting NHS organisation deploys the system to cover the entire clinical processes that are performed by a certain ward, clinicians would be more inclined to use the system as they can use the system to support all their medical/clinical decisions. The more coverage of clinical processes, the better and easier for end users to realise the benefits of the system.

By looking at the left hand side of Figure 9-6, one can see that there are other relationships that exist between the concepts of the *Departmental Factors* major category, and the other two external concepts. The bullet points below explain these relationships.

- The author argues that the *Individualistic Nature of the Practice* (i.e. practice of medicine) brought about diversity in clinical processes, which in turn, led to the existence of various specialities and user groups. This situation makes it harder for either the NHS or system designers to build an (IS) that supports the implementation of the variety of interdependent, but not the same, clinical processes. One point to bear in mind is that the task of designing an IT-based health solution becomes more challenging when there are no structured, and standardised clinical processes as in the NHS case.

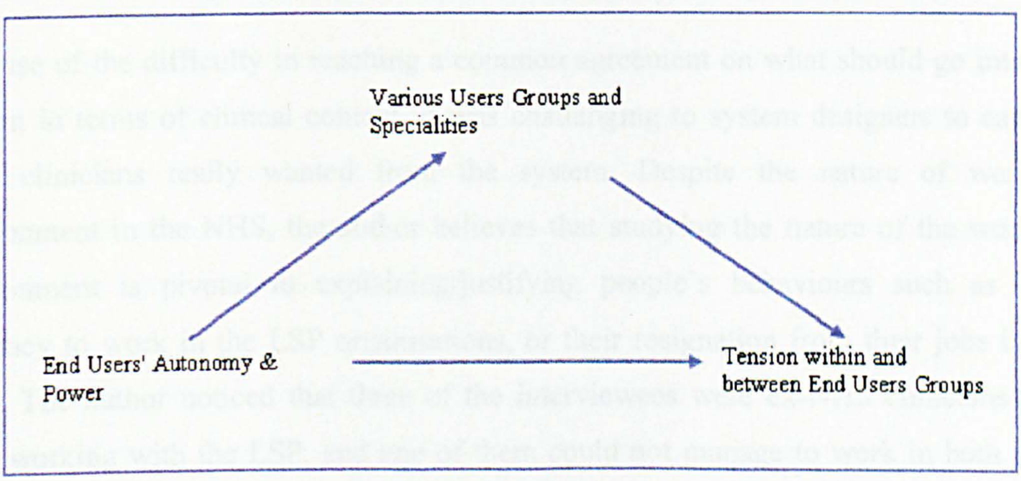
- The author would mention the fact that; the individualistic nature of medicine does not necessarily mean a lack of standardised clinical processes. The author thinks that because there are diverse user groups and specialities, tension exists within and between user groups. As a result, tension makes it difficult to reach a common agreement on what should be included in terms of clinical information in LORENZO. Thus, the author thinks that tension is one of the factors that contributed to having clinical processes that are unstandardised, ill defined, and ambiguous. The author stresses the fact that the existence of such clinical processes in the NHS causes tension between, and within the various groups, and for this reason, the relationship is a two-way directional relation between *Tension within and between End Users Groups* and *The Nature of Clinical Processes* concepts.

In conclusion, the author states that heterogeneity of user groups, along with tension that existed between, and within these groups might influence the intra-departmental interaction, which is useful to enable end users to determine the clinical specifications.

- Figure 9-6 shows that *End Users' Autonomy & Power* resulted in *Various Users Groups and Specialities*. The author justifies this outcome of users' autonomy and power by the fact that clinicians (who are the knowledge workers in the NHS) force certain ways of carrying out clinical processes that suit the internal interests of their speciality. Due to this situation, one can see that the same processes may be performed slightly or entirely differently, by either the same speciality in the numerous NHS organisations scattered throughout England, or the different specialities.

At the same time, the author thinks that the authority and power of clinicians cause tension between and within the same specialities. Figure 9-7 shows schematically the connections between the three concepts: users' power, various groups, and tension between and within these groups.

Figure 9-7: The Linkage between End Users' Autonomy & Power, Tension within and between End Users Groups, and Various User Groups and Specialities



From Figure 9-7, clinicians' power led to the existence of various user groups in the NHS. The variety in user groups also led to tension that existed within and between these groups. In addition, one can see that tension was also caused by users' autonomy and power, as each group tried to force the work practices it used to perform. The author argues that tension can be reduced by either lessening the effect of diversity, or reducing users' power, which is something difficult to achieve and would be opposed by clinicians themselves. Thus, the author proposes that the negative effect of groups' variety can be overcome by assisting the different speciality groups to reach consensus.

In summary, the impact of users' power on the extent of tension that exists in the NHS may be mediated by encouraging more agreement on what should go into the system in terms of clinical content. The author argues that the autonomy of medicine, tensions that took place between and within specialities, combined with end users' power makes it hard to find representative teams that can talk on behalf of all users, or represent everyone in arriving at the system specifications.

Regarding the *Work Pressure* concept, the author argues that because clinicians work under pressure as a result of the demanding and busy nature of clinical work, they do not have time to discuss the system requirements, and to work in the supply side of LORENZO (the LSP side). This situation forced clinicians to either resign from the NHS to work with the LSP, or reject the chance of having a position in the LSP organisation. Therefore, work pressure, along with lack of time, resulted in the existence of non-practising clinicians working for the LSP.

Because of the difficulty in reaching a common agreement on what should go into the system in terms of clinical content, it was challenging to system designers to capture what clinicians really wanted from the system. Despite the nature of working environment in the NHS, the author believes that studying the nature of the working environment is pivotal to explaining/justifying people's behaviours such as their tendency to work in the LSP organisations, or their resignation from their jobs in the NHS. The author noticed that three of the interviewees were ex-NHS clinicians who were working with the LSP, and one of them could not manage to work in both sides and kept his position in the NHS.

9.3.3. Organisational Factors

The third major category is *Organisational Factors*. This category encompasses 14 concepts. Regarding the external concepts, there are nine external subcategories and/or concepts. All of the concepts in the *Organisational Factors* category are linked by 21 one-way, two way, and associative relationships. Figure 9-10 shows the *Organizational Factors* category with its external concepts and linkages.

The author would mention the fact that some of the relationships between the sub concepts of the current major category and the external factors were not explained as they were clarified in the discussion of previous major categories. The relationships that were explained previously and will not be repeated here are: *Focus on Single Organisations for Deployment (absence of Critical Mass)* with *Lack of Benefits realisation*, *Lack of NHS Trusts Involvement* with *Lack of Benefits realisation*, *Legal Implementation of Procedures vs. Guidance* with *Difficulty in Reaching Consensus*, *Variation in (Unstandardised) Clinical Process between and within NHS Organisations* with *Difficulty in Reaching Consensus*,

The author thinks it is worthy to mention that NVivo does not show the relationships between the external variables; either if they are sub concepts (level 2 concepts), or categories. The author argues that this feature should not be considered as a drawback of the software because he believes that if the NVivo software were designed to show the relationships between the external variables, it would cause confusion and misunderstanding for researchers due to the complications of the crossing lines relating the variables together. The author noticed that sometimes, it was even difficult to draw the relationships between the sub concepts and the linkages with external variables for even one category, as the area of the computer screen did not allow the author to observe all of these relationships.

Thus, the author aimed to show the relationships of each major category in a separate diagram and then to sum up (in the Research Findings and Recommendations chapter) all the affecting variables for certain concepts in a form of causal maps that represent the end findings of the data analysis. To explain this point, the author refers to the *Clinicians' Attributes* major category and *Organisational Factors* major category as shown in Figure 9-8 and Figure 9-9 respectively.

Figure 9-8: External Relationships with Difficulty in Reaching Consensus

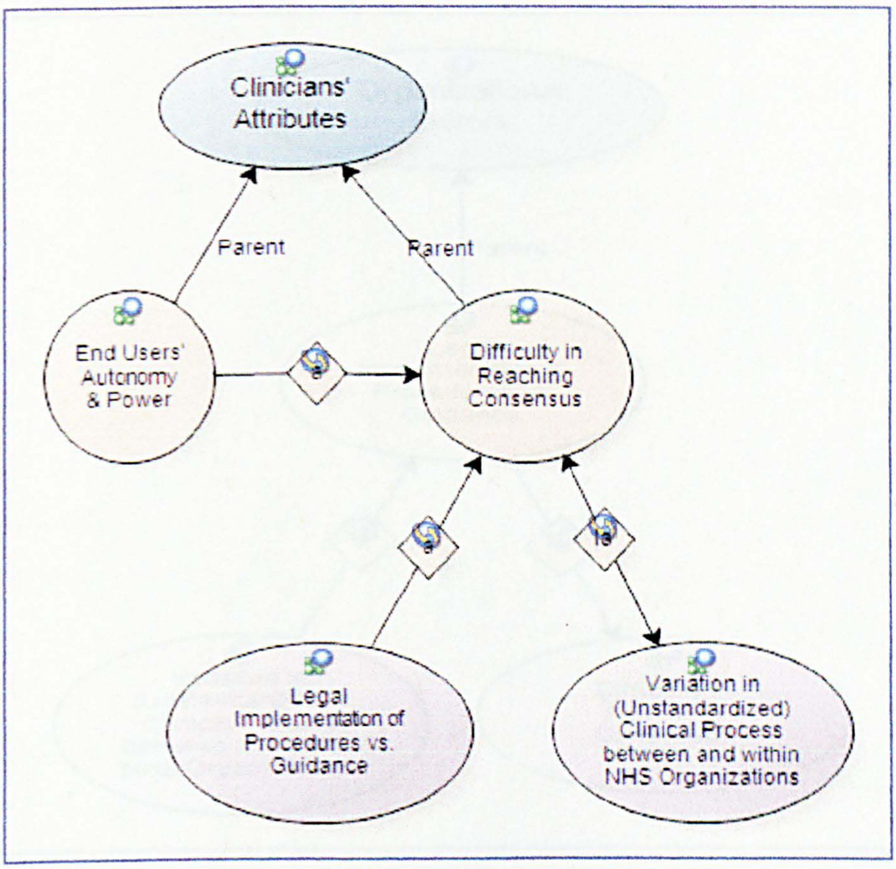


Figure 9-8 shows that *Difficulty in Reaching Consensus* concept is connected with *Legal Implementation of Procedures vs. Guidance* external concept by a one-way link and *Variation in (Unstandardised) Clinical Process between and within NHS Organisations* external concept by a two-way directional relationship. The *Clinicians' attributes* major category in Figure 9-8 does not show a relationship between the two external variables. Whereas, there is a one-way relationship connecting *Variation in (Unstandardised) Clinical Process between and within NHS Organizations* external concept, with *Legal Implementation of Procedures vs. Guidance* concept as appears in Figure 9-9. Additionally, *Difficulty in Reaching Consensus* external concept is only connected with the *Legal Implementation of Procedures vs. Guidance* concept.

Figure 9-9: External Relationships with Legal Implementation of Procedures vs. Guidance

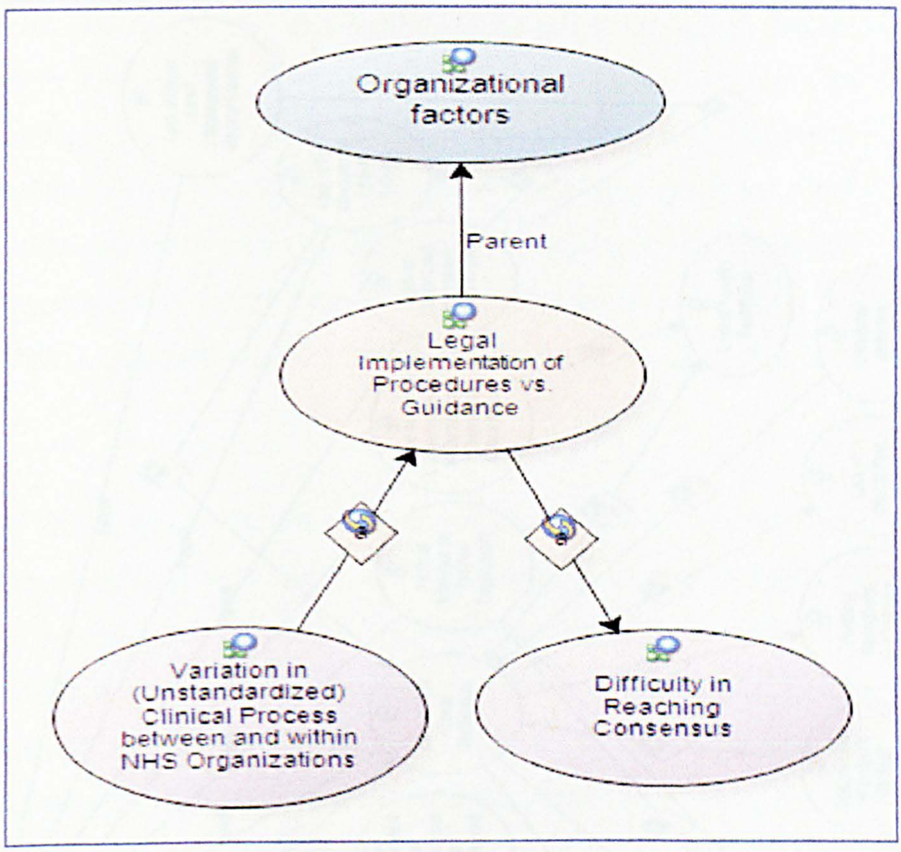
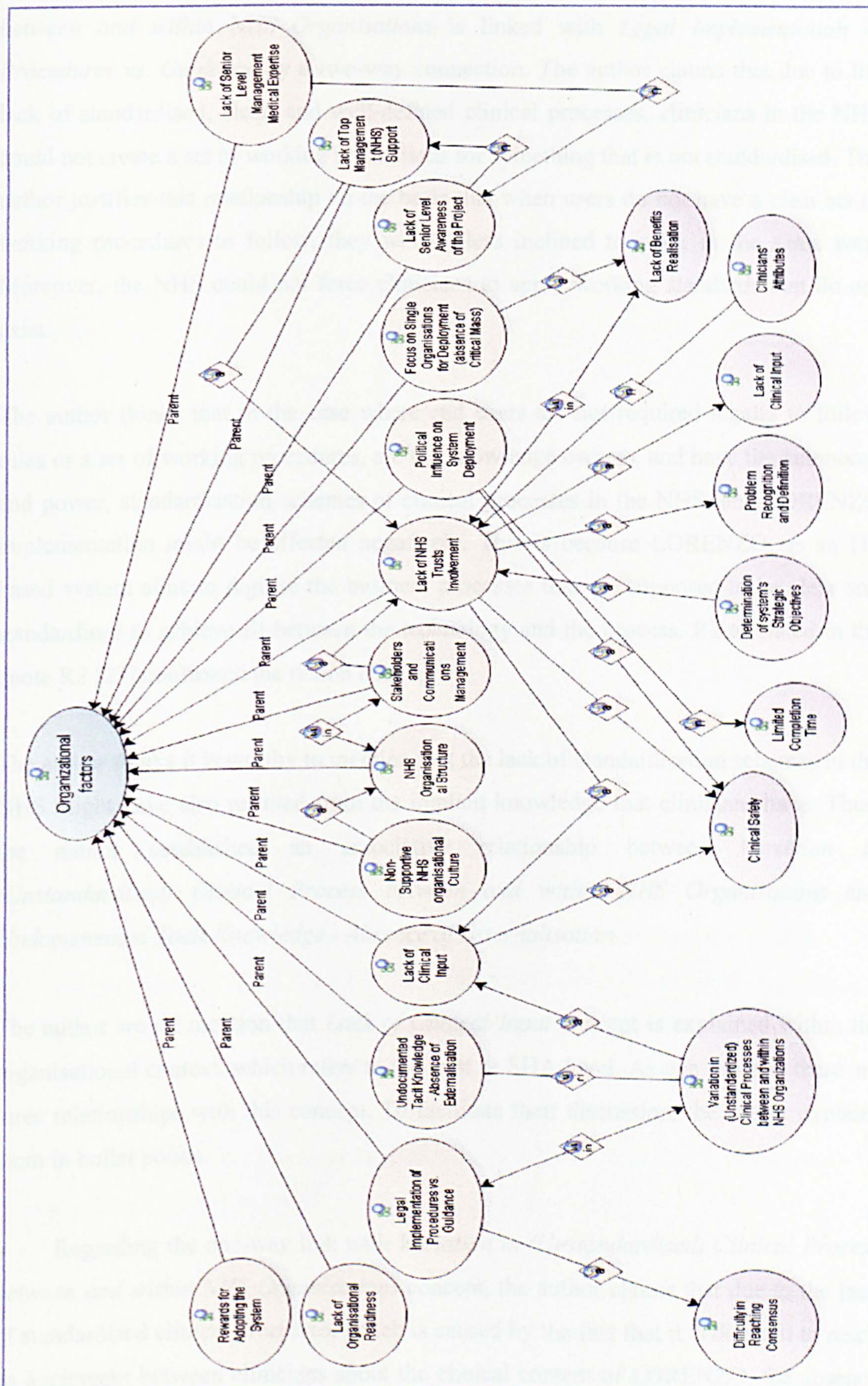


Figure 9-10: Organisational Factors Major Category with Linkages



From Figure 9-10, one can see that *Variation in (Unstandardised) Clinical Process between and within NHS Organisations* is linked with *Legal Implementation of Procedures vs. Guidance* by a two-way connection. The author claims that due to the lack of standardised, clear, and well-defined clinical processes, clinicians in the NHS could not create a set of working instructions for something that is not standardised. The author justifies this relationship on the basis that when users do not have a clear set of working procedures to follow, they will be less inclined to work in the same way. Moreover, the NHS could not force clinicians to apply working standards that do not exist.

The author thinks that in the case where end users are not required legally to follow rules or a set of working procedures, are the knowledge owners, and have the autonomy and power, standardisation schemes of clinical processes in the NHS, and LORENZO implementation might be affected negatively. This is because LORENZO, as an IT-based system aims to digitise the business processes that are supposed to be clear and standardised to achieve fit between the technology and the process. R2 as stated in the quote R2 [27] confirmed the notion above.

The author thinks it is worthy to mention that the lack of standardisation schemes in the NHS might have also resulted from the implicit knowledge that clinicians have. Thus, the author established an associative relationship between *Variation in (Unstandardised) Clinical Process between and within NHS Organisations* and *Undocumented Tacit Knowledge - Absence of Externalisation.*

The author would mention that *Lack of Clinical Input* concept is explained within the organisational context, which refers to the trust or SHA level. As one can see, there are three relationships with this concept. To facilitate their discussion, the author explains them in bullet points.

- Regarding the one-way link with *Variation in (Unstandardised) Clinical Process between and within NHS Organisations* concept, the author claims that due to the lack of standardised clinical processes, which is caused by the fact that it is difficult to reach an agreement between clinicians about the clinical content of LORENZO, the absence of rules that clinicians should follow to perform the various processes, and the existence of tacit knowledge, all together resulted in no, or little clinical input into the development of LORENZO.

- About the relationship with *Clinical Safety* concept, the author assumes that the lack of clinical input into the development of any IT-based health solution means that there is no clinical ground, on which the system stands to perform clinical processes. This produces negative ramifications on the entire clinical safety of the system, as users will not be aware of the consequences, in terms of patient safety, of performing clinical processes.

- The author argues that *Lack of NHS Trusts' Involvement* causes *Lack of Clinical Input*. By looking at *Lack of NHS Trusts' Involvement* concept in Figure 9-10, one can see that this factor also causes the lack of clinical input, which is shown as an external variable. The author would mention the fact that *Lack of NHS Trusts' Involvement* affects the extent of clinical input at the departmental level, which is represented in the wards/speciality departments, as well as at the organisational level, which is represented in the trust or the SHA level.

The author argues that *Clinicians' Attributes* resulted in the lack of involvement as clinicians did not have time to be involved, lacked the IT experience to deal with the system, had inappropriate training, anxiety, had difficulty in reaching consensus, and the generational gap did not allow them to put their clinical expertise into the development of LORENZO. Thus, the lack of clinical input at the ward or department level resulted directly from the lack of involvement, which was rooted in clinicians' attributes. Because there is no clinicians' involvement at the bottom level of NHS organisations, trust or SHA management would find it difficult to lead the development of LORENZO clinically, as there is no source of clinical participation coming from the lower level of NHS organisations, and thus, one can infer that NPfIT and LORENZO are not sufficiently clinically led.

In summary, the author argues that the lack of users' involvement is the most obvious reason that explains the lack of clinical input into the development and deployment of LORENZO. The author based his arguments on the foundation that the group of clinicians, which was appointed by the NHS CfH agency and represented end users, did not engage the real users of the system. Thus, one can understand that the lack of clinical input in the NHS was not only because of the nature of clinicians' work (e.g. lack of time or the busy nature of work), but also because of the fact that the real users were not involved (they were not consulted on the system specifications). The two quotes from R5 [48] and R6 [34] symbolise the author's argument.

Figure 9-10 shows that *Lack of NHS Trusts' Involvement* has a set of relationships, some of them were discussed previously. The author explains the remaining relationships that have not been discussed as shown in the following bullet points.

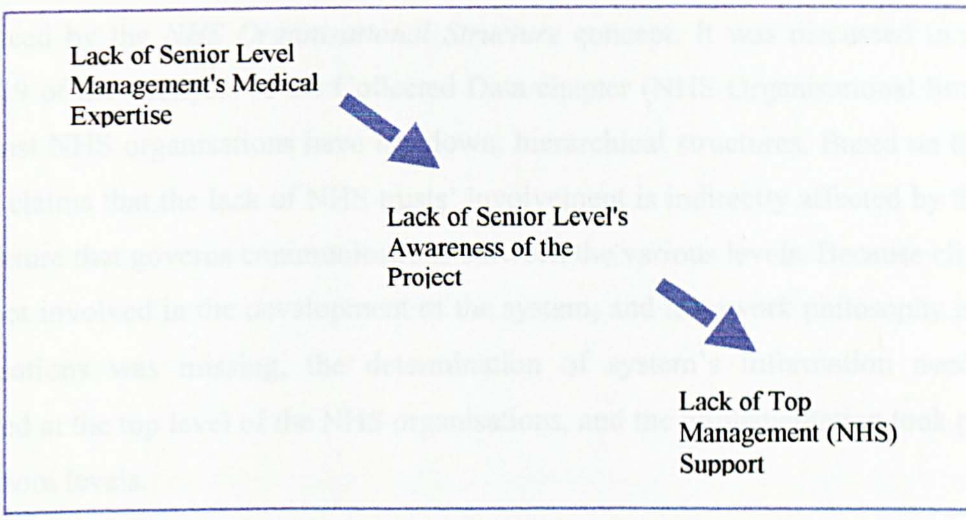
- *Lack of NHS Trusts' Involvement* influences *Clinical Safety*; this is similar to the impact of *lack of clinical input* on *clinical safety*. The author claims that clinical safety was directly affected by the fact that the development of LORENZO was not clinically led, which originally resulted from the lack of trusts' involvement. One point to bear in mind is that users' absence of involvement continued beyond the design and development of the system, end users were not even engaged in discussing the clinical safety of the system that they were supposed to use.

Despite the fact that end users should be included in the determination of system's requirements, involving end users does not necessarily help system designers and the NHS CfH to come up with functional specifications that achieve the desired outcomes and benefits an organisation is looking for. The author argues that this is true because not all users have the informatics experience, which would enable them to talk to system designers and agree on the system's requirements

- Figure 9-10 shows that there is a one-way link between *Lack of Top Management (NHS) Support* and *Lack of NHS Trusts' Involvement*. The author argues that lack of top management support could be caused by the seniors' lack of understanding and awareness of the system. Moreover, the author thinks that the lack of senior management's awareness and understanding of the system, which is represented in *Lack of Senior Level's Awareness of the Project* concept, could be brought about by the notion that senior level management in the NHS did not have enough medical expertise.

Figure 9-11 shows the chain of relationships that explains the lack of top management support.

Figure 9-11: The Causes of the Lack of Top Management (NHS) Support



- The author argues that *Stakeholders and Communications Management* is related to the *Lack of NHS Trusts' Involvement* concept. The connection between these two concepts is based on the foundation that the lack of open, bottom-up communication channels prevented clinicians from communicating their information requirements to the higher managerial levels of the trust, or the SHA. The author discussed in section 2.2.3 of the Information Technology in the Healthcare Sector chapter (Socio-technical Theory), that successful adoption of the socio-technical approach requires organisation to provide open, democratic, and participative communications that enable end users to convey their needs. Thus, it becomes important that the leadership in the NHS pay more attention to creating more effective communication system among the various organisational levels.

Furthermore, the author thinks that what the LSP could have done is communicating directly with clinicians in Local NHS organisations to negotiate the system requirements, and then communicate these requirements to the SHAs and the NHS CfH agency. In addition, the author claims that communication problems did not only exist between the upper and the bottom levels of NHS organisations, but also there was a lack of communication between the NHS and the LSP. The lack of communication between the NHS and the LSP might be a ramification of the commercial nature of the contract that defined the relationship between the NHS and the LSP. R2 [28] supports this notion.

Figure 9-10 reveals that the *Stakeholders and Communications Management* concept is influenced by the *NHS Organisational Structure* concept. It was discussed in section 8.3.6.3.9 of the Analysis of the Collected Data chapter (NHS Organisational Structure) that most NHS organisations have top-down, hierarchical structures. Based on this, the author claims that the lack of NHS trusts' involvement is indirectly affected by the type of structure that governs communications between the various levels. Because clinicians were not involved in the development of the system, and teamwork philosophy in these organisations was missing, the determination of system's information needs was executed at the top level of the NHS organisations, and the implementation took place at the bottom levels.

However, determining a system's information needs at higher managerial levels is not as useful as the engagement of the real users who are in constant contact with the system and the clinical processes carried out. The lack of senior level knowledge of what is going on the bottom level limits the chance of having suitable systems that meet users' needs. Accordingly this situation may have created resistance to using the system as it was perceived as an external, intrusive IT innovation, that clinicians (who did not have any role in its development) had to adopt.

One can notice that there is a separation between the determination of system requirements, which is mostly done at the high level of the NHS, and the implementation of these systems, which is pursued by the local NHS organisations. Thus, engaging clinicians (the real users) in the determination of information requirements is crucial in reducing their resistance and encouraging them to raise unexpected system requirements, or providing suggestions on how the system should handle their clinical processes.

- The author argues that the lack of clinicians' involvement at the bottom level of NHS organisations prevented them from being informed about the prospective outcomes of the system and its purposes. This notion is represented in the one-way relationship between *Lack of NHS Trusts' Involvement* and *Problem Recognition and*

Definition. The author postulates that for an NHS organisation to succeed in deploying IT based solutions, they should undertake all sorts of preparations to inform users at all managerial levels about what is needed from the system, and for what purposes they are going to deploy it, whether the system is deployed to enhance the current performance, or to solve a problem. Therefore, establishing open and effective communication channels that link users who are scattered throughout the organisational hierarchy, is vital for enhancing interaction with real users.

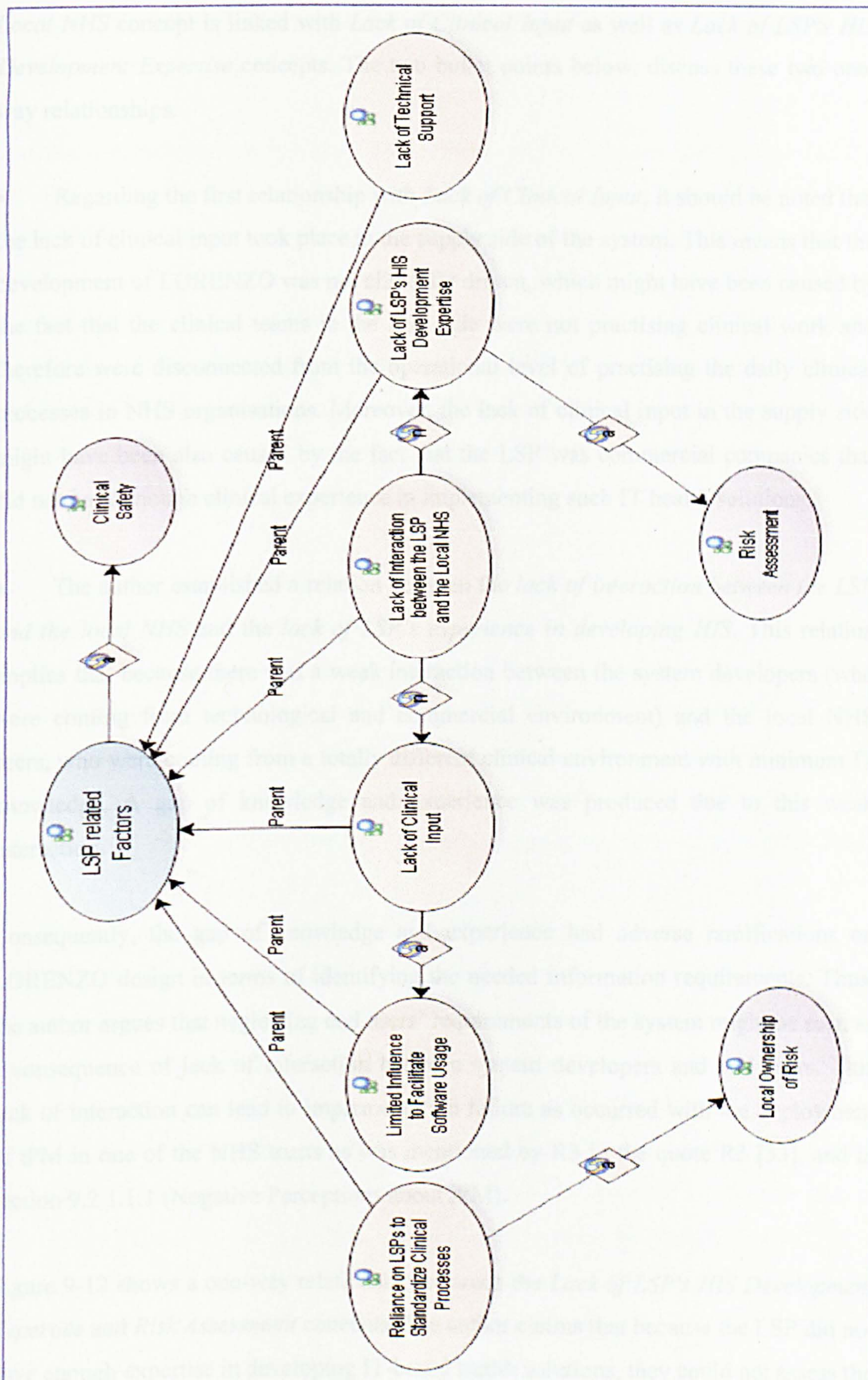
- Another factor that reduces end users' involvement is the fact that the system's objectives were determined by the top-level management of NHS organisations that wished to deploy LORENZO.

Finally, Figure 9-10 shows that *Political Influence on System Deployment* concept affects the *Clinical Safety* concept. The author believes that the political pressure generated by politicians, the government, and the decision makers in the DoH could have an adverse impact on LORENZO's success (as was stated by R4). The author thinks that posing political pressure on the completion time of the system could jeopardise the entire system's clinical safety. This is because the NHS organisations will not have time enough to assess the potential risks associated with using the system, or they will be forced to roll out the system without going through a careful and gradual deployment of the system in a controlled environment.

9.3.4. LSP Related Factors

The fourth major category is *LSP Related Factors.* This category encompasses six concepts. Regarding the external concepts, there are three external categories/concepts. All of the concepts in the *LSP Related Factors* category are linked by five one-way relationships. Figure 9-12 shows the *LSP Related Factors* major category with its external concepts and linkages.

Figure 9-12: LSP Related Factors Major Category with Linkages



From Figure 9-12, one can notice that *Lack of Interaction between the LSP and the Local NHS* concept is linked with *Lack of Clinical Input* as well as *Lack of LSP's HIS Development Expertise* concepts. The two bullet points below, discuss these two one-way relationships.

- Regarding the first relationship with *Lack of Clinical Input*, it should be noted that the lack of clinical input took place in the supply side of the system. This means that the development of LORENZO was not clinically driven, which might have been caused by the fact that the clinical teams in the LSP side were not practising clinical work and therefore were disconnected from the operational level of practising the daily clinical processes in NHS organisations. Moreover, the lack of clinical input in the supply side might have been also caused by the fact that the LSP was commercial companies that did not have enough clinical experience in implementing such IT health solutions.

- The author established a relation between the *lack of interaction between the LSP and the local NHS* and the *lack of LSP's experience in developing HIS*. This relation implies that because there was a weak interaction between the system developers (who were coming from technological and commercial environment) and the local NHS users, who were coming from a totally different clinical environment with minimum IT knowledge. A gap of knowledge and experience was produced due to this weak interaction.

Consequently, the gap of knowledge and experience had adverse ramifications on LORENZO design in terms of identifying the needed information requirements. Thus, the author argues that neglecting end users' requirements of the system might be seen as a consequence of lack of interaction between system developers and end users. This lack of interaction can lead to implementation failure as occurred with the deployment of iPM in one of the NHS trusts as was mentioned by R3 in the quote R3 [33], and in section 9.2.1.1.1 (Negative Perceptions about iPM).

Figure 9-12 shows a one-way relationship between the *Lack of LSP's HIS Development Expertise* and *Risk Assessment* concepts. The author claims that because the LSP did not have enough expertise in developing IT-based health solutions, they could not assess the risk associated with using such systems in the real working environment. An existence of clinical standards, against which the system is evaluated in terms of its safety, was absent, at least prior to 2006 as stated by R6.

Another link that appears in Figure 9-12 is between *Reliance on LSPs to Standardise Clinical Processes* and *Local Ownership of Risk*. The author argues that because the NHS relied on the LSP to standardise the clinical processes, the LSP should have assisted local NHS organisations to bear the risk that may appear when using the system's deployment units. Moreover, the author argues that the 45 days of technical support provided to NHS organisations was not enough if one considers the complexity and the scope of the system. Lack of technical support might be one of the reasons that prevented local NHS organisations from understanding and/or assessing the impact of the potential risks when performing clinical processes.

The clinical processes, which are supposed to be digitised by the system, were determined by the LSP. When a potential risk was reported, the LSP did not interfere to fix the system as long as the risk was perceived to be within the acceptable level as determined by the LSP. The author believes that this is controversial because what seems to be risky in the LSP's eyes is not necessarily so from a clinical point of view and vice versa. The author wonders how the NHS organisation is supposed to own a risk associated with a process that was originally designed and determined by the LSP.

Figure 9-12 demonstrates a one-way relationship between *Lack of Clinical Input* and *Limited Influence to Facilitate Software Usage* concepts. The author argues that system designers had little influence on the NHS end users in terms of changing their perceptions about the use of LORENZO. The author argues that the LSP's limited influence stems from the fact that the LSP did not have sufficient numbers of practising clinicians in its design teams, who were able to bring about the required influence since the LSP's specifications were based more on technological than clinical considerations. This made it hard to communicate and understand users' information needs. Thus, instead of confining the responsibility of encouraging clinicians to use the system to the LSP side, both the LSP and the NHS should bear a mutual responsibility for ensuring this.

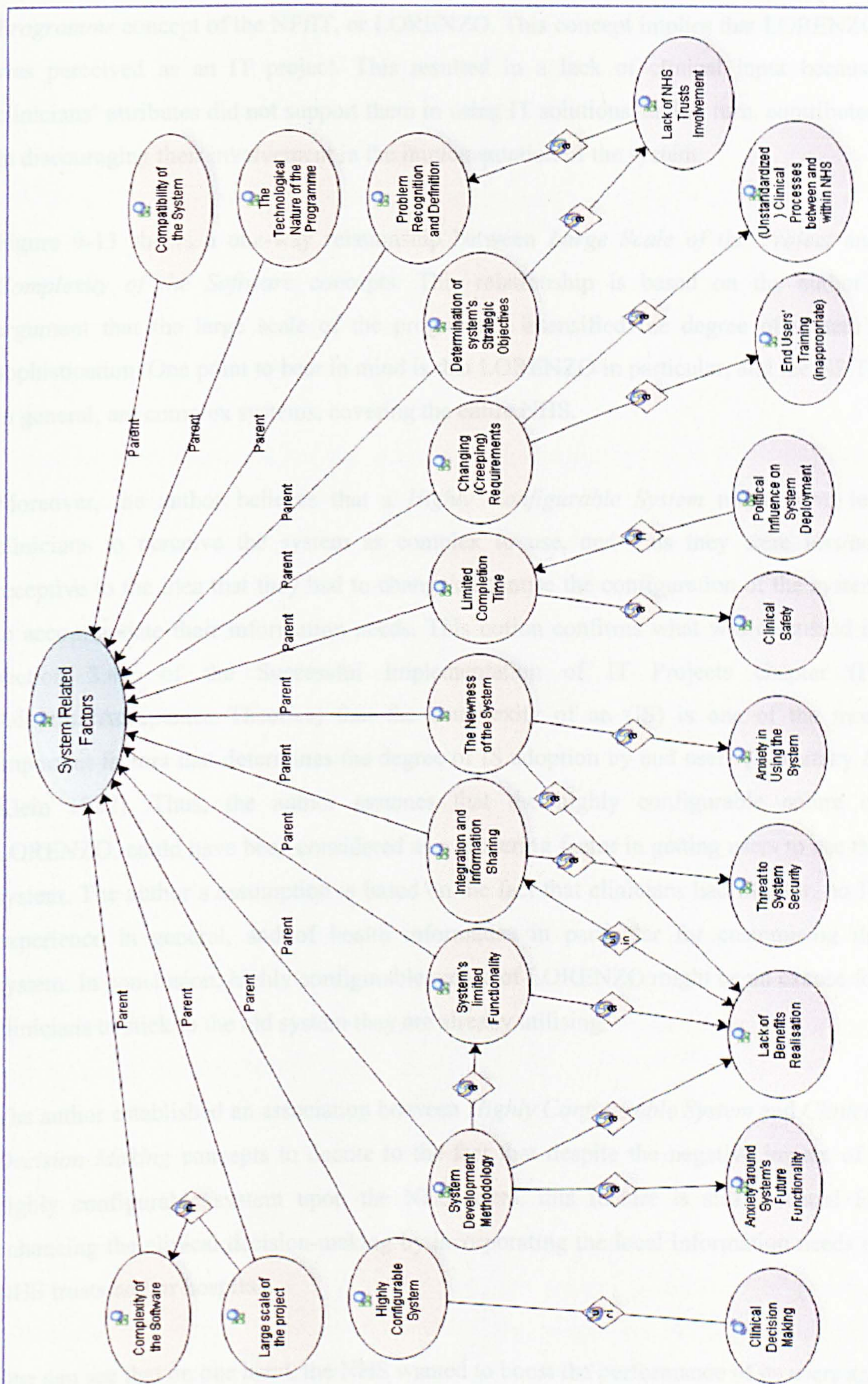
The final relationship as illustrated in Figure 9-12 is the one that links *LSP Related Factors* with *Clinical Safety*. Based on what has been discussed previously regarding the LSP related factors, the author believes that the entire clinical safety of LORENZO is partially affected by the lack of LSP's experience in developing HISs. The development of the system is not clinically driven enough, and there is a lack of interaction between the LSP and the local NHS organisations. What one can conclude is that clinical safety is a very crucial aspect in designing and implementing any IT-based health solution and should be seen as the foundation, upon which the HIS stands. Therefore, all stakeholders (i.e. LORENZO's LSP, the NHS CfH and the local NHS organisations) should contribute to building HIS collaboratively, rather than individually as occurred with LORENZO.

9.3.5. System Related Factors

The fifth major category is *System Related Factors* that encompasses 13 concepts. Regarding the external concepts, there are ten external category/concepts. All of the concepts in the *System Related Factors* category are linked by 16 one-way, two way, and associative relationships. Figure 9-13 shows the *System Related Factors* category with its external concepts and linkages.

The author would mention that most of the relationships were discussed in the preceding major categories. However, the author repeats the discussion of these relationships, but this time with greater focus on their impact upon the LORENZO development methodology, which is the core concept in this category. The author's emphasis on the importance of the development methodology stems from the fact that the LORENZO development methodology had an enormous effect upon end users' acceptance, and the way their needs were taken into consideration during the development stages of the system.

Figure 9-13: System Related Factors Major Category with Linkages



The author starts the discussion of this category with *The Technological Nature of the Programme* concept of the NPfIT, or LORENZO. This concept implies that LORENZO was perceived as an IT project. This resulted in a lack of clinical input because clinicians' attributes did not support them in using IT solutions, and in turn, contributed in discouraging their involvement in the implementation of the system.

Figure 9-13 shows a one-way relationship between *Large Scale of the Project* and *Complexity of the Software* concepts. This relationship is based on the author's argument that the large scale of the programme intensified the degree of system's sophistication. One point to bear in mind is that LORENZO in particular, and the NPfIT in general, are complex systems, covering the entire NHS.

Moreover, the author believes that a *Highly Configurable System* might have led clinicians to perceive the system as complex to use, and thus they were less/not receptive to the idea that they had to change/customise the configuration of the system to accommodate their information needs. This notion confirms what was discussed in section 3.4.2 of the Successful Implementation of IT Projects chapter (IT Adoption/Acceptance Theories) that the complexity of an (IS) is one of the most important factors that determines the degree of IS adoption by end users (Tronatzky & Klein 1982). Thus, the author assumes that the highly configurable nature of LORENZO, could have been considered as a hindering factor in getting users to use the system. The author's assumption is based on the fact that clinicians had little or, no IT experience in general, and of health informatics in particular for customising the system. In conclusion, highly configurable nature of LORENZO might be an excuse for clinicians to stick to the old system they are already utilising.

The author established an association between *Highly Configurable System* and *Clinical Decision Making* concepts to denote to the fact that despite the negative impact of a highly configurable system upon the NHS users, this feature is still essential for enhancing the clinical decision-making by incorporating the local information needs of NHS trusts and/or hospitals.

One can see that on one hand, the NHS wanted to boost the performance of its users and to enhance the health service it offers to patients by introducing a HCIS. This HCIS is going to be complex to achieve the NHS aspiration of having one commonly shared IT-based network that connects NHS trusts to enable them to share clinical information. On the other hand, NHS trusts and users lacked the IT skills to deal with such a system that requires technical intervention (i.e. the configuration of the system). This scenario let the author argue that both the NHS and the LSP should work together on improving clinicians' IT knowledge and understanding, and at the same time, to suggest a mechanism, through which the system configuration could be made more convenient for the real users. For instance, intensifying the technical support, or assigning technical teams to work with the adopting NHS organisation; the NHS organisation proposing the clinical changes and the technical teams working on tuning the system.

Regarding the *Changing (Creeping) Requirements* concept in Figure 9-13, the author argues that this concept might add more sophistication to the system as clinicians wanted to try out something new in the system and asked for different functionalities that suited the way they were used to performing clinical processes. Emerging information requirements, new ways of implementing clinical processes by numerous user groups, and more systems as the programme moves on to accommodate departmental/specialities differences entails that implementing NPfIT should not be seen as a sequential and planned approach.

Moreover, one can see that changing requirements cause *Variation in (Unstandardised) Clinical Processes between and within NHS Organisation*s. The author justifies this effect, that changing information requirements is not the same as changing the clinical processes themselves. This reminds us of an imperative fact that the NHS should have decided on the clinical processes to be digitised first, and then the system should have been designed accordingly.

Regarding the *System Development Methodology* concept;, the author argues that because most of LORENZO's deployment units have not been designed and deployed in NHS organisations, there would be an incomplete definition of the system's scope, which makes it very possible to have delays in delivering the product to NHS organisations. Moreover, adopting Deployment Units caused limited functionality of the system and in turn difficulty in realising the system's benefits. In conclusion, the author claims that the lack of benefits realisation is a direct implication of the system's limited functionality. Figure 9-13 shows that lack of benefits realisation is affected by the development methodology, to denote to the fact that the development methodology caused lack of benefits through its direct impact on the system functionality, which was limited.

The author argues that the system development methodology affected negatively clinicians' involvement due to the limited system functionality and the lack of benefits realisation. Nevertheless, the LSP could have enhanced end users' participation in determining system's outcomes or objectives by giving more chances to end users to have a role along with their superiors. It should be noted that it is not only the LSP's responsibility to engage clinicians in determining system's requirements. It is also the local NHS organisation that should think of engaging their bottom subordinates.

One can see from Figure 9-13 that the *Integration and Information Sharing* concept affects the *Threats to System Security* concept, and mutually relates with the *Lack of Benefits realisation* concept. The author included the relationship with system security that threatened the success of iPM, which was the preceding PAS. The author's intention to do so is based on the foundation that system security is crucial to any IT system in general, and HIS in particular as it deals with patients' health. Although system security was threatened in the old system, not LORENZO, it is still a notion that must capture the attention of system designers to think of how to assure security during the various stages of LORENZO development.

Because LORENZO is based on new concepts such as information sharing and exchange of information via a common data warehouse, this benefit was not clear in users' minds, as integration was needed first to enable them to exchange clinical information. However, limited functionality that is a direct ramification of the development methodology prevented such integration. In addition, the author believes that integration and sharing of clinical information might be a source of breaching system security, as clinicians wanted a system that guarantees information privacy and confidentiality.

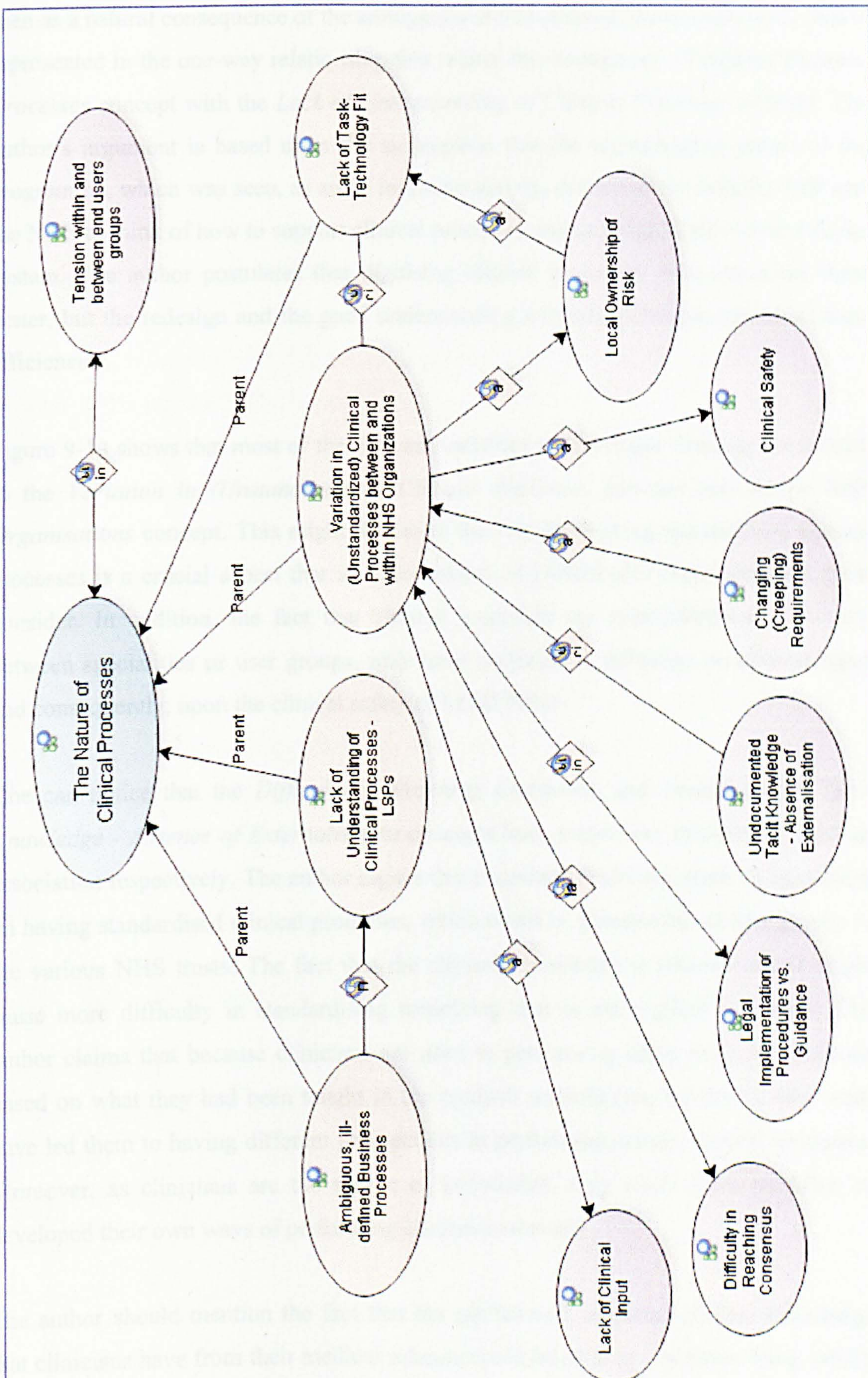
In spite of the fact that information sharing and integration of the various deployment units makes the system more vulnerable to breaching privacy and confidentiality such as information misuse and unauthorised access, integration remains pivotal for the NHS to attain smooth flow of information across clinical processes. However, based on analysis of the data, the participants revealed the importance of achieving compatibility, which is vital to facilitate integration (Kamal 2006, Tronatzky & Klein 1982).

Based on the definition of technological and organisational compatibility, which was defined in section 3.4.2 of the Successful Implementation of IT Projects chapter (IT Adoption/Acceptance Theories), one can conclude that due to the lack of reliance on IT in the NHS (mainly in secondary care, see 8.3.6.1.3), clinicians found it difficult to use the system especially as they had little or no IT experience/knowledge. In addition, even if clinicians had utilised IT-based health solutions such as iPM, the underlying concept of LORENZO was totally different as it was clinical software, which relies upon integration and information sharing to enable the various systems under the NPfIT to communicate (talk) with each other. Regarding the Organisational compatibility, it poses another challenge to NHS. This challenge stems from the fact that clinical processes are still vague, unstandardised, and undocumented.

9.3.6. The Nature of Clinical Processes

The sixth major category is *The Nature of Clinical Processes* that encompasses four concepts. Regarding the external concepts, there are eight external categories/concepts. All of the concepts in the *Nature of Clinical Processes* category are linked by eleven one-way, two way, and associative relationships. Figure 9-14 shows *The Nature of Clinical Processes* major category with its external concepts and linkages.

Figure 9-14: The Nature of Clinical Processes Major Category with Linkages



As one can see from Figure 9-14, lack of understanding of the clinical processes can be seen as a natural consequence of the ambiguous and ill-defined clinical processes; this is represented in the one-way relationship that relates the *Ambiguous, ill-defined Business Processes* concept with the *Lack of Understanding of Clinical Processes* concept. The author's argument is based upon the assumption that the technological nature of the programme, which was seen, as an IT initiative mainly, did not allow both the LSP and the NHS to think of how to support clinical processes and redesign them to better fit the system. The author postulates that digitising clinical processes does not make them better, but the redesign and the good understanding of these processes can boost their efficiencies.

Figure 9-14 shows that most of the external variables in this major category are related to the *Variation in (Unstandardised) Clinical Processes between and within NHS Organisations* concept. This might denote to the fact that having standardised clinical processes is a crucial aspect that all stakeholders of LORENZO implementation must consider. In addition, the fact that clinical processes are unstandardised, and vary between specialities or user groups, may have undesirable influence on clinical input and consequently, upon the clinical safety of LORENZO.

One can notice that the *Difficulty in Reaching Consensus* and *Undocumented Tacit Knowledge - Absence of Externalisation* concepts have a two-way relationship, and an association respectively. The author argues that clinicians could not reach an agreement on having standardised clinical processes, which could be pursued by all user groups in the various NHS trusts. The fact that the clinical knowledge is undocumented might cause more difficulty in standardising something that is not explicit to people. The author claims that because clinicians are used to performing daily clinical operations based on what they had been taught in the medical schools (see 8.3.6.6.3), this could have led them to having different perspectives in performing certain clinical processes. Moreover, as clinicians are the source of knowledge, they could have modified or developed their own ways of performing clinical processes.

The author should mention the fact that the pre-learned, acquired clinical knowledge that clinicians have from their medical schools could be seen as a positive thing, which assists in standardising clinical processes. However, when clinicians start working, they might be required by the medical bodies/specialities to which they belong to change their practice. Thus, the variation in clinical processes could be seen as an internal consequence, and reflection of the variety of specialities that are performed within the NHS.

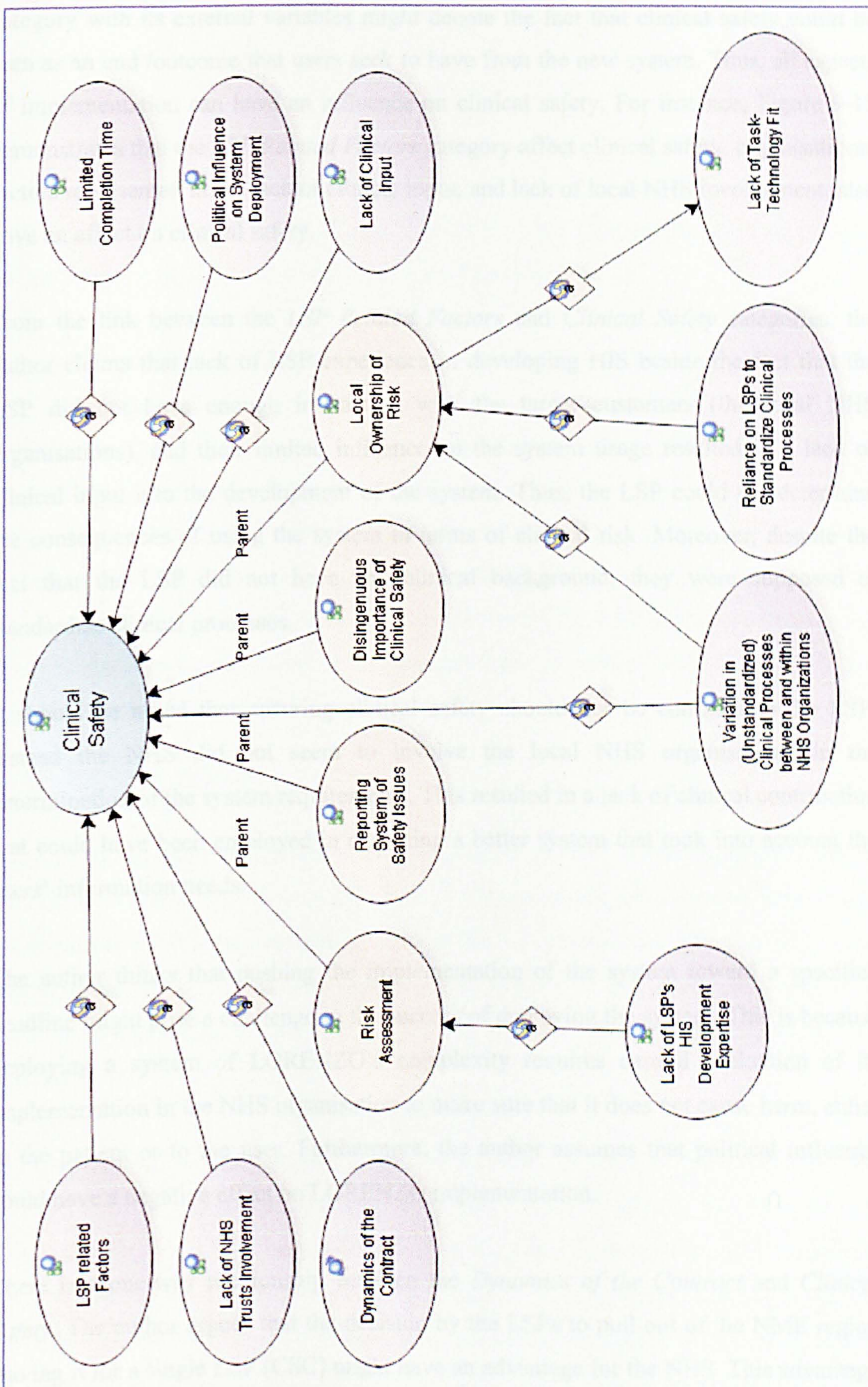
The author argues that when the NHS signed the contract with LORENZO's LSP, it was assumed that the LSP was required to present an IT system that was based upon well-defined, and standardised clinical processes. The face value of the NHS assumption looks valid, but one should bear in mind that the NHS should have reviewed their clinical processes before signing the contracts, and then decided upon the types of systems that suited their clinical practices.

Regarding the *Lack of Task-Technology Fit* concept, the author justifies the association of this concept with the *Variation in (Unstandardised) Clinical Processes between and within NHS Organisations* concept, on the fact that for any technology to have positive impact on performance it must be utilised, and have a good fit with the task it is supposed to support, as we saw in section 2.2.2 of the Information Technology in the Healthcare Sector chapter (The Concept of "Fit"). The author argues that reaching "fit" between task and technology characteristics may be achieved by adopting the "Pull strategy" that Eason (2006) mentioned. The pull strategy entails that the focus must be on the local level (bottom) of the NHS organisation. This strategy gives more freedom and involvement to clinicians to negotiate their requirements with system developers to have systems that are more acceptable.

9.3.7. Clinical Safety

The last, but not the least, major category is *Clinical Safety* that encompasses four concepts. Regarding the external variables, there are ten external variables. All of the concepts in the *Clinical Safety* category are linked by eleven one-way relationships. Figure 9-15 shows the *Clinical Safety* major category with its external concepts and linkages.

Figure 9-15: Clinical Safety Major Category with Linkages



The author argues that the one-way relationship that link the *Clinical Safety* major category with its external variables might denote the fact that clinical safety could be seen as an end /outcome that users seek to have from the new system. Thus, all aspects of implementation can have an influence on clinical safety. For instance, Figure 9-15 demonstrates that the *LSP Related Factors* category affect clinical safety, organisational factors represented in the lack of clinical input, and lack of local NHS involvement, also have an effect on clinical safety.

From the link between the *LSP Related Factors* and *Clinical Safety* categories, the author claims that lack of LSP experience in developing HIS beside the fact that the LSP did not have enough interaction with the target customers (the local NHS organisations), and their limited influence on the system usage resulted in a lack of clinical input into the development of the system. Thus, the LSP could not determine the consequences of using the system in terms of clinical risk. Moreover, despite the fact that the LSP did not have any clinical background, they were supposed to standardise clinical processes.

It should be noted that ensuring clinical safety should not be confined to the LSP, instead the NHS did not seem to involve the local NHS organisations in the determination of the system requirements. This resulted in a lack of clinical contribution that could have been employed in designing a better system that took into account the users' information needs.

The author thinks that pushing the implementation of the system toward a specified deadline might pose a challenge to the success of deploying the system. This is because deploying a system of LORENZO's complexity requires careful evaluation of its implementation in the NHS organisation to make sure that it does not cause harm, either to the patient or to the user. Furthermore, the author assumes that political influence could have a negative effect on LORENZO implementation.

There is a one-way relationship between the *Dynamics of the Contract* and *Clinical Safety*. The author argues that the decision by the LSPs to pull out of the NME region leaving it for a single LSP (CSC) might have an advantage for the NHS. This advantage stems from the fact that having a dedicated partner that has been working for a long period of time with the NHS could assist that company in understanding the nature of the working environment in the NHS, and better design a HCIS that fits the clinical processes.

However, for a single partner to succeed in developing an IT health product for the NHS there should be collaborative contractual arrangements that manage the contract between the NHS and the LSP. The quotes R6 [35], R6 [36], and R6 [37] support the author's argument of having collaborative arrangements.

R6 stated that although collaborative contracts are necessary between the NHS and its service providers, the underlying theme of these arrangements should be based upon mutual trust. One point to bear in mind is that when the NHS had many LSPs who were responsible for providing IT health solution in the NME region, the author did not notice any collaboration, or a potential for a consortium that focused the LSPs' resources and efforts in a single direction towards building systems that are more robust. This was a result of distrust, not only between the LSP and the NHS, but also between commercial companies as one can see from the quotes R6 [38], R6 [39], and R6 [40].

9.4. CONCLUSION

Analysis of the data collected presented an evidence of an IT failure in the NHS due to the failure of the system to take into serious considerations the numerous information requirements of the various user groups in NHS organisations. Ignoring end users' requirements led to workarounds and threats to system security. Thus, adopting more user-centric approach for developing computer systems enhances the success of such systems.

Additionally, this chapter focused mainly on showing the various types of connections between the generated concepts and categories. Analysis of the data showed that although human factor is imperative in designing and implementing ISs, clinicians' traits prevented them form being involved enough in developing and implementing LORENZO's deployment units. Inappropriate training, busy nature of clinicians, lack of IT skills and experience, and difficulty in reaching consensus among end users were among the most prominent factors that contributed to a very limited role of end users in the process of identifying the system requirements.

The author stresses the notion that in spite of the importance of investigating the attributes of individual users for assessing their role in the design and implementation of LORENZO, taking into account the potential role of user groups in the implementation of LORENZO is also imperative. Therefore, the author discussed how departmental factors affected negatively the implementation of LORENZO's units at the departmental/ward level. Because system requirements were discussed at a departmental level, the variety in user groups resulted in autonomous and fragmented systems that made it difficult for the speciality/user groups to reach consensus, and consequently led to a lack of clinical input form the bottom level of NHS organisations.

Analysis of the data also showed that the organisational context also affected the implementation of the deployment units of LORENZO. This is because senior level people at the SHA level and the NHS CfH did not have the awareness and clinical expertise enough to support and champion the implementation of LORENZO. Furthermore, the top-down communication channels, the absence of teamwork philosophy, and the non-supportive culture confined, if not prevented, the role of end users to just using the system without a clear understanding of its benefits. Thus, one can conclude that because end users in the adopting NHS organisations did not realise the usefulness of LORENZO, they might have less favourable attitudes toward using it.

Regarding the clinical processes, the analysis revealed that clinical processes were ill-defined, unclear, and unstandardised. These features made it difficult for either the NHS side to agree on SOPs for carrying out these processes by clinicians, or for the LSP to design appropriate systems (i.e. deployment units) that should rest on clear and adequate processes. This notion reminds us of the concept of fit and the socio-technical theory discussed in sections 2.2.2 and 2.2.3 of the Information Technology in the Healthcare Sector chapter, that technology characteristics should match with process characteristics for technology to provide its intended benefits.

The LSP resulted to have an influence on the implementation of LORENZO's deployment units in NHS organisations as they had no, or little expertise in designing HCIS for the NHS, lacked the understanding of the clinical processes that had to e digitised by LORENZO, and lacked the interaction with the intended users. This stresses the importance of taking into account he special nature of the clinical processes pursued and the attributes of clinicians who had not enough experience in using IT-based systems. The author suggest that providing more than 45 days of technical support is required as well as creating more collaborative contractual arrangements that enhance the exchange of both technical and clinical knowledge between the NHS and the LSP.

The author discussed the System Related Factors category and focused on explaining the consequences of adopting the deployment units development methodology. Analysis of the data revealed that because LORENZO is still being developed and few units have been only deployed, it offered limited functionality and prevented clinicians from realising the benefit of integrating various clinical and administrative systems together as a distinguishing feature of LORENZO. Because such a gigantic system has not been implemented before, end users had some sort of anxiety as whether the system would improve the efficiency and enhance the quality of the health care or not the undefined scope of the system, its large scale and complexity, and the newness of the idea of LORENZO (i.e. integration and information sharing) contributed to less involved users and therefore, a lack of clinical input.

Clinical safety is considered as a fundamental feature of any HCIS to be implemented in the NHS. However, it was revealed form an/alysis of the data that the NHS did not do enough in practice to translate this feature into practical procedures such as assessing risk incorporated with the execution of clinical processes. The author thinks that assuring clinical safety needs clinical processes to be well standardised, clear and understood by the end users and the LSP.

The author stresses the notion that although the seven categories of factors that have been discussed above are related to the implementation of LORENZO in the NHS in the NME region, they still can be considered as a frame of reference or useful guide for decision makers in the NHS CfH, the local NHS organisations, and system developers of HCIS in the other parts of England (i.e. the LPfIT and SPfIT). This is because NHS organisations in the southern and London regions share similar working environments and consequently the same challenges might encounter NHS organisations in the rest of England. Furthermore, the author thinks that taking into account these factors for deploying IT projects in the public sector (other than the health industry) is essential. This is because most of the factors, particularly the organisational factors, are basic requirements for successfully implemented IT projects.

Chapter Ten

10. RESEARCH FINDINGS AND RECOMMENDATIONS

10.1. INTRODUCTION

In this chapter, the author discusses the implications of some patterns, which represent the causal maps of several concepts from the resulting seven major categories. The author uses the term patterns to refer to the consolidation of various concepts from the major categories. These patterns are illustrated by causal maps in order to obtain a sort of holistic view of what really enhances LORENZO implementation, and what would stimulate the intra-organisational usage of LORENZO. The author thinks that these patterns are pivotal to understanding end users' acceptance of LORENZO and the recommendations of this study will be based on them.

The author thinks that the conclusions and recommendations of the current study could be useful for future implementation of other IT projects in the NHS. This is because the enriched and accumulated knowledge that the author gained about the NHS working environment, clinicians' attributes, and the organisational climate can be seen as transferable. Transferable knowledge means that it could be reflected/employed in future IT projects. In the next section, the findings of the current study are presented with respect to the research questions, which were addressed in section 1.4 of the Introduction chapter. The current research contributions, limitations and ethical considerations, and recommendations are also discussed in this chapter.

10.2. MAJOR FINDINGS AND CONCLUSIONS

In this section, the answers to the research questions are presented. These answers are based on analysis findings obtained from the previous chapter (Chapter 9).

10.2.1. Extensions to the TAM

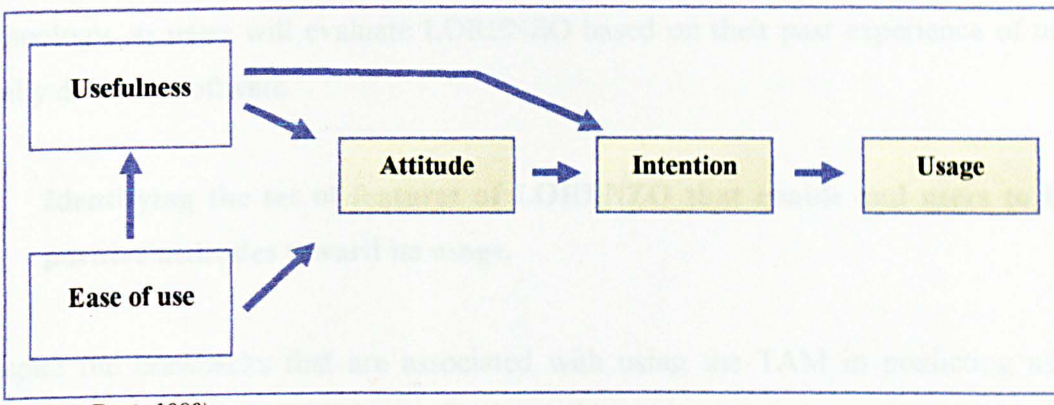
The first question, as one can see in section 1.4 of the Introduction chapter (Research Questions), is ***what extensions to the TAM are suggested by examining the implementation of LORENZO?*** The author believes that answering this question should be divided into three parts. These parts are listed below:

1. **Evaluating the suitability of the TAM to assess and predict users' behaviour toward LORENZO usage in the NHS.**

Regarding the first part, one can see in section 3.4.2 of the Successful Implementation of IT Projects Chapter (IT Adoption/Acceptance Theories), that various models have been proposed to explain/justify users' behaviour with regard to the use of technology. One can also see in section 3.4.3 of the Successful Implementation of IT Projects Chapter (Technology Acceptance Model (TAM)), that there were two factors that affected users' attitudes toward the use of technology assuming that users' attitudes predict their behaviour. These factors were usefulness, and complexity. LORENZO is expected to be associated with a high level of sophistication, which is required to meet the NHS requirements of having a network, through which clinical information is exchanged among geographically dispersed and very diverse NHS organisations.

Stating that complexity and users' acceptance/usage are strongly correlated may not serve either the NHS or the LSP in stimulating clinicians to use the system, as this feature (complexity) is something embedded in the design of the system and would be difficult to eradicate. The author claims that if the TAM is going to be used for predicting users' behaviour toward the use of LORENZO, complexity should not be considered as a factor influencing end users' attitudes. The exclusion of complexity is based on the premise that clinicians are deemed to be well educated (e.g. doctors, GPs, nurses and consultants) and able to learn new technologies. Regarding usefulness, the author thinks that this factor is crucial in predicting users' behaviour as research-based evidence shows that usefulness explains most of the variance in the behaviour construct (Davis 1989). The original TAM is depicted in Figure 10-1.

Figure 10-1: The Original TAM



Source (Davis 1989)

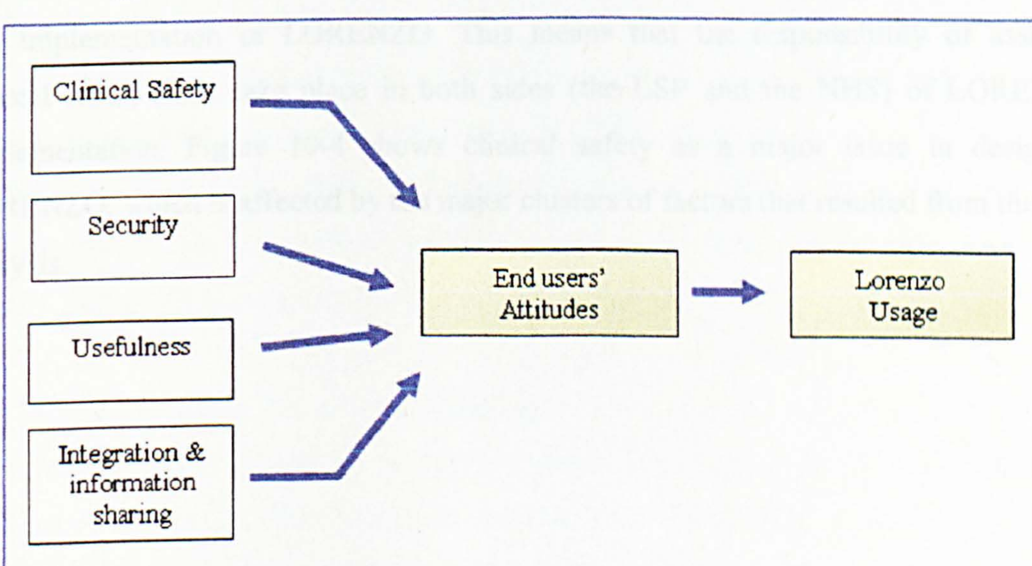
Furthermore, the author believes that although the TAM is one of the most useful models in explaining users' behaviour toward the use of technology, it might not be the same in the case of studying clinicians' behaviour toward the use and acceptance of LORENZO in the NHS. This is because users' behaviour toward the use of technology (according to the TAM) is mainly determined by the perceived characteristics of the computerised system, which is ready to be used and fully functional. In LORENZO the perceived features of the system are not clear, as the system is not fully functional due to the Deployment Units methodology. Thus, one can conclude that the methodology, by which LORENZO was developed, affected users' attitude toward its usage, as one can see in section 8.3.6.5 of the Analysis of the Collected Data chapter (The Fifth Category: System Related Factors). Moreover, the author claims that the TAM is based on the evaluation of a certain IS that is used by a certain group of users. In LORENZO, it is not the same as LORENZO encompasses various sub systems (deployment units); each deployment unit accomplishes different tasks, and consequently might entail different methods of usage. One point to bear in mind is that LORENZO is a mega IT project, which makes it difficult to study its level of usage through the TAM lens. This necessitates taking into account the size of the project when studying users' behaviour.

In terms of user groups, there are heterogeneous user groups using LORENZO and this may add difficulty in forming an idea about their attitudes as not all users will hold the same attitudes, especially in the NHS where people in primary care for instance, have been using computer systems for a long time compared to people in secondary care. Thus, past experience in terms of using technology is not similar for all users. This situation may mislead researchers who are studying people's resistance to using technology, as users will evaluate LORENZO based on their past experience of using totally different software.

2 Identifying the set of features of LORENZO that enable end users to hold positive attitudes toward its usage.

Despite the drawbacks that are associated with using the TAM in predicting users' behaviour toward LORENZO usage, the author suggests some factors, apart from usefulness, which LORENZO's designers, the NHS CfH agency, and the SHAs should take into account when it comes to enhance users' usage of the deployment units. These factors are clinical safety, security, and integration and information sharing. The author should mention the fact that not all of the factors are perceived characteristics of the system; for instance, security may be seen as an embedded system feature that users perceive when they use the system, whereas, clinical safety and information sharing may be perceived as an outcome of using the system. Figure 10-2 below, shows the factors influencing end users' attitudes.

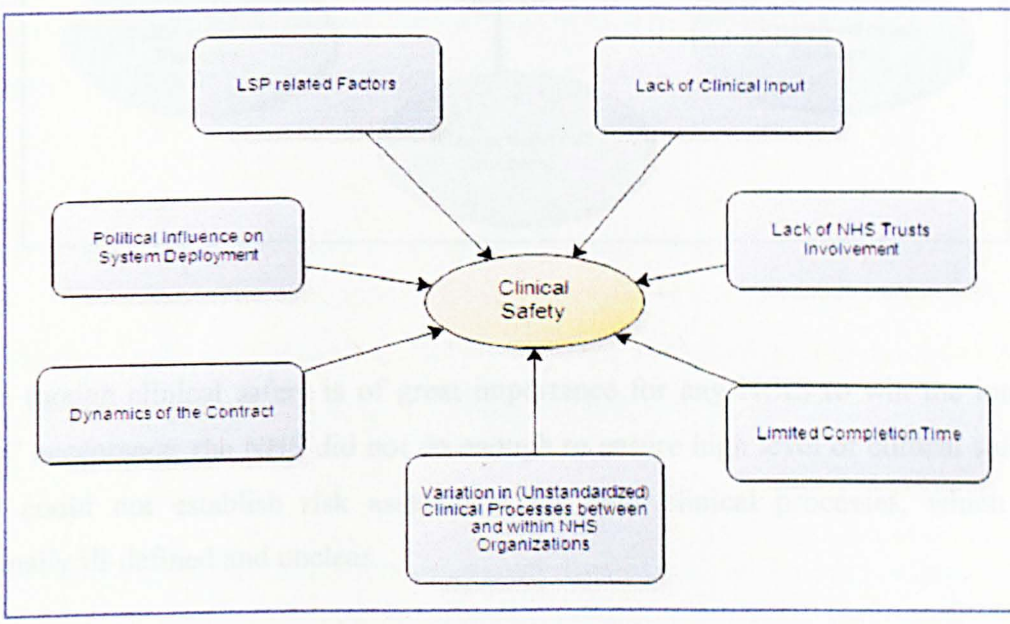
Figure 10-2: Factors Affecting End Users' Attitudes in a Modified TAM



2.1. Clinical Safety

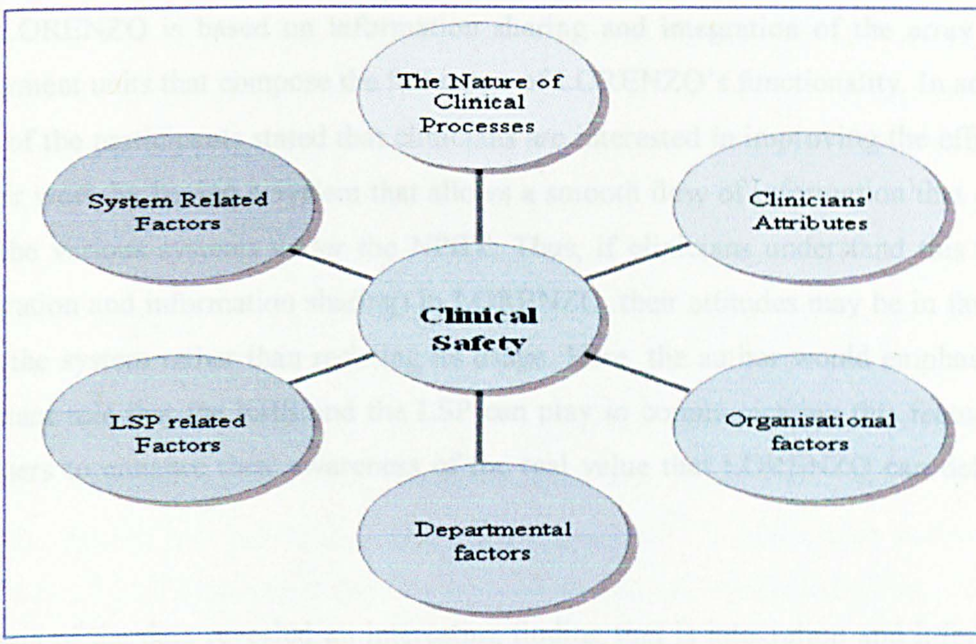
The author postulates that clinical safety is one of the most important factors that must be asserted when using the system. Clinical safety is an outcome resulting from using the system. Clinicians are more likely to use the system if they perceive it clinically safe. Figure 10-3 shows clinical safety, and its influencing factors based on analysis of the collected data.

Figure 10-3: Influencing Factors on Clinical Safety



One can conclude from Figure 10-3 that clinical safety, as an influencing factor on end users' attitudinal beliefs about LORENZO, is a multi-perceptual construct that is reliant on the cumulative efforts of the stakeholders, who are concerned with the development and implementation of LORENZO. This means that the responsibility of assuring clinical safety must take place in both sides (the LSP and the NHS) of LORENZO implementation. Figure 10-4 shows clinical safety as a major issue in designing LORENZO, which is affected by the major clusters of factors that resulted from the data analysis.

Figure 10-4: Clinical Safety



Even though clinical safety is of great importance for any HCIS to win the intended users' acceptance, the NHS did not do enough to ensure high level of clinical safety as they could not establish risk assessment for their clinical processes, which were originally ill-defined and unclear.

2.2. System Security

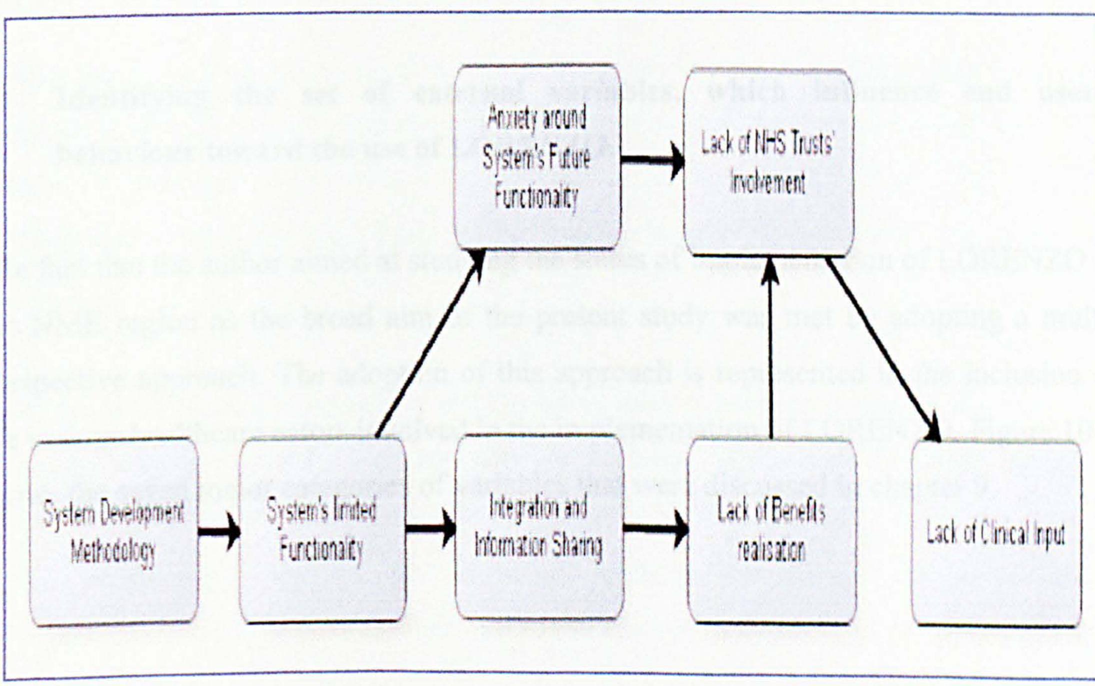
The author argues that system security is one of the factors that may directly affect clinicians' attitudes toward the use of LORENZO. This argument is based on the fact that end users were mostly concerned with the extent to which the clinical content is secured against unauthorised access and/or information misuse, and that patients' privacy is assured. Although system security was mentioned in only one interview (R3), and meant to be the major hindering factor for iPM PAS, as we saw in section 9.2.1.1.3 of the Theory Building chapter (Threats to System Security), the author perceives information privacy and confidentiality as pivotal to the design, and implementation of a HCIS that could gain the acceptance of end users.

2.3. Integration and Information Sharing

The third factor that should be taken into account when studying clinicians' behaviour toward the use of LORENZO is integration and information sharing. The author discussed in section 9.3.5 of the Theory Building chapter (System Related Factors), how LORENZO is based on information sharing and integration of the array of the deployment units that compose the full range of LORENZO's functionality. In addition, some of the participants stated that clinicians are interested in improving the efficiency of their work by having a system that allows a smooth flow of information that crosses over the various systems under the NPfIT. Thus, if clinicians understand this feature (integration and information sharing) in LORENZO, their attitudes may be in favour of using the system rather than resisting its usage. Here, the author would emphasise the important role that the NHS and the LSP can play in communicating this feature with end users to enhance their awareness of the real value that LORENZO can deliver to them.

Analysis of the data revealed an interesting finding that is integration and information sharing, which distinguishes LORENZO from the rest of the IT initiatives that the NHS had implemented, is affected by the development methodology (Deployment Units). Figure 10-5 demonstrates how the development methodology influenced integration and information sharing.

Figure 10-5: The Impact of Development Methodology on System's Features



As one can see from Figure 10-5, Deployment units, which is LORENZO's development methodology has drawbacks represented in the fact that there is an unclear definition of the system's scope due to the incomplete state of the deployment units' implementation, and consequently the limited functionality of LORENZO. The limited functionality of the system resulted in anxiety about what the system can perform in the future in terms of digitising clinical processes. End users' anxiety in turn discouraged people from being involved in the design of LORENZO's various deployment units.

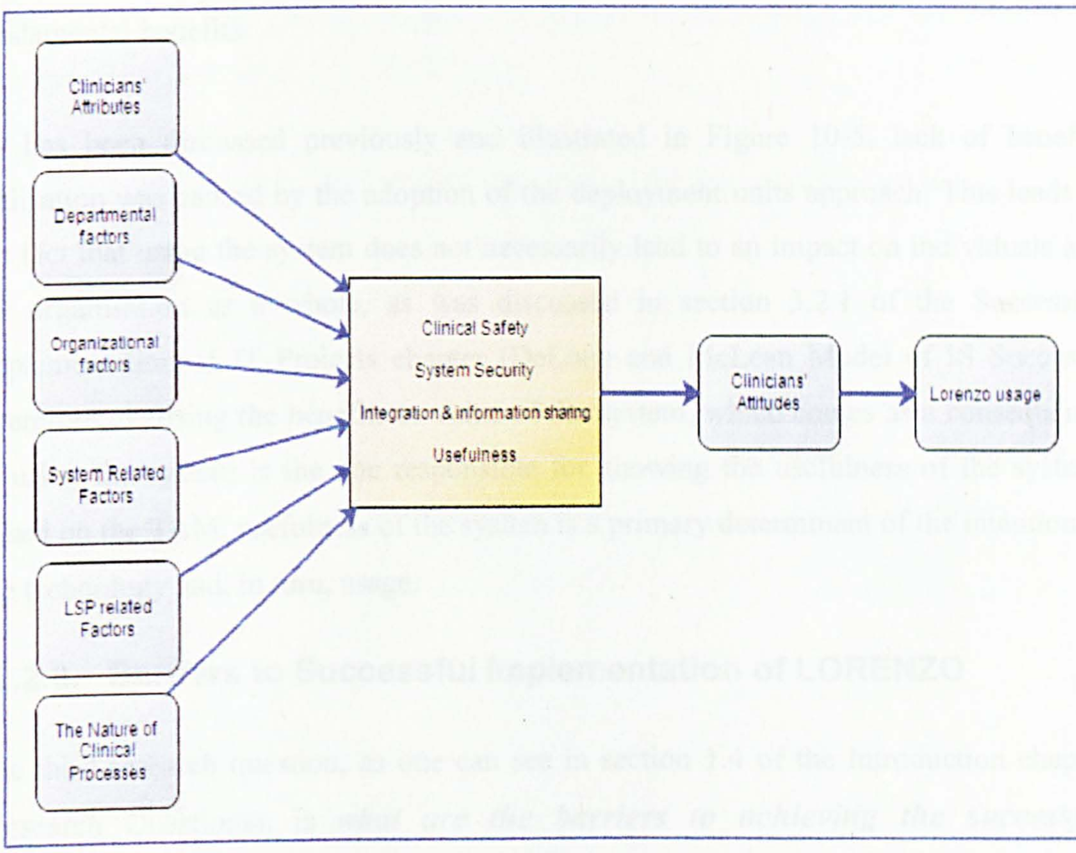
Moreover, LORENZO's limited functionality resulted in problems in the promised integration and information sharing capabilities as these features will only be achieved when the system has full functionality. This prevented clinicians from realising the benefits that LORENZO can deliver to them. Thus, one can conclude that lack of either clinicians' or local NHS trusts' involvement was a consequence of the anxiety that people had, and the unseen system's benefits.

In conclusion, one can note that LORENZO's development methodology (i.e. deployment units) has a significant impact on its implementation, and its success. In addition, the Deployment Units development methodology also influences end users' inclination to use Lorenzo.

3 Identifying the set of external variables, which influence end users' behaviour toward the use of LORENZO.

The fact that the author aimed at studying the status of implementation of LORENZO in the NME region as the broad aim of the present study was met by adopting a multi-perspective approach. The adoption of this approach is represented in the inclusion of the various healthcare actors involved in the implementation of LORENZO. Figure 10-6 shows the seven major categories of variables that were discussed in chapter 9.

Figure 10-6: External Variables in Modified TAM



10.2.2. Perceiving the Benefits of LORENZO

The second research question, as one can see in section 1.4 of the Introduction chapter (Research Questions), is ***what are the benefits of LORENZO at the local level?*** The analysis findings reveal that despite the promised benefits of implementing LORENZO's deployment units in the NHS organisations, there was a lack of benefits realisation.

Lack of benefits realisation is a crucial point to look at because it means that end users do not have convincing reasons for participating in developing and deploying LORENZO in NHS organisations. This is because lack of benefits realisation does not allow clinicians to see how the system will improve their clinical decisions through sharing of clinical information. Information sharing is considered as the core benefit of LORENZO, which distinguishes it from other IT systems. Therefore, the usefulness of the system can not be experienced because most of the deployment units have not been implemented yet. In sum, end users might perceive the system as efficient, but not effective in improving their decision making process due to the lack of LORENZO' fundamental benefits.

As has been discussed previously and illustrated in Figure 10-5, lack of benefits realisation was caused by the adoption of the deployment units approach. This leads to the fact that using the system does not necessarily lead to an impact on individuals and the organisation as a whole, as was discussed in section 3.2.1 of the Successful Implementation of IT Projects chapter (DeLone and McLean Model of IS Success). Therefore, realising the benefits or value of the system, which comes as a consequence of using the system is the one responsible for showing the usefulness of the system. Based on the TAM, usefulness of the system is a primary determinant of the intention to use technology and, in turn, usage.

10.2.3. Barriers to Successful Implementation of LORENZO

The third research question, as one can see in section 1.4 of the Introduction chapter (Research Questions), is ***what are the barriers to achieving the successful implementation of LORENZO at the local level?*** The analysis findings reveal that there are some barriers to successful implementation of LORENZO's deployment units. These hurdles are:

1. Internal and external characteristics of end users

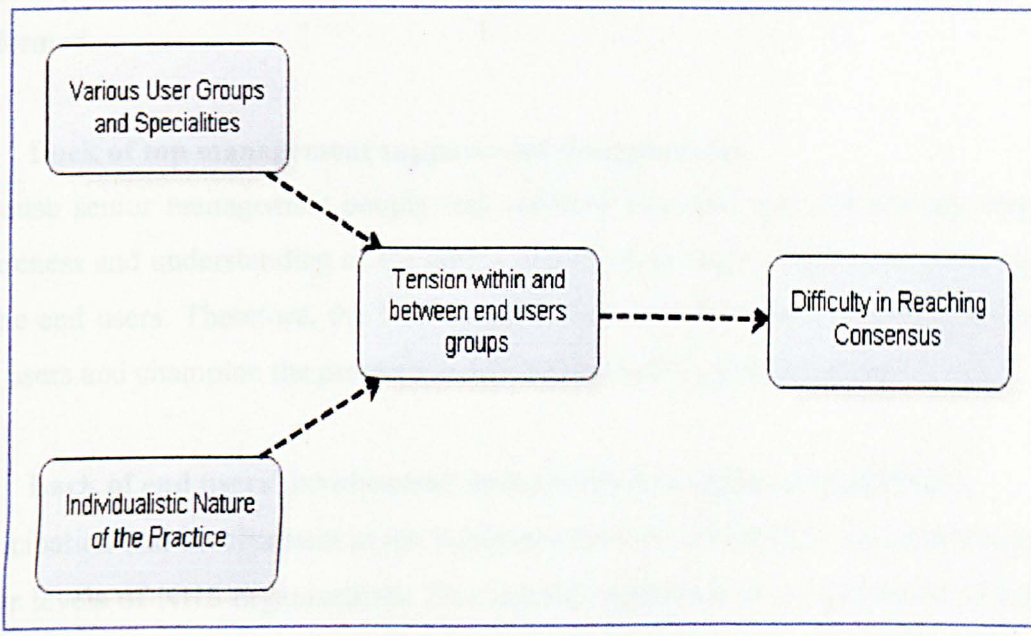
Clinicians' feel they do not have time to spend on meetings and discussions regarding the deployment of LORENZO. They lack the required IT skills due to inappropriate training programmes, and the anxiety clinicians hold about the use of the system makes them unable to participate in LORENZO development and deployment. The author stresses that clinicians' attributes lead to fewer practising clinicians who are involved in developing and deploying LORENZO, either on the LSP side or the NHS side.

2. Fragmented departmental systems

Despite the importance of understanding how clinicians' attributes affect their tendency to use LORENZO, the analysis reveal a very crucial point that the focus should also be on the departmental factors. This is because systems requirements are determined and negotiated at a departmental level. However, the nature of the working environment in

NHS organisations makes it difficult for the NHS users to reach consensus on these requirements. Figure 10-7 illustrates how departmental factors could be a barrier to successful implementation of LORENZO.

Figure 10-7: The Impact of Various User Groups on Clinical Input



From Figure 10-7, the individualistic nature of medicine, accompanied by the existence of various user groups and specialities caused tension within and between these groups. Tension became apparent as each group was used to performing clinical processes in the way they had been trained in medical schools. Due to the tension, it became hard to reach consensus on the clinical content of LORENZO, or agree on how clinical processes should be accomplished. The notion of various user groups and the tension that exists between them brings to mind the idea that the human side of IT adoption should not only be seen as individuals, but also as groups. This confirms the Mantzana et al.'s (2007) who focus on the use of individuals and groups sub lenses in the identification of healthcare actors involved in the IS adoption..

3. Lack of standardisation of clinical processes

The analysis findings confirm the notion that clinical processes are non-standardised, ill defined, and unclear. These features of the clinical processes made it difficult for the LSP to understand them. The fact that clinicians perform these processes without having clear and documented guidelines, and the existence of tacit knowledge further complicated the task of standardising these processes. Furthermore, the fact that there are various speciality groups in the NHS, which resulted in tension and difficulty in reaching agreement, added more challenges to the standardisation and documentation of the clinical processes. One can conclude that because of the non-standardisation of clinical processes, there would be no match between the technology and the process performed.

4. Lack of top management support and championship

Because senior management people lack medical expertise and did not have enough awareness and understanding of the NPfIT overall, they were unable to provide support to the end users. Therefore, the NHS needs to have top level seniors who can support end users and champion the project towards a successful implementation.

5. Lack of end users' involvement in the implementation of LORENZO

Participation and involvement in the implementation of LORENZO was confined to the upper levels of NHS organisations. That caused separation in the definition of system requirements, which were identified by senior level management, and the implementation of these requirements by end users (i.e. bottom level). Primarily, lack of end users' involvement

There are two reasons, based on analysis of the data, for the lack of users' involvement; firstly, stakeholders and communications management influenced users' involvement. This effect is rooted in the NHS organisational culture and structure that restricts and confines bottom level roles to merely implement what comes from the upper managerial levels. This is because most NHS organisations have top-down hierarchical structures that restrict the free flow of information between the upper and the lower managerial levels. Secondly, clinicians' attributes prevented end users from being inovlled in the implementation of LORENZO.

6. Lack of technical support provided to end users

One of the prominent barriers facing the implementation of LORENZO is the limited technical support provided to end users by the LSP, which is only 45 days. This denotes the fact that the LSP did not have enough interaction with the end users, and the LSP did not have enough influence to facilitate the system usage.

The contractual arrangements that manage the relationship between the NHS and the LSP, is based more on a commercial basis, rather than a clinical basis. This might contributed to the limited support provided. In addition, commercial nature of the contract restricted end users from working in the both sides. Thus, the author claims that adjusting the terms of the contract would not only help in designing a clinically driven system, but also would allow more clinicians to practice medicine while working in both sides of the contract.

10.3. CONTRIBUTIONS OF THE RESEARCH

This study came at a time when NHS organisations started rolling out some of LORENZO's deployment units in the NME region. The huge government investment in the NPfIT was made to improve the health service in England, and enable patients and health providers to obtain complete and up-to-date information anywhere and at any time. The contribution of this thesis can be summarised in the following:

1. Unlike previous studies that investigated specific IT-based health applications, this thesis focused on LORENZO as a whole in order to enable the author to examine the outcome of this application on end users. The decision to study LORENZO represents an opportunity to study a mega IT project that has not been applied in other healthcare sectors in Europe.

2. This thesis presented a proposed extended TAM model, as one can see from Figure 10-6, that was created using qualitative data obtained from informed, internal views. This is considered as a departure from the usual way of extending the TAM quantitatively. The perceived features of LORENZO reflect the special nature of that system and the real setting (i.e. the NHS)

3. From a theoretical point of view, this thesis adds a contribution to the IS literature by exploring a potential relationship between the development methodology of an IS and the intended users' acceptance (usage). In practice, this potential relationship proved to exist between LORENZO's development methodology and its usage. This relationship is medicated by the extent to which the benefits of LORENZO are realised.

4. This thesis provide a research-based evidence that the human factors involved in the implementation of IS should be seen at a micro and macro level. The micro level is represented in the individual users and their influencing internal and external traits. The macro level is represented in the groups of individual users.

5. This study presents strong practice-based evidence that realising the benefits of an IS, after using it, is as important as incorporating end users' requirements into the design and development of that system. Accordingly, this study adds a theoretical contribution to the IS success literature by confirming the criticism to the D&M IS success model. The contribution is that using the system does not necessarily lead to positive impact on the individuals and the organisation unless realisation the benefits are realised by the intended users.

10.4. RESEARCH LIMITATIONS AND ETHICAL CONSIDERATIONS

This study was qualitative in nature and incorporated human interaction with people who were interviewed. Thus, assuring high ethical standards of conduct was imperative. This study was designed and implemented in accordance with the University of Kent research ethics procedures. Moreover, people who were interviewed were given a brief introduction about the purpose of the study. Interviewees chose the venue and time of the interviews for their convenience. The participants' decision to be interviewed was completely their own without any force. The author made sure that their privacy was not invaded and the questions were within the course of achieving the objectives of the study.

Anonymity and confidentiality are of extreme importance and were achieved by ensuring that interviewees' names, roles, or any related data are not shown in the study findings unless clear consent and approval was granted. Additionally, all interviews were recorded by using a digital voice recorder to enable the author to transcribe the interviews and obtain data that is rigorous. At the outset of each interview, the author asked the participant for their permission to record the interviews. Transcripts, recordings, and all other materials related to the interviewees were kept in a confidential and secure place not exposed to anyone who was not involved in the current study.

The limitations of this study stem from the research strategy, research method, and sampling technique. Qualitative research suffers from the fact that findings are difficult to replicate, generalise, and involves a high degree of subjectivity, as one can see in section 5.3 of the Qualitative Research: Nature, Types and Limitations chapter (Disadvantages of Qualitative Research). One of the difficulties the author faced in this study was the enormous amount of textual data that was obtained. The process of analysing a large amount of contextual data incorporated some degree of bias as the author relied on his understating and interpretation. Additionally, it took the author almost a year to carry out the process of collecting, analysing, and interpreting the data.

Moreover, the author adopted a single case study, which was difficult to claim generalisation of the findings. In addition, the author encountered another challenge which was a lack of available journal articles, textbooks and other online material concerning LORENZO's development methodology and the state it reached in terms of the deployment of its various units. Due to the fact that the author aimed to focus on the implementation of LORENZO as a whole, it was difficult for him to evaluate the implementation of each deployment unit that had been deployed in the various NHS organisations. Moreover, the adoption of a cross-sectional design did not enable the author to evaluate/compare the performance of those NHS organisations before and after deploying or rolling out LORENZO's units..

The data collection method (face-to-face qualitative interviews) also poses limitations on this study for instance, the number of the interviews conducted was relatively small to enable the findings to be generalised. In addition, the author failed to interview executive people from the DoH or/and the NHS CfH to obtain their thoughts and views about the implementation of LORENZO in the NME region. Thus, the author only interviewed people from local NHS organisations.

The sampling technique used in this research lacks the representativeness as the author used non-probabilistic sampling, and the number of the people interviewed was small to have more insights about the implementation of LORENZO.

The resulting modified TAM is restricted to the nature of health care organisations in England (i.e. the NHS in England). It might be useful to take into consideration the set of variables discussed in the modified TAM when it comes to implement IT related projects in the health industry in some other countries. However, careful assessment of the environment in which these projects operate is essential.

Due to lack of time and resources, the author could not combine research approaches that is usually applied in the IS field (Mingers 2001). Using mixed methods means adopting quantitative and qualitative research methods (Triangulation of data collection methods) to enhance the reliability of findings. This triangulation could have been performed by either distributing survey questionnaires and interviewing people from he NHS at the same time, or follow a two-stage research project where analysis findings of the qualitative research methods (e.g. interviews) could be infused in the design of one of the quantitative research methods.

10.5. RESEARCH RECOMMENDATIONS

In this part of the chapter, the author presents recommendations to overcome or lessen the adverse effect of the pitfalls encountered in the design and implementation of LORENZO. These were derived from the analysis of the data. Before discussing the recommendations, the author would mention the fact that these recommendations are not the only corrective actions the NHS or the LSP can undertake to remedy the problems that may arise when implementing such a gigantic project like the NPfIT, in general and LORENZO in particular. However, these recommendations may act as a spur to stimulate decision makers to consider some issues that should have been taken into account from the beginning of the programme. Furthermore, stating these recommendations provides an answer to the fourth research question mentioned in section 1.4 of the introduction chapter (Research Questions).

10.5.1. How should we perceive the development methodology?

10.5.1.1. Adopting multi-staged and iterative development methodology

A multi-staged and iterative process requires that the LSPs and the NHS be aware of the fact that clinicians' information needs must be the driving force in all the stages of system development. This does not only mean discussing with end users what they need to accomplish from the system, but also seeking their feedback and embedding it in the subsequent releases (i.e. deployment units). Thus, each stage should be considered as cyclical with two-way communication between the system designers and the real users, instead of having one-way, sequential stages where each stage starts when the preceding one ends. Figure 10-8 and Figure 10-9 show the traditional and the iterative approaches in IS development.

Figure 10-8: Sequential Stages of System's Development

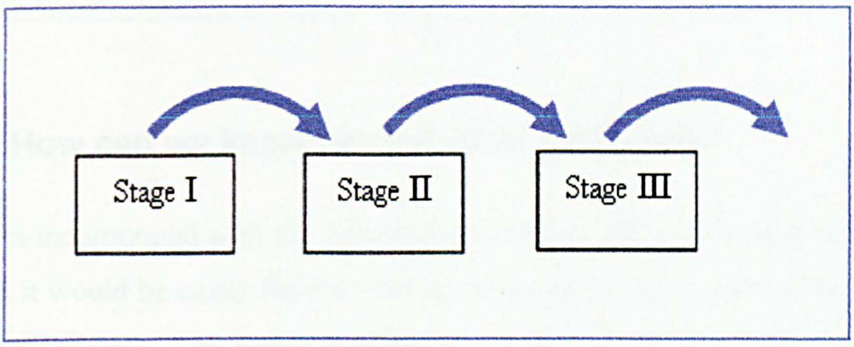
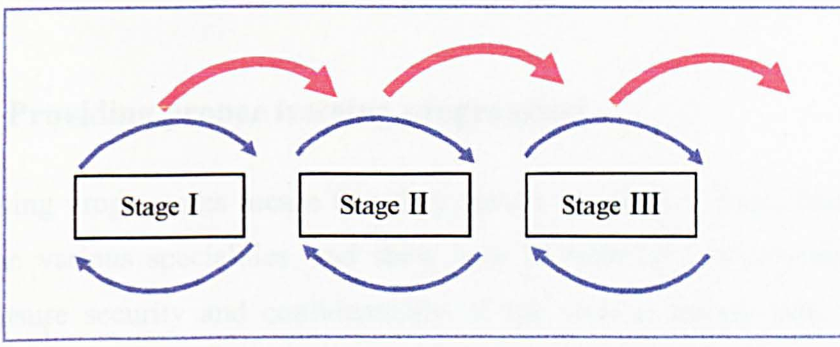


Figure 10-8 shows that when each stage of system's development is dealt with separately, and if end users' information needs are taken into account, they are taken at the beginning of each stage without obtaining the feedback of the end users and reflecting this feedback on the improvement of the stage. The sequential approach shown in Figure 10-8 is similar to the SDLC development methodology that was discussed in section 2.2.4.1 of the Information Technology in Healthcare Sector chapter (System Development Life Cycle).

On the other hand, Figure 10-9 shows that when system designers negotiate the design of each deployment unit or stage of the system's development process, they modify the design and include end users' suggestions into the stage, and keep doing this for the rest of the development process. This interactive process is crucial for system success, and to be more responsive to emerging requirements. The iterative approach shown in Figure 10-9 is similar to the prototyping development methodology that was discussed in section 2.2.4.2 of the Information Technology in Healthcare Sector chapter (Prototyping).

Figure 10-9: Iterative Stages of System's Development



10.5.2. How can we improve clinicians' attributes?

The newness incorporated with the introduction of LORENZO is something difficult to change, and it would be easier for the NHS to foster users' acceptance of the system by reducing their anxiety. The author presents the following recommendations to reduce users' anxiety.

10.5.2.1. Enhancing end users' IT experience

The author believes that users' anxiety in using the system was rooted in their lack of the required informatics experience. Consequently, enhancing users' IT experience would enable them to perceive the real value and benefits of the system, and to reduce their anxiety. The author bases his argument on the grounds that, when users have sufficient level of IT skills and knowledge, they can deal more easily with the new deployment units and be more informed about their advantages.

10.5.2.2. Encouraging clinicians' involvement

As we saw in section 8.3.6.1.4 of the Analysis of the Collected Data chapter (Busy Clinicians (Lack of Time)), end users in the NHS did not have enough time to be involved, and lacked the IT skills. Therefore, senior people were involved in the determination of information requirements. However, high level management involvement may not be as useful as desired because system developers lose the sense of operational processes, which real users are aware of. Therefore, the author believes that allowing clinicians to be more involved in the discussions and training programmes concerning the new system usage is useful to make them more familiar with the new system.

10.5.2.3. Providing proper training programmes

Proper training programmes means that they should be simpler, more focused on the needs of the various specialities, and show how LORENZO's deployment units are going to ensure security and confidentiality of the clinical information. The author should mention the fact that clinicians might not be worried about using software; instead, they are worried about patients' privacy and confidentiality. Therefore, stressing this aspect in the various training and education programmes might lessen clinicians' reluctance. Furthermore, the author thinks that training programmes should enhance end users' understating of the technical issues concerning the development of LORENZO.

As we saw in section 8.3.6.1.6 of the Analysis of the Collected Data chapter (Generational Gap), older users are less inclined to use IT than younger ones. This notion requires that the NHS undertake intensified training programmes for older employees who seem to be resisting the system.

10.5.2.4. Encouraging a teamwork philosophy in NHS local organisations

The author recommends that the NHS should stimulate more teamwork among its end users at the local level to encourage the exchange of ideas, knowledge, and experiences between end users. Stressing teamwork would improve the bargaining power of end users while negotiating the system's requirements with the LSP. Enhancing clinicians' bargaining power stems from the fact that teamwork is supposed to enhance their technical and clinical experience and thus, would bridge the designer-user communication and knowledge gap. Moreover, having teamwork in the NHS may assist in having capable and willing people who would like to be engaged in the system development process.

10.5.2.5. Emphasising the importance of health informatics departments in the NHS trusts

Encouraging more collaborative work between system designers and end users requires end users to possess sufficient health informatics skills. One way to enhance these skills is by establishing health informatics departments that control and organise the collective efforts of individuals who are involved in the design and implementation of LORENZO. These departments might be established at a local level where each NHS trust has its own health informatics department. Because most of the end users' skills reside in the clinical side rather than the technical side of the project, as was discussed in section 8.3.6.1.3 of the Analysis of the Collected Data chapter (Lack of End Users' Informatics Experience), the author thinks that health informatics departments should provide training programmes and assistance to clinicians to improve their technical experience in dealing with computerised health solutions.

10.5.3. Fostering the NHS Organisational Context

Regarding organisational factors, the author suggests the following points that may enhance the organisational context in which LORENZO operates. These points are:

10.5.3.1. Focusing on the bottom level of the NHS organisations

The author thinks that involvement and engagement schemes should focus on the bottom level of NHS organisations. This is based on the premise that end users are the real users who are going to use the system, and already have the experience in terms of performing clinical processes. They are therefore able to determine the deficiencies or the unnecessary tasks. Furthermore, the author proposes that end users should be included from the very beginning in discussing the system's objectives along with senior level people.

10.5.3.2. Fostering open, bottom-up communication channels

Having open communications offers many benefits to both the NHS and the LSP. The author thinks that fostering open and bottom-up communication channels enables end users to be involved in the design and implementation of LORENZO. Moreover, facilitating open communications with the end users enables the LSP to have more suggestions from clinicians about potential uses of the system and improve the overall performance of the system.

10.5.3.3. Obtaining top management support and championship

The author recommends that more "champions" should lead, and support the implementation of LORENZO in the NHS local organisations.

10.5.3.4. Emphasising seniors' clinical/technical expertise

The author argues that in order to have the required support from senior level management, those who are situated at the top of the managerial hierarchies should possess a certain level of technical and/or clinical expertise so as to be more informed and capable of understanding end users' information needs.

10.5.3.5. Ensuring the NHS responsibilities toward LORENZO implementation

As we saw in section 8.3.6.4.3 of the Analysis of the Collected Data chapter (Lack of LSP's HIS Development Expertise), the LSP did not have enough clinical expertise in designing and developing computerised health solutions. Therefore, the author believes that the NHS should take the responsibility of owning the change because they are the ones that run the service, and know better how to improve its efficiency. This entails that the NHS organisations should be responsible for encouraging their workers to understand what the system is for, its benefits, and how it can improve the entire performance of the organisation, instead of relying on the LSP to bring the change and motivate the employees inside the NHS to use LORENZO.

10.5.4. How the LSP can boost users' acceptance of LORENZO

The author thinks that the LSP can enhance end users acceptance of LORENZO. This can be achieved by:

10.5.4.1. Adjusting contractual arrangements

The author thinks that it is important to look at the contractual arrangements that manage the relationship between the NHS and its LSP. For instance, the LSP should take the responsibility of providing better technical support and services to end users. This can be done by giving more than 45 days support to the trusts installing LORENZO's deployment units, as the 45 days support might not be enough if one considers the massive complexity of LORENZO.

10.5.4.2. Allowing part time contracts

Some of the interviewees claimed that the relationship between the NHS and the LSP is commercially, rather than clinically grounded. This type of a relationship restricts people who are working in the NHS from having part-time contracts. Thus allowing the NHS users to have part time contracts to work in both sides, and be more active in the design of the new system is a suggestion that could be beneficial in fostering their informatics experience. This may make those clinicians advocate LORENZO, and subsequently reduce its usage resistance.

10.6. FUTURE RESEARCH

Because the author could not distribute questionnaires to the users in the NHS due to the limited time and the difficulty in obtaining the NHS approval to pursue surveys, further research could involve quantitative research to investigate users' acceptance of LORENZO. The author thinks that conducting large-scale quantitative research is beneficial because one could test empirically the proposed model created in this thesis as shown in Figure 10-6, examine statistically the relationship between the development methodology and the intra-organisational acceptance of LORENZO in the NHS, and enhance the generalisability of the findings.

Since it is intended that LORENZO will be completed in 2014, in terms of developing the entire deployment units, the author thinks that one could conduct a study after the completion of developing LORENZO's units to explore end users' perspectives. Moreover, one could also conduct a comparative study to assess the perceived determinants of deploying the various deployment units in various NHS organisations located within the NME region.

The author thinks that a research area that could be explored that is investigating and measuring end users' satisfaction with LORENZO. Conducting a study to investigate the factors that affect the dependent variable that is end users' satisfaction is valuable. This is because User Information Satisfaction (UIS) has a high face value as we saw in section 3.2.1.1 of the Successful Implementation of IT Projects chapter (D&M Model Components), and usage (as a dependent construct) might be misleading since LORENZO usage is compulsory.

The author suggests that one could pursue research to investigate the contract signed with CSC and its impact on users' acceptance of LORENZO. In addition, further research could be conducted to examine the decision making process with regard to the design of the NHS CRS as well as to assess its outcomes by taking into consideration the protagonists involved in the determination of the system requirements. This type of research offers an opportunity to link the IS literature with the organisational decision making literature to obtain an original study

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APPENDICES

APPENDIX 1: INTERVIEWS QUOTES

R1 Quotes

Quote	R1
1.	*The reality was the clinicians were being very very autonomous and we still had not got this within the groups themselves how to achieve consensus*
2.	*There is another tension and the tension was to do with the implementation side with people's ability and understanding of the technology*
3.	*The point I am making here is that to me it seems like there was a feast and famine situation when it came to IT in the NHS... When it came to IT in secondary care sector or ... (noise phone ringing) or mental health it was famine, these guys had hardly anything there*
4.	*There is also the generational gap within the hospital sector you know the more senior people doctor, nurses...etc perhaps not intuitively geared toward technology*
5.	*If I look to my laptop or computer I usually use 5 % of its capabilities. Microsoft WORD for example and there is a danger to assume that everybody will use the 100% of that capability, No. so the training has to be targeted, training has to be in terms of what is the core, basic and minimum skills that everybody needs to have*
6.	*Training has to be made simple*
7.	*I think we partly got distracted by our success of PACS We misunderstood that PACS technology was very different to care record technology. And people did not make that connection and everybody got too optimistic that will be the same and they could repeat that success*
8.	*What can we learn form the implementation of PACS and the bottom line was PACS was successful because it was a very simple technology... and to use that as the indicator for the rest of the programme was inappropriate, highly ambitious and pretty naïve*
9.	*there is clearly a need for a unified system but the challenge for the unified system is firstly the administration side of the PAS and then the departmental system and this is middle grounded the electronic patient record is going to occupy* (pointing to the position of the NHS CRS between PAS and departmental systems)
10.	*Medicine does not work through protocol guidelines, it is very very individualistic and to achieve consensus among different groups of clinicians is very difficult*
11.	*Here are core teams, LORENZO core team on subject basis...etc the fact that they can not be representative, nobody can be representative because it is how medicine is organized. I can't speak on behalf of doctors, particular subset of doctors, because it is so individualistic*
12.	*The fact there was different types of end users... There was no one end user and in every time you did that and you implemented something, you got into ( ) the other end because everybody started saying that "I don't work like him or her*

13.	*To achieve consensus among different groups of clinicians is very difficult... Diversity was between those groups, within those groups*
14.	*It came home to me at that stage that the tension within the end users and managers and also the fact there were different types of end users*
15.	*The reality was the clinicians were being very very autonomous and we still had not got this within the groups themselves how to achieve consensus and that still plays out so although there are specially based group*
16.	*So the tension was just not in term of specification, the tension also in term of implementation and all of that was contributing because it was not very structured planned approach, sequential approach*
17.	*The fact that I became a bit disconnected from the day to day area... trying to reconnect back here to find exactly what is happening on the ground level but I did on the one hand I got better understanding much broader understanding, on the other hand I lost the sharp focus because of not being grounded in the detail at the very local level*
18.	*That very brief is the ( ) journey from 2002 to my CSC days I actually left CSC in August... largely because of work pressures here* (here refers to the NHS) *I just could not have two jobs and especially because both jobs are very demanding both systems in constant trauma*
19.	*We should have this as a more iterative and incremental project because ultimately the only way the system can work is to go down to the lowest level... we can't afford even one clinician not to participate because the system does not work. So there is no choice than to make to the lowest dominator level and that means that you have to take very very slow*
20.	*We have to acknowledge that it was not just unique to see CSC, it was other IT companies as well. They were on a steep learning curve; they are coming from a very different IT perspective. They were not clinicians intuitively and they fully acknowledge that but that acknowledging was not as same as that they can change that fast. Remember that these are huge organisations and the challenge I pose was that CSC needs to move from being IT company to a health care company*
21.	*The contract is structured in such a way that LSPs are responsible for only 45 days of deployment and implementation that NHS supposed to pick it up*
22.	*From the early beginning, there was all these discussions whether it was about IT or about clinical services and what the role of clinicians*
23.	*The project NPfIT programme itself is changing. It started with very clear ideas that ... the infrastructure issues like email and N3 and electronic transmission of transcription and electronic patient record PACS started coming later on*
24.	*This was not structured planned controllable project. In my mind it was always evolutionary emerging making it as you are going along... We should see that it has emerging strategy, evolving project than the one that we try to plan it in detail before you start implementing*
25.	*Technological challenge was also compounded by the scale of the project because nobody has tried to do it for a country, it was very ambitious*
26.	*From the early beginning, there was all these discussions whether it was about IT or about clinical services and what the role of clinicians*
27.	*When you talk about business processes we are talking about clinical processes? R1: yes that's right"*

28.	*Here were some fundamental assumptions... business processes were well understood... it became apparent that there was a fundamental assumption, a mistaken assumption in this project from the very beginning which was business processes are well defined and well understood*
29.	*It was not just unique to see CSC, it was other IT companies as well. They were on a steep learning curve; they are coming from a very different IT perspective. They were not clinicians intuitively... but I think we have been stuck in technology for quiet some time because we did not have clear understanding of business processes, we could not come up with the final product*
30.	*The fact that there was a common problem and the common problem was boiling down to was lack of understanding uniformity about business processes unclear understanding how do patients flow through the system*
31.	*There was a common issue and I think we were coming together around patient safety a bit more. There was a requirement remember we had also to develop common standards for patient safety uh you know we never had standards as they apply to healthcare IT*
32.	*there is that challenge and all then the challenge because the fact is not the joining up but the question is some of them to ( ) that where the resistance will come because these people are used to a particular way of working they are not going to give up that very easily... there will be going back before you can go forward so people will perceive it as a sense of loss...*

R2 Quotes

Quote	R2
1.	*We are providing them a framework of, whether you know data items or data objects all of that sort of stuff and it will be down to them to sit down and say 'Well when we click on this, what do you want to see in the back... that is what the NHS are defining and that is the single most difficult thing because it is at that stage you get into the debate and the discussions and the arguments about what is standardized practice*
2.	*In LORENZO, and in all the other solutions, there is a requirement to have what we call; we call it the patient banner... They have to decide what goes on that patient banner. You would think that would be fairly easy wouldn't you? No. Some people want the full address on it because if you are a district nurse you need to know where the patient lives... There is a huge debate about what they actually sought on there*
3.	*The role that I had within the SHA, and I was a Direct um the SHA's equivalent of a Director of Nursing and Clinical Governance, I had absolutely no input whatsoever to the national programme for IT. So given that nurses are 70% of any NHS organisation's workforce, as a Director of Nursing responsible for a geographical patch I had had no input at all*
4.	*it is interesting because, of course, if you look at the (Royal Colleges) actually they are power-base is phenomenally strong but within the national programme I do not think the power-base of clinicians working in the national programme, whether we are here or whether you are in Connecting for Health, is actually strong at al*
5.	*the amount of engagement and involvement clinicians have within the national programme generally. And I would say probably the amount of involvement and engagement we have on either side... is probably not enough, at all*
6.	*So Trusts will choose to deploy it in a speciality and that will be their decision, where they feel either they have either got people that are enthusiastic to take it and they know will, they can trust to make a good job of it, I would think, more than anything. They are not going to start, they are highly unlikely to start with a group of, you know antagonistic (laugh) users*
7.	*I also think that the people that are not as engaged in this as probably they ought to be are the PCTs who are commissioning services, because actually it is them that should be driving clinical effectiveness and clinical safety and standardisation because they should be driving it through the service and not through the national programme*
8.	*if you look at the NHS, of course, neither is the NHS clinically led or clinically driven so the person that heads up the NHS is Dave Nicholson who probably has not even got a first aid certificate so he is not a doctor and he is not a nurse either*
9.	*I do not think that the NHS actually put in as much support as they should be doing into the deployment*
10.	*The thing is they...It is never been done before so to be quite honest they do not know, we do not know, we have not done a clinical product before so we will know because we will have to learn on the (hoof), in effect. Use the experience we have got but some of this will be about learning for all parties frankly*
11.	*One of the chief information officers said this on Monday and I thought it is a really good point, the national programme was uhh a programme established to try and fix a problem that people didn't actually know, they had not really defined what the problem was to start off with*
12.	*Medical Royal Colleges are much more involved in setting standards for medical education, for medical practice etc, etc. You know, the standards of what they expect people to act... they'll provide them with a blank (toolkit), it is the NHS responsibility to fill that toolkit up with all the drop down lists, with the standardised templates for care and they have to be owned by them because they're the people that are dealing with patients. So I think there's been a huge disconnect*
13.	*what IT systems do and what LORENZO does is it makes, it requires people to be more explicit about how they work and how they work together in teams and at the moment much of that is art not science, so it is something you do because that is's your job and that iss what you have been trained to do and you, it is because they have an innate umm we know that is how they operate*
14.	*Within the national programme I do not think the power-base of clinicians working in the national programme, whether we are here or whether you are in CfH, is actually strong at all*
15.	*I have no control whatsoever over the content or indeed the behaviour of clinicians, be that doctors or nurses once that solution gets out in practice it will be, it is there, it is that Trusts' responsibility really, that is where the standardization has to sit with them because they are the ... they are bodies that are accountable for delivering patient care. So what we are accountable for and responsible for is delivering a solution, is delivering a contract really. The contract that we have is with CfH that is what we are accountable for delivering*
16.	*I used to say earlier there was "How many people work in the NHS? 1.3m and 70%...and there are one thousand people working in (omitted for confidentiality) , of which 30 of them are clinical subject matter experts... but actually the amount of influence we can have on the programme is fairly limited*

	when you have got 1.3 million people working in the NHS
17.	*The level of complexity and sophistication within that software we should have started 20 years ago (laugh) in order to cope with it, yeah. To cope with all the things that the NHS have said that it wants*
18.	*The implementation of this will never stop because there will be constant refinement, both in the way in which they use it because they will be saying "Well that is a really--, actually let's do it this way. Let's use that bit of software... so there will be that cycle of development as well as the cycle of development where people themselves will be using it*
19.	*Actually the things they want to talk about are patient confidentiality, consent, the impact that it would make on their, on the doctor/patient relationship*
20.	*It is been sold really as a technology programme and I think that switches a lot of people off. We haven't even got past base camp really*
21.	*If we went to University hospitals in Birmingham or St. James' in Leeds you would probably find slightly different ways of doing the same operation because we all have different ways*
22.	*the National Health Service is not a national health service is it? We have got variation of practice all across the UK so it is only national by the fact that it is got the same logo as far as I can see. Having worked in it for donkey's years there is very little standardization*
23.	*There are no standards for medical records, so there is no umm You could go anywhere in the UK and you will see a medical record that looks slightly different... so what the national programme wants to see, of course, is that standardisation. The reality of it is it is really difficult to get the standardisation because what you are looking for of course is the agreement of people within the NHS to what suits*
24.	*What LORENZO does is it makes, it requires people to be more explicit about how they work and how they work together in teams and at the moment much of that is art not science*
25.	*General Practice said "But we do that now" (laugh) "We do that now, we still have a ( ) and I'm talking at the same time" They want to talk about the professional issues (short pasue) really. Those are the things that they want to talk about. They want to talk about doctor/patient relationship, confidentiality, safety, effectiveness*
26.	*Every time we go out and we do a deployment then every single trust in the UK, well of our 60% of the UK, will say "But we do not do it like that here, we want something different*
27.	*initiatives set up in the NHS to try and get people to operate along the same sorts of guidelines and where there is a, where that becomes a "must be done" and you know legal, you know part of a legal framework then of course they will operate in that way but while ever it is left up to "it is guidance" well it is guidance I can choose (laugh) to ignore it if I want and as long as I can account, as long as I'm recognized as a registered person I'm accountable for my own actions*
28.	*Once that solution gets out in practice it will be, it is their, it is that Trusts' responsibility really, that is where the standardization has to sit with them because they are the ... they are bodies that are accountable for delivering patient care. So what we are accountable for and responsible for is delivering a solution, is delivering a contract really. The contract that we have is with Connecting for Health that is what we are accountable for delivering*

R3 Quotes

Quote	R3
1.	*I think is where many other trusts, they just don't have clinicians who have the informatics experience, some do, but not many and I think that, I think that's holding a lot of these trusts back*
2.	*That's one of the problems that I have seen and people who really don't understand what this software is doing... the problem is, is that there are not that many people around, not that many clinicians around that understand what the limitations of it are*
3.	*Three extra clicks means a lot to a busy clinician... The problem is the doctors are so busy... I mean the only reason I can spend this time with you is because I work full time for Informatics, if I was working full time as a clinician I mean there's no way that I could get this kind of time away to do what I do*
4.	*I mean just as an example, you know, was the a lot of time, you know, I mean when IPM first came out... there's no-one that can work with that, you can't work with a mini-math logon and they absolutely wouldn't fix it... I mean that was the number one thing was the logon time and still in almost a minute, still almost a minute*
5.	*We have had very little success in getting the more senior doctors to interact in the system. They're going to have to, but it may take, you know, sort of the attrition and then moving up through the system*
6.	*If you give them a choice they'll continue to use what they're comfortable with. I mean that's human nature but on the other hand we have to show them they will get some benefit out of the new system, not so easy*
7.	*you can listen to a committee of five and that's the key, which is what CSC and Connecting for Health did not do is they did not get a core group together of people who really have invested interest in seeing the project succeed and listen to them*
8.	*the informatics team is multi facetted, I mean they have a good hardware infrastructure, we have some very smart people to do uh, you know, operational design uh within the, within our network uh, you know, I mean our infrastructure is very good*
9.	*We have a very good leader, I mean, R4 is an excellent, inspirational kind of guy and, and thank god, because I mean he really helped his people... he doesn't micro manage, he lets people get on with what they do best and, and just doesn't... I mean he steers the project well, he steers the work well, without being, you know, over bearing*
10.	*the whole construction of the informatics department is very robust I mean in the sense that we have the trainers are good and we have, you know, good leaders and it's, we're picking the right people*
11.	*We designed and built it ourselves. So I mean that's just an example of some of the innovation that we have in this department and that's why we have been so successful with our deployments*
12.	*I think that's the key is that our team, the morale of our team is very high and, and we believe in what we're doing, we believe that, that what we're doing is*

	good for the NHS, good for the patients and it's just making the doctors see it that way
13.	*is a much bigger project, incredibly more complicated, and complex*
14.	*I think the concept of flexible design, uh, didn't enter into their mind at all...*
15.	*I mean when IPM first came out they had a lot* **[08:56]** *and uh... well I mean there's no-one that can work with that, you can't work with a mini-math logon and they absolutely wouldn't fix it. They refused*
16.	*Again see I mean PACS is an example of how it should work, but PACS is a very single purpose system. I mean it's a big data storage, image storage system. All it does is store images, that's all it does*
17.	*That is the thing is, we have to give them the choice. If you give them a choice they'll continue to use what they're comfortable with... but on the other hand we have to show them they will get some benefit out of, out of the new system, not so easy*
18.	*if you've got three practices with one system and two practices with another, they'll never be able to share information without a very complex interface action, and so LORENZO the idea with LORENZO is to cut across all that and try to have one system that everybody has and so the [ ] is there*
19.	*here are only about two or three real players in the GP market... but still they don't talk to each other... it's very difficult to have one system talk to another, the fields map differently and they interfaces are different and even NHS messaging it's still not that easy to do*
20.	*Clinical documentation. We haven't solved that problem yet, okay. I mean they've come along way to good clinical data catch, okay, and data input, but, and from my perspective they have not solved the data output issue yet*
21.	*they're just working on, just barely agreed on a format of what, you know, the gold standard is plain English, okay, I mean people like to read a note, I mean we're used to reading, we're used to reading text, okay, and in a structured way, okay, to organise, you know, formatted like a, you know, like a letter*
22.	*For IPM it was awful... they started showing us IPM, I said that's the worst system I've ever seen, you know, I mean it's terribly clunky and I mean process heavy... I said you will not treat us like this and I said I'm going to do everything I can to make sure that this programme is changed, because the end users will go crazy and they did, everybody hates it*
23.	*I think the primary problem that I think the UK has as opposed to the US is they don't understand who the customer is and they don't understand, you know, what customer service means*
24.	*You need people who understand what the end user requirement is and deal with them on that. Well they, they didn't understand that concept and so it was a, it was a difficult process, you know, through, through months of, of dealing with these people. They just didn't understand*
25.	*I said that's the worst system I've ever seen, you know, I mean it's terribly clunky and I mean process heavy, you know, I came up with about fifteen... I came up with two pages of criticisms and the, yeah for IPM, well they did, they totally ignored it, they didn't implement a single one, I said what, you know, why, why did you waste my time*
26.	*you can't fix that login or you know they came up with all these excuses as to why they couldn't fix the system, as opposed to coming up with solutions... they came up with more excuses they never really focussed on what the*

	problem was and how to solve the problem
27.	*that's the whole problem with IPM, is they didn't really clinically engage with anybody and they came out with a shitty product, it's almost unworkable... that's then part of the major adaption problem that the national programme has had is they didn't really think about the end users before they deployed new systems*
28.	*Three extra clicks mean a lot to a busy clinician*
29.	*I mean there's no-one that can work with that, you can't work with a mini-math logon and they absolutely wouldn't fix it. They refused... I mean that was the number one thing was the logon time and still in almost a minute, still almost a minute*
30.	*A mid-path logon, it just does not work. You have to have ten second logon, or less. If you want people to not share cards, then that's what people do is they all share cards, which defeats the whole security issue... I mean we have to work too. So people develop workarounds*
31.	*we deal with people's lives, and, and you're dealing with doctors and nurses and healthcare professionals, and not everything works the same way with every patient the same, you know, every time and I think the concept of flexible design didn't enter into their mind at all... I mean I can deal with a card and a pin, but then you have to be able to be flexible and change the system, so that it reflects what the end users need*
32.	*So people develop workarounds, they do and that's basically is undermining the entire security aspect of the data protection act and the patient/carer guarantee*
33.	*That's then part of the major adaption problem that the national programme has had is they didn't really think about the end users before they deployed new systems. I mean how they could ever let a system with a minute and a half login get out the door is beyond me*
34.	*LORENZO is the same thing. You know, we could, we could wait for, you know, the gradual change to come or we could force it and unfortunately we don't have the time to wait, you know, because it's, it's so complicated it will take years of attrition*

R4 Quotes

Quote	R4
1.	*I mean these systems can't be specified by IT people or informatics people, you have got to have real-time practising clinicians involved in that whole requirement stage*
2.	*there's clinicians involved in the iSOFT solution office but I firmly believe that you have got to have practising clinicians in enthusiastic organizations to actually get that requirement fully articulated and fully expressed down to the right level of detail to make these sort of systems work*
3.	*So I think it is extremely important that clinicians are allowed to practice clinically whilst contributing to this whole agenda... within our informatics team clinicians on a two-day-a-week basis to allow them to treat patients for the majority of their time but, but have some protected time to actually engage with a requirement definition with final testing, system testing, system development etc, but then still go back to clinical practice to keep them sharp*
4.	*There was clinical involvement from the core clinical group that Connecting for Health employed, and that numbered around about 80 clinicians across the country, and I think that was woefully inadequate for the complexity of the sorts of systems that were being designed*
5.	*So by and large the core clinical team from Connecting for Health, the clinicians that are involved in iSOFT, the clinicians that are involved with CSC that designed and developed the big capability, have got it 80% correct, what we are bringing is the 20% that you can only get from a deployment*
6.	*The model of care is easier to understand in the surgical area than it is in a medical area... we believe that there were more advantages to the project in engaging with a surgical set of users than a medical set of users*
7.	*You also need to look at the dynamics within the wards in terms of how busy they are, how easy it is to engage and disengage at various points of the development and the deployment*
8.	*the kind of the busy working day did actually work against us in the deployment, we have actually just concluded in that, the surgical wards tend to be busy all of the time...the ward is always busy...Medical wards do tend to have kind of peaks and troughs*
9.	*The whole clinical journey for the patient within a surgical intervention on this particular hospital site, so we cover orthopedics, we cover general surgery, we cover all aspects of the surgical specialty across the surgical wards and departments on this site... So it's a critical mass around surgery. So whether a patient is going to either pop into the system or pop out of the system against those three formal wards there's a whole kind of support group that sits round that nucleus of those three wards, and they're all using LORENZO*
10.	*It is more predictable and therefore it was easier for us to construct the workflow... within that more pre-defined model of care... We would tend to conclude that it is easier to deploy these sorts of new systems in surgical environments than it is medical environments, because of the predictability and all the rest of it*
11.	*The NHS hasn't really worked out how the heck it's going to deploy these sorts*

	of systems with its current workforce configurations. So in terms of the informative services they tend to still get locked within single organisations and while they are locked in single organisations they're not big enough and they don't have the influence enough around the health community to deploy these systems to give a maximum benefit
12.	*I think what the NHS needs to do is learn from what is happening in places like Morecambe Bay, Blackburn, South Birmingham*
13.	*There is a lack of understanding within the senior responsible officer layer within the NHS as to what the real benefits of these sorts of systems are and then there is a lack of understanding as to what it actually takes to deploy these systems to get all those benefits out*
14.	*The senior responsible officers need to really engage in the programme to encourage local organisations to do that piece of work and once that piece of work is done to actually encourage those organisations to think seriously about how they are going to deploy it*
15.	*I want to see more evidence and literature and encouragement from the national levels back down into the SHAs and PCTs as the senior responsible officers to define the benefits and the need for change around the patient record agenda. So I would like to see a lot more coming down through the NHS to encourage people to get more involved, because organisations themselves... it's still optional,*
16.	*So I would like to see a lot more coming down through the NHS to encourage people to get more involved, because organisations themselves... it's still optional, there's umm and umm you can't blame an acute hospital down the road for not getting involved in the LORENZO piece because there's just no real evidence as yet that they can see that it's actually working*
17.	*I'm a bit concerned about time scales being putting on the early deployments because really we should be going live when we're ready to go live... we won't go live because some politician has told us we've got to go live whenever, we'll go live when we believe it's fit for purpose to go live and that consultants will be supported by it.*
18.	*I think compulsory is difficult, but encouraging, they should be more encouragement... Perhaps even rewards*
19.	*Given the stage of the programme, my personal preference would be not to have a deadline hanging over it. I think it can be quite counter-productive... it puts an unnecessary pressure onto both the NHS to receiving the deployment as well as the organisations deploying it to have this kind of very, very big important deadline imposed on them*
20.	*So it is a relative captive, client base if you like, patient base and what that geography, that 1,000 square miles, actually gives us is, is quite a significant communications problem...on in our deliberations around how do we solve that problem we came to the conclusion what we required was an electronic patient record*
21.	*it has given us enough configuration options to satisfy the individuals as well as the kind of the core requirement against the specialty... one of the problems with LORENZO at the moment is it is too highly configurable*
22.	*It is a bit counter productive to have that vast difference in configuration because one of the benefits obviously as doctors, especially locums, move around the NHS, they are familiar with the tools that are on offer through the information systems, and if have got completely different configuration then*

	you have got issues with interpretation of information and training and all the rest of it
23.	*So we had to ensure it that what we were getting was clinically safe, we were not compromising patient care... So for example our chief concern is to make sure we come up with a business process that is clinically safe, protects the patient, delivers patient care*

R5 Quotes

Quote	R5
1.	*In terms of clinicians, clinicians are trained to do clinical work and a lot of them say "We're not trained to work with computers*
2.	*People had never used computers, clinicians particularly and community sectors had never had to spend time putting in such information about contacts with patients, you know, they saw their time to be used for clinical stuff*
3.	*Now with LORENZO, there are a few things that help us, one is that most organizations use iPM or a PAS system ... they've gone through that already. So it's not like we're starting from a fresh and they've got to start using a whole new concept, but they use IT already so that's a positive thing*
4.	*Another organization that I work with, they are about to deploy a particular system... It's been a long time plenty of opportunity for talking to people and everything else, preparing, getting people's head around it all supporting people through all the anxieties around change and the potentials around change, None of that's really been picked up. None of that's really been done. So I know that when the system switches on, it won't be particularly wanted people will use it because they know they'll get told off if they don't but they'll use it for the minimum*
5.	*I think people get frustrated because they want this (pointing at the LORENZO roadmap) and unfortunately you can't walk before you can run and you take that (means that deployments units are not fully functional yet) (Laughter). You have to sort of work through this. I think that's really, really frustrating because managing expectations I find is quite difficult because you go in "Oh we want this. We want that. And we want the other*
6.	*we realize that and there may be other things we can do to support that side of the programme" to support some of their frustrations around the systems and the fact that they're not ready yet to talk to each other or to do whatever but I think that that's hugely difficult*
7.	*People fear that because the computer can do everything there's no need for them. There's lots of fear around that, with administrative people in particular*
8.	*I think with older staff, and in some particular professions the demographic of the people are a lot older. District nursing... if you looked at the age range of people in District Nursing and where most are sitting in that range, you'll find that they are in the 45+ age range? So it doesn't take much to really compute that they're going to find that a little bit more challenging because they weren't brought up with computers they may not even use a computer they might. But they may very well not do*
9.	*As time goes on that record gets fuller and more things in it. So you don't get the benefit straight away, you get the benefit further down the line... some of our deployments might not be sort of whole sale deployments. So while we'll deploy a deployment unit, so we have all the functionality. They may choose that they're only going to deploy it to a certain part of the organisation to start with and that will be the project*

10.	*...So at first when you switch on you don't get all the benefits... If you switch the system on well there's nothing in it is there? It's empty. There's nothing about, apart from the patient's name and address and whatever. There's nothing about what's happening to the patient*
11.	*But then we have to say "Okay, well at the end of the programme you're going to get all of that. We're in here now, we're here." And then they go "But, but it doesn't, but it's this, but it doesn't. It doesn't do this. It doesn't do that." And we'll say, "Yes we realise that and there may be other things we can do to support that side of the programme" to support some of their frustrations around the systems and the fact that they're not ready yet to talk to each other or to do whatever but I think that that's hugely difficult*
12.	*I think that's really, really frustrating because managing expectations I find is quite difficult... LORENZO at the moment doesn't do all of that it just does this (point at the first three releases of LORENZO) so as yet we're not talking to all the systems*
13.	*So we have a role in managing expectations, we have to explain to people that this is a journey and they might that take that and they might take. They've started on their journey but they're not going to be able to talk to their pathology system yet, not yet, that'll come over here. They're not going to be able to talk to their GP system because that's not going to come until here. But the vision is that it will happen*
14.	*They're the ones that are going to be starting to do the formal benefits measurements because we do measure before going live... You know there are all sorts of parameters of how you might measure what life is now. Then you deploy your system and use it and then you have to re-measure those things... "When I go back after the 45 days, they then review with me all the benefits stuff. So I would then be looking at what the measurements pre and post were*
15.	*The organization has to map out their current processes and that's often quite a challenge really because even within a service or within a team, people can do things differently*
16.	*I feel that the strategic health authorities probably have got a role in trying to get that sorted out really, to engage with very senior people, chief executives to help them to understand that these systems are there to support the business, It's not just an IT system... It's about developing and delivering, expanding and driving a business really. So I think that bit of understanding is missing in quite a lot of organisations*
17.	*The only people who really know the truth are the ones that are doing it, aren't they? They're the only ones who know the truth of what you really do. So I always encourage the change leads and the organisations to go out there to make face to face visits with the district nurses, the ward staff, whoever they are, make sure that they actually get the real process*
18.	*So what I encourage the project to do, in some very, very early days, to engage their clinical governance people. So they're the people in the organisation who are responsible for all that process the clinical process and the risk and everything like that*
19.	*I formally run workshops with senior people within organisations. To drive out what they want to get out of a deployment... but it's the organisation at its top level thinking of what it needs to do strategically that influences what they're taking. Do you see what I mean? So the end user might not have any*

	visibility of any of that
20.	*The NHS is an interesting organisation... I suppose people, who work outside, and I'm outside the NHS which is very interesting, I get a good view of it. But people who have limited knowledge about the NHS tend to say...Somebody said to me the other day, who was actually applying for a job in the NHS, she said to me "I want to work for an organisation that has a vision and that people are really, really working towards it." Okay? You read about the NHS and it sort of seems like that, doesn't it? Seems fabulous. So you've got all these people, they're all working to the same objectives. they've got the same ways of moving forward, they work together and it all sounds like a wonderful thing. But the reality of course is that that's not true*
21.	*We go through from that phase to doing some assessments of organisations to see how ready they are to deploy a system... I might be asking them about their IT infrastructure. I'd be asking about what their resource space is to deliver a project. I'd be looking at the type of resource they've got, skills, capabilities, competencies*
22.	*I think there was a lack of resource and understanding of what that resource needed to be... I think that competencies and resources were underestimated. I think that's developing but still a problem*
23.	*We look at that at readiness stage. I think still in terms of buying. There are a still lots of organisations where the driver is IT rather than the driver being the business and looking at what IT can do to support it*
24.	*In terms of standard organisational bureaucracy and the shape of an organisation, they're all hierarchical, you know, they're all triangles*
25.	*I've worked in other ones where there was a lot more ability to have a much more bottom-up approach. So that people who were there on the front line could seriously influence what happened around having organisations developing on, moving on, changes that were made... what I find is that the successful ones are the ones where they're matrix managed they're networked there's lots of opportunity for people at all levels of the organisation to influence the leaders*
26.	*People at the top are often disengaged from people at the bottom... the organisations that are very hierarchical, comes from the top down to the bottom that's your place and you stay down there. Much more difficult to deploy a system then because their communications and their understanding of social networking and how people, you know, work together and influence each other is much less and they don't buy into the communications at all. And you end up with a deployment that is much more limited, much less useful possibly doesn't deliver the benefits they wanted*
27.	*It's a whole group of disparate organisations that have their own cultures... So you end up with all NHS organisations are like that. However within them, there are other aspects of culture are there? So, depending on who sits at the top I guess it's very influential in how the culture is driven down*
28.	*different NHS organisations are very different in terms of their culture*
29.	*There was a rule from the top and it was implemented down to the bottom and a huge "blame" cultures and all that sort of thing. I've worked in other ones where there was a lot more ability to have a much more bottom-up approach. So that people who were there on the front line could seriously influence what happened around*
30.	*The organisations that uh a little team of people at the top make the decisions.*

	And everyone has to bear the burden of those decisions. Which often are not very well informed. Find it much more difficult to change, because they're there busy working, they have lots of pressures
31.	*Teamwork at the end of the day if they're a culture that's bought into that anyway, it'll work well... They share things they develop things together. People on the front line actually can say to people a bit higher up "Oh do you know if we did it this way?" And they'll be listened to*
32.	*Particularly this year. General Election year and everything else isn't it? Well you know, this year, next year. So yeah there's lots of challenges aren't there?*
33.	*So I guess our first communications are at the high level of an organisation really, to try and work with them and see what they want and how we can support them. In terms of communications with end users that's as we move through the project*
34.	*So, more recently, I've just been talking to my team about, "You know we don't really go out and see commissioners, why don't we do that then? Because wouldn't it be good to go the commissioners? Because they commission the services so actually us, putting in LORENZO will create an environment for them to get all the information they require about boom, boom, boom, boom, boom. So wouldn't they be advocates for it?*
35.	*nothing to do with me really because 45 days after deployment, I've gone out the door anyway*
36.	*Everyone thinks that as you use a new system. It's difficult and it's worrying but you know "Ow!" But you get used to it don't you... So LORENZO, at the moment, is an early product. It doesn't provide them with everything they're going to get in another few years time. It's a starter really*
37.	*Well obviously you can take documents, results and requests without changing your PAS system that rests on whatever PAS you've got but to progress through then it's a useful thing to have care management but some of these deployment units don't rest on care management*
38.	*We tend not to talk about releases, we talk about deployment units. At first we had a strategy of two releases then it went to four and now the strategy is about deployment units*
39.	*LORENZO itself as you're aware is a long programme, so it's not just a one hitter and it's all there, It is lots of different deployment units*
40.	*Obviously in terms of when we're talking to organisations about of "Well what do you want to take? Which of these deployment units do you think you might be interested in?" It starts off talking at a high level with the organisation an... at this moment in time I'd be saying to them "Okay." If they're a community trust I'd be saying to them "Well let's look at clinical documents." If they were a hospital I'd perhaps say "Let's look at results and requests and may be look at clinical documents*
41.	*LORENZO at the moment doesn't do all of that it just does this (point at the first three parts of LORENZO roadmap) so as yet we're not talking to all the systems*
42.	*We have to explain to people that this is a journey and they might that take that and they might take. They've started on their journey but they're not going to be able to talk to their pathology system yet, not yet, that'll come over here. They're not going to be able to talk to their GP system because that's not going to come until here. But the vision is that it will happen*

43.	*I've said before at a very high level saying to the organisation you know "What outcome do you want from this project?" And they'll say things like "Oh we want to minimise our clinical risk" or "We want to make our processes more effective we want to reduce our financial burden... So at that level, that's the sort of stuff we get out of them. As we move through the project we work in a structured way to sort of drill some of those things down... So we work with end users to look at what that might mean for them as a group*
44.	*And you might go to another organisation who say, "Well we're using IPM and that's been quite a lot of pain for people because all these clinicians are now being told to (type or tackle) all their contacts into a computer and everyone complains about it and everything else, it's tough."... I actually worked in the NHS on IPM deployments and I was in the NHS, it's very, very painful. But the cultural changes were huge, huge. The changes to practice that were negative were very difficult to manage because people had never used computers, clinicians particularly and community sectors had never had to spend time putting in such information about contacts with patients, you know, they saw their time to be used for clinical stuff, absolutely right as well*
45.	*So there are a lot of organisations at the moment that want to get on to the LORENZO platform but starting off by getting their admin sorted so they've perhaps used IPM, which was our previous iPM PAS... you can take documents, results and requests without changing your PAS system that rests on whatever PAS you've got but to progress through then it's a useful thing to have care management but some of these deployment units don't rest on care management*
46.	*So there's a huge cultural changes. Now with LORENZO, there are a few things that help us, one is that most organisations use IPM or a PAS system and in the community in particular, where there was a lot of resistance some of that, they've gone through that already. So it's not like we're starting from a fresh and they've got to start using a whole new concept, but they use IT already so that's a positive thin*
47.	*I mean a lot of the, just to be technical, a lot of the issues that people had with iPM were not actually iPM problems, they were problems with their own networks because their own networks weren't mature enough. They weren't really ready for the wholesale adoption of an IT system. So people said "Oh, this doesn't respond. It's not working." iPM's working fine what actually isn't working is their own network*
48.	*I feel that the projects that don't go so well, if you track them back, you see that they didn't do anything at the beginning to manage the stakeholders... They didn't really engage people*
49.	*Those organisations that I suppose do share a vision better across and within their hierarchies. So that people who are engaged within the project end users for example, they understand this is the way our organisation's going because they got lots of general comms but focused to them*

R6 Quotes

Quote	R6
1.	*You're there because you've got time to go away from your work and do some of that stuff but by its very nature you are at one removed from the operational process. So it's impossible for an organization like this to get to the operational process*
2.	*you can't blame an acute hospital down the road for not getting involved in the LORENZO piece because there's just no real evidence as yet that they can see that it's actually working, so I think what the NHS needs to do is learn from what is happening in places like Morecombe Bay, Blackburn, South Birmingham, and push that collateral, that information up into an SHA and CfH level to come back down to give people confidence that this is ( ) to get involved in*
3.	*There is a centralised standardising IT-based project and very early on the project didn't have much in the way of clinical input... you would have thought there would have been a lot of clinical input and it would have been a clinically driven programme. But it wasn't'*
4.	*To be in that level where you're going to get invited to discuss requirements you're not going to be your ordinary Ward Sister or your ordinary Ward Nurse or your ordinary Radiographer or your ordinary IT, you're going to be somebody who is already in a senior management level*
5.	*All they had done is model their existing processes (apply a PAS) and just said we want to be completely separate from the rest of the world, which is difficult when we're contractually obliged to connect you into Spine and to provide, you know, all of the infrastructure services that are managed in the centre*
6.	*We are in a very strange world because the contract is written in a tripartite fashion, so you've got ourselves and our commercial relationship with the client, which is Connecting for Health, but our customer is the NHS and they themselves have a strange relationship with the client. So it's a very uneasy triangle and it doesn't serve us very well. It doesn't serve the NHS particularly well and I don't actually think it serves CfH, but it's what we have got at the moment*
7.	*The problem for LSPs is that, one, they're IT companies and they hadn't, unless they'd been in information critical IT solutions before, hadn't got safety as an underpinning, fundamental principle and therefore didn't have the resources, in terms of intellect and knowledge about the um (short pause) organisation they were putting these products into*
8.	*It is interesting that companies like this one have been driving these changes...but we're now beginning to get the NHS to recognise that it needs its own standardisation process that we can then draw upon so we need a clinical governance process*
9.	*I'm comfortable as a clinician that we have set that risk at an appropriate level but nobody tested that. It's never been tested in law and it's certainly never been tested with a customer. It's because we don't want to. The customer (wave in his hand that the client indicates the NHS) doesn't own it, doesn't want to own it and I will stress this to everybody I talk to*
10.	*A substantial reservoir of opinion in the NHS that sees IT as that and one of the things we spend a lot of time in this organisation doing is that this isn't an IT system, this is a clinical system that's got IT as it is underpinning infrastructure*
11.	*The problem we have got is that even in individual organisations, you don't all admit the patient in the same way, you don't all take a history in the same way. It will all depend which school you went to, how long you've been qualified. It'll depend on what the underlying ... it also depends on what's happening that day... The variation of business process is, is immense*
12.	*We can't model every possible variation on the business process. And indeed we won't, nor do we try. We try to model against a standard process. Now, if nobody tells us what the standard process is, you get the one we designed... to get the NHS to recognise that it needs its own standardisation process that we can then draw upon so we need a clinical governance process in the NHS; it's no good CSC setting those limits but we have*
13.	*I would have done differently is made the local ownership work. (long pause) So they set the contracts then the requirements and what they should have done is set the requirements then the contracts. They should have gone to the professional bodies actually and just said, here is what we want to achieve now tell us what we need to do and then gone away and written a contract that we based on that*
14.	*The problem we have is that the answer to does it fit our business process, no, should lead you to let's see how we can change the business process and it does fit it very, ver- um 90% of the time it leads to let's see how we can fix LORENZO and I use the term fix in inverted comas "fix" to make it fit our business process and the problem with that is if you've got a business process of one of our early adopters, it may not be guaranteed, umm not to be the same business processes of our other early adopters so the concept of the issue fix is a very*

	interesting one because we try very hard to limit the number of isolated fixes for individual organisations to as few as possible
15.	*We are talking about the ability not to harm patients. We're also talking about the ability not to harm staff and we're also talking about, at some level, protecting reputational umm protecting ourselves and the NHS from reputational damage*
16.	*It was definitely a technically drive programme and one of the key omissions from the contracts is clinical safety*
17.	*In 2004, Connecting for Health, or the National Patient Safety Agency on behalf of the NHS and Connecting for Health, commissioned a company called DNV to do a report into the contracts... the fundamental outcome of the report was that in any other industry where, which is information critical, the whole contract would have been underpinned by a safety element; there would have been a safety requirement, there would have been a safety expectation, it would have been overt and the contract was effectively criticised because it was not like that... no Trust in the country would have um effectively done a clinical safety assessment of any product, any IT product, that they bought*
18.	*I joined CSC three and a bit years ago now. They didn't have an all encompassing, account-wide safety system, they had a fairly light touch approach to basically looking at tests that has failed and said do these tests represent a risk or not? And that is not how safety works*
19.	*I would be concerned if you took at face value the view from every organisation that clinical safety is really, really important to them, in choosing the product or in deploying the product. Because the evidence I've seen is that that's not necessarily the case. It ought to be the case*
20.	*I acknowledge that anybody who is involved in the commissioning of LORENZO and the implementation of that in an organisation is going to have clinical safety high on its list... it would be interesting for you to interview organisations that are not on our critical, commercial path to say what role does clinical safety play in your decision to take LORENZO or any product on? And it is a glib answer to say, oh it is vitally important to us and then you say, okay, so what are you doing about it? They say well what do you mean? That to me is the underlying threat*
21.	*In the IT world, it's never been a requirement when you bought a patient administration system or an IT system to manage clinical care, to do a risk assessment. So every GP has had IT for 25, 30 years now, but not one of them did a risk assessment when they bought the product*
22.	*The problem for LSPs is that, one, they're IT companies and they hadn't, unless they'd been in information critical IT solutions before, hadn't got safety as an underpinning, fundamental principle and therefore didn't have the resources, in terms of intellect and knowledge about the um (short pause) organisation they were putting these products into, to be able to do risk assessments. You can't risk assess a product if you don't know what it is going to be used for*
23.	*We only have four levels of risk, apart from none of course. So there are only four levels of measurable risk, very low, low, medium and high... Very low is a level of acceptable risk. Low, we will leave in a product until the next major fix so obviously each product has a series of updates... Mediums, we don't allow that (into the world or at all ?!?). High, we have got to kill somebody and the plan is never to*
24.	*So there is a standard now for Trusts deploying any software, it doesn't have to be connected to the health software, saying, you have got to have local ownership of two things, you've got to have local ownership of the technical hazards that your supplier tells you exist. You've also got to have local ownership of your own business hazards but what will be the impact of putting this product in*
25.	*The issue we said would happen, did happen and the first thing they did was try to raise the clinical risk on us and we said, very interesting yes we agree but you own this so you need to go away and fix your business process because we are not changing the product. It is not the product. We told you if you had the product built that way, it would contribute to the potential for harm. You said no it will not, we will own it*
26.	*There is no infrastructure, apart from the technical infrastructure around who and when issues should be raised as clinical risk*
27.	*Clinical safety doesn't stop with deployment, it carries on it carries on because you have got a product out there that will go wrong or will do something you're not expecting it to do... So we risk assess all of those but if you look at those at the moment, 60% that are raised as clinical risk, come in as "Oh my God, the sky's falling in" that's the first thing*
28.	*An example we have had recently is somebody could not print from the other's machine that's a high clinical risk but how is that going to lead to the immediate death of the patient that you*

	can't print from somebody else's machine? What are you doing on their machine anyway?... 60% of those come in. They raise 70%, I can't remember what it is, 60%, 70% are raised with the risk level as high, which nonsense but all they are trying to do is attract our attention
29.	*So anybody can, a number of the risks we have had have been raised by people on their first day in the NHS and they're secretaries...how do they know what a clinical risk is? Never met a patient, certainly never looked at the business process but it's perfectly reasonable for them to raise a clinical risk in the way the service, the NHS, the customer sees that process*
30.	*Being safe doesn't make it any more usable, that's really important. Usability and safety are not linearly linked, indeed, they can be horizontally opposed. If I make a really, really safe system, it is probably going to be really unusable... So don't mix usability and safety because they're not the same*
31.	*The other thing is don't mix governance in terms of record governance with safety because again they can be in opposition... If you want a system that protects the privacy of the patient very strongly that in its own self can lead to clinical risk because you might not have the record available to the person in front of the patient*
32.	*IPM is a patient administration system; LORENZO...is fundamentally a clinical system so it sits on top of IPM at the moment*
33.	*iPM is a product that is way beyond its design scope (short pause) even with us using it as an interim product, it's way beyond its design scope. I mean it is not designed to be into a strategic environment, it is designed to [...]. You buy it off the shelf, you take it into your organisation, you slap in on some test servers and you decide how to configure it, what it will do, what it won't do and what functionality you're going to give to people*
34.	*The clinical safety piece has been involved in all of that. User acceptance has, kind of, not been involved in any of it in some sense because the people who set the original requirements were a self-selecting or limited selecting bunch of clinicians who were engaged and the problem is that a lot of the people who we give the tool to are not engaged*
35.	*The national programme for IT established the original contract for the local service providers and they were fundamentally IT commercial contracts. They were based on a model that was successfully used by Transport for London because the guy, who took over, Richard Granger, had done that contract*
36.	*I think there's a natural... and to be fair, suppliers have not been their own best friends because in the past, suppliers have exploited the um the bureaucracy shall we say of the NHS. I remember when I worked for the old information authority we were talking to BT about the phone bill for the NHS and because every organisation had a phone bill, the NHS worked out it was probably paying about three times as much as it would by having one central phone bill. Because then it could have the economies of scale*
37.	*They took a very commercial view and then applied the requirements to it whereas what they should have done it taken the requirements and then applied the commerce to it*
38.	*I don't think they trust us. I think it's very easy to look at...it is not um it is not that they do not trust because they think we are evil or whatever but I just don't think there's a culture in the customer client relationship that says this is a collaborative thing and in safety it has to be. It has to be a collaborative thing*
39.	*change in culture is the most important thing that we can do in clinical safety and that's not a change in culture in the service to acknowledge clinical safety, it's a change in culture in the relationship, whether it be commercial or whatever, between the system builder and the organisation that requests the system. That relationship has to change. It cannot be a purely contractual*
40.	*So that's what I mean about there's no trust. It's not just a question of they're distrusting CSC because we're a big, fat commercial company, it's because there's a latent distrust of commercial organisations, and between commercial organisations*

APPENDIX 2: INTERVIEWS GUIDES

R1 Interview Guide

1. Does your current position relate to the NPfIT/CRS?
2. What was your involvement with the CRS system?

3. What can you tell about the new CRS?
4. What are strengths and weaknesses of the CRS?
5. How does NHS CRS relate to the previous ways of working?
6. In what ways CRS was innovative?.
7. What was the motive for NHS to introduce the CRS?
8. Do you think the resignations of some medical figures affected the programme?
9. Tell me please, how CRS specifications were determined?
10. How has the system affected employees and processes?
11. How can end users deal with the technological sophistication brought by launching the new CRS?
12. What can you say about users' attitudes towards the use of new CRS?
    (Are they willing to try out technological innovations?)
13. What are the attributes of CRS that aid its acceptance?
14. What are the attributes of CRS that hinder its acceptance?

15. Would you like to add any anything you think is important to understanding the impact of the new CRS?
16. If you were the person in charge of managing CRS, what are the changes/improvements you would recommend to enhance end users' acceptance?

Question	Variable		Answered, Not answered
1,2	Work experience	How long have you been working with the NHS?	
	Position	Could you please tell me what is your latest position within the NHS?	
	Role & responsibility	May I know what your role and main responsibilities are	
	Nature of activities	What is the dominant nature of activities you perform? medical, technical or managerial	
7	Perceived benefits	8. a. Who can benefit from the CRS? 8. b. does NHS CfH communicate these benefits to end users? 8. c. Can you tell me more about the benefits?	
8	Orphan Knowledge	What information do the users rely on the system to provide?	
9,10 **who else's involvement they feel was critical to the system development** **Their perception of the process by which the CRS was developed.**	Users' participation & involvement	What was the involvement of end users with CRS requirements? What was your involvement with the information standard board? Did they influence the final design of the project? What was their involvement with conflict resolution? **Who determined what data to be included in the system? Content and display**	

11	Users training and education, NHS CfH support, IT knowledge and experience	Can you assess the effectiveness of training provided by NHS Connecting for Health? Are there any procedural steps, other than training, that can improve employees' expertise? Lead the interviewee to the championship and top management support. Can users use CRS with the existing **competence they possess?** **Is CRS technically compatible?**	

R2 Interview Guide

1. Did CSC have past experience in providing information systems to health organization before the NPfIT programme?
2. How can you describe, from your own perspective as an LSP, the nature of NPfIT? Is it IT project or what?
3. How did you deal with the fact that organizing the contract with NHS as one of the LSPs was new to them?
4. Do you deal with clinical advisory groups at departmental or cluster/ SHA level to tackle problems that emerge during specification or implementation?
5. How do you think CSC dealt with the fact that there are various groups of end users of the new system?
6. How do you think CSC could deal with the fact that NHS needed unified integrated systems and at the same time having various departments who already implemented packs systems?
7. Did CSC consider business processes?
8. What do you think were the issues of CSC contract that made you keep providing the system and took over contracts from other LSPs?
9. What do you think were the procedures taken into consideration to raise end users awareness and understanding of the new sophisticated technological systems?
10. Did you have any role in providing technical support to end users, especially in secondary care?
11. Tell me please, how CRS specifications were determined?
12. How do you perceive the process by which system specifications were defined and implemented?
13. What do you think of prototyping as system development approach for designing the new system?
14. Is it good way to take into consideration end users needs by adopting iterative and incremental approach?
15. How do you think CSC dealt with enhancing the efficiency of the systems? In terms of the adaptation process (regular update or fast response)?
16. What do you think was the criteria in determining the timing (readiness) of a certain SHA to deploy and implement the new systems?

17. Do you think CSC should have met with the other LSPs like Accenture and Fujitsu before walking away to have more coherent systems and encourage the clinical engagement systems that you started with R1?

18. What do you think are strengths and weaknesses of the CRS?

19. Would you like to add any anything you think is important to understanding the impact of the new CRS?

20. If you were the person in charge of managing CRS, what are the changes/improvements you would recommend to enhance end users' acceptance?

R3 Interview Guide

- General questions:

1. Can you tell me please how you got involved in the Lorenzo? Royal Lancaster Infirmary System implementation?

2. Please, can you tell me about the history of Lorenzo I in Morecombe Bay?

3. How you have organized the implementation of the system in Morecombe bay trust?

- System implementation success:

4. What is the current situation of the programme, is it piloting, testing, deployment?

5. What do you think were factors that contributed/facilitated the launch of the programme?

6. Why do you think systems under the NPfIT such as PACS, QMAS and ETP succeeded while there is 4 years delay in Lorenzo CRS?

- Conversion strategy:

7. What do you think about using both paper form and card systems with Lorenzo I?

- User involvement in system requirements:

8. What was the national clinical involvement input into the design of the Lorenzo system?

9. Do you think national clinical involvement input into the design of the Lorenzo system was sufficient? What the deficiencies were?

- System maintenance:

10. Is there any direct interaction between Morecambe Bay Trust staff and the CSC to modify the specification of Lorenzo?

11. If yes then, how this interaction translated into modification of the software? Over what timescale (e.g. beginning of the system implementation)?

12. Are there difficulties for clinicians in communicating their requirements to CSC? If yes, what are they?

13. Do you think such direct interaction is useful?

- Cerner and Lorenzo:

14. Why do you think Cerner Millennium failed to deliver its intended outcomes?

15. How do you think Lorenzo implementation differed from that of Cerner system?

16. What do you think were relative advantages/disadvantages of both two systems?

R4 Interview Guide

1. Can you tell me please, what is the current situation of Lorenzo in Morecombe Bay NHS trust? How many wards have got "Go live" status till now?

2. Tell me please, what were factors that contributed to the success story of Lorenzo's deployment at Morecombe Bay NHS trust? What are its strengths and weaknesses?

3. Despite the success, what do you think were factors contributed to the delay in rolling out Lorenzo in Morecombe Bay trust in the planned wards?

4. What issues/criteria were taken into account for choosing the piloting/testing wards?

   * In some wards (e.g. Surgery ward), patients rarely come back to see their records or see doctors, while in some wards patients use their electronic records frequently that enable them to realise the benefits of the electronic format of their health information.

5. Quoting your words from EHI "NHS needs to step up to the plate" what do you think NHS should have done to support the implementation of Lorenzo?

6. What do you think about November deadline set up by NHS for the current LSPs?
7. Tell me please, how end users' requirements were determined? Mainly with the release-based approach, where each version is different from the one that proceeds or proceeds?

8. What did you do, as health informatics team, to overcome/reduce the sophistication of the new system?

9. Why do you think people are more inclined toward the use of the manual system?

10. Do you have an idea about TPP SystmOne PAS software? If yes, how do you think this, as an alternative PAS software used in Primary Care and recently has been used in SC, will affect the future of Lorenzo in the NME region?

11. Under the limited choice of systems given to Southern cluster's SHAs, what do you think about the integration between both BT's Cerner software and iSoft's Lorenzo software?

12. Would you like to add anything you think is important to understanding the impact of the new CRS?

13. If you were the person in charge of managing the CRS, what are the changes/improvements you would recommend to enhance end users' acceptance?

R5 Interview Guide

1. Can you tell me please, how is your current position at CSC related to the implementation of Lorenzo?
2. What were the main issues considered in the implementation of Lorenzo?
3. What do you think were the main challenges in implementing Lorenzo?
4. In your opinion, what do you think about NHS input into the implementation of the programme?
5. What do you think NHS should have done to support the implementation of Lorenzo?
6. What do you think about November deadline set up by NHS for the current LSPs? **It is political process and top management has a role here.**
7. What social and technical issues taken into account for helping end users to become adopters of Lorenzo? ****Socio-Technical System*.**
8. What did you do at CSC to ensure end users' acceptance of Lorenzo?
9. How do you think the programme influenced the decision making process? ***What about documentation standards?**
10. How did you communicate these issues with end users? What was the mechanism of hearing the end user's voice?
11. Why do you think people are more inclined toward the use of the manual system?
12. Would you like to add anything you think is important to understanding the impact of the new CRS?
13. If you were the person in charge of managing the CRS, what are the changes/improvements you would recommend to enhance end users' acceptance?

R6 Interview Guide

1. How is your current position at CSC related to the implementation of Lorenzo in terms of Clinical safety? How has the implementation gone?

2. What were the main issues considered in the implementation of Lorenzo?

3. How did you, as Director of clinical safety, achieve the balance between system flexibility and assuring clinical safety?

4. How did you deal with the fact that in just 10-year-period programme, an integrated EPR connect all the NHS organizations and at the same time assuring safety?

5. What do you think were the main challenges in implementing Lorenzo?

6. How did you communicate with end users, the mechanism of hearing end user's voice in terms of clinical safety?

7. Would you like to add anything you think is important to understanding the impact of the new CRS?

8. If you were the person in charge of managing the CRS, what are the changes/improvements you would recommend?