Developing Web-based Information Systems for Emergent Organisations through the Theory of Deferred Action: Insights from Higher Education Action Research

A thesis submitted for the degree of Doctor of Philosophy

by

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Abstract

This investigation follows a philosophically interpretive approach on how the web developer developed Web-based Information Systems (WBIS) in a continuously changing higher education organisation. The investigation focused on emergence within the organisation and the resultant problems this gives the web developer in developing WBIS.

The web developer used an action research methodology to investigate the emergent higher education organisation and its need for web-based aesthetics & internet speed. This approach was designed by the action researcher to assist both the web developer and manager in developing WBIS within emergent organisations. It is also designed to address a number of major constraining factors placed on the web developer. These included: time constraint, web-based aesthetics, internet speed, emergent aspects, methodology issues and accommodating planned organisational change. The interpretation of these constraining factors gained through the theory of deferred action enabled the action researcher to understand, interpret and create associations to explain the WBIS development process.

The web developer had to defer the design process at several points because of unexpected events occurring in the organisation and take deferred action. As a result the Kadar Matrix was created and used by the web developer to manage the constraining factors. The Kadar Matrix has extended the theory of deferred action (ToDA) by implementing its constructs in the analytical tool, Kadar Matrix, for WBIS development. This is a modification of theory for practice. The research further identified that deferred action is necessary for the web developer in emergent organisations.

Table of Contents Page

Abstract 2

List of Figures 11

List of Tables 14

List of Abbreviations 16

Acknowledgements 20

Declaration 21

CHAPTER 1: Developing WBIS in Emergent Organisations 22

1.1 Introduction 22

1.2 The Research Problem 23

1.3 The Rationale for the Research Investigation 26

1.4 Objective of this Research 29

1.5 Research Question 30

1.6 Sub Questions 31

1.7 Structure of Thesis and Order of Presentation 31

CHAPTER 2: The Phenomena of Emergence in Systems 34

2.1 Introduction 34

2.2 The Ontology of Organisations 38

2.3 Emergent Organisation 39

2.4 Managing the Web Development Process in an Emergent Organisation 42

2.5 Defining Information Systems in Emergent Organisations 42

2.6 Development Methodologies and Emergent Organisation 44

2.7 Inadequate Information Systems Development Methodologies 46

2.8 ISD Methodologies and Web Revolution 49
2.9 The World Wide Web Revolution 50
2.10 Comparison of Web-based Development and Information Systems Development..... 51
2.11 Ad-hoc Web Developers and Web-based Methodologies 52
2.12 Web-based Information Systems Methodologies 53
2.12.1 Relationship Management Methodology..... 54
2.12.2 Object-Orientated Hypertext Design Method..... 54
2.12.3 Web Information Systems Development Methodology 55
2.12.4 Web Site Design Method (WSDM)..... 56
2.12.5 Internet Commerce Development Methodology 57
2.12.6 Takahashi-Liang's Web-based Information System Analysis and Design..... 57
2.12.7 Howcroft-Carroll's Methodology for Web Development 58
2.12.8 Intranet Design Methodology 60
2.12.9 The Eight WBIS Methodologies..... 61
2.13 Critical Factors in WBIS Development 62
2.13.1 Web-based Aesthetics..... 62
2.13.2 Internet Speed 63
2.14 The Importance of Web-based Aesthetics and Internet Speed 65
2.15 Adopting an Appropriate WBIS Methodology..... 66
2.16 Amethodical WBIS Development Problem needs Action Research 66
2.17 Summary of Web-based Information Systems Development..... 67
2.18 Information System Theories for Emergent Organisations 68
2.19 Theories in Information Systems 70

2.20 Theory of Deferred Action 73
2.21 ToDA's Applicability to Practice 78
2.22 Summary of Theory for Web-based Information Systems 80
2.23 Concluding Remarks 81
CHAPTER 3: The Methodology of Action Research 82
3.1 Introduction 82
3.2 Ontology and Epistemology 82
3.3 Appropriateness of Qualitative and Quantitative Methods 84
3.4 An Interpretivist Stance on Research Paradigms 86
3.4.1 Positivist Research 86
3.4.2 Interpretivist Research 87
3.5 Justifying Action Research or Case Study as a Qualitative Method 89
3.6 Action Research Methodology 91
3.7 Initiating an Action Research Method 92
3.8 The Action Research Method 93
3.9 Action Research Data Collection Techniques 94
3.10 The Research Design 96
3.10.1 Phase One: Literature Review 97
3.10.2 Incorporating Clarity and Focus to the Research Problem 98
3.10.3 Overcoming Problems of Methodology from the Literature 98
3.10.4 Broaden the Knowledge Base in the Research Area 98
3.10.5 Phase Two: Development of Student Services via Action Research 99
3.10.6 Phase Three: Development of Student Research Handbook via Action Research . 99

3.10.7 Phase Four: Constructing the Web-based Analytical Development Tool 99
3.11 Time Periods 100
3.12 Design and Execution Issues 103
3.13 Placing the AR Data in Context 104
3.14 Qualitative Analytical Observation 105
3.15 Direction of the Research 107
3.16 Research Ethics 108
3.17 Research Ethics Statement 109
3.18 Qualitative Data Analysis 109
3.19 Qualitative Data Analysis Software: Nvivo8 110
3.20 Expected Outcome of Categorisation Data Analysis 112
3.20.1 Strategy Employed by Action Researcher for Data Analysis 112
3.21 The Real World Problem 116
3.22 The Real World Problem through Action Research 118
3.23 The 1st Iteration of the Action Research Cycle: Student Services WBIS 119
3.24 The 2nd Iteration of the Action Research Cycle: Student Services WBIS 121
3.25 The 3rd Iteration of the Action Research Cycle: Student Services WBIS 123
3.26 The 4th Iteration of the Action Research Cycle: Student Services WBIS 125
3.27 Analysis of the Action Research Method Used 127
3.27.1 Time Constraint Relating to Student Services Action Research Cycle 128
3.28 Change in Personnel 128
3.29 1st Iteration of the Action Research Cycle: Student Research Handbook 129
3.30 2nd Iteration of the Action Research Cycle: Student and Research Handbook 132

3.31 3rd Iteration of the Action Research Cycle: Student and Research Handbook 134
3.32 4th Iteration of the Action Research Cycle: Student and Research Handbook..... 135
3.33 Scope and Limitations of Action Research 137
3.34 Concluding Remarks 138
CHAPTER 4: Brunel University Growth 139
4.1 Introduction 139
4.2 Growth of Brunel University..... 139
4.3 Brunel University Switching from Paper-based to an Electronic Format..... 142
4.4 Times Newspaper Report on Brunel University 142
4.5 Brunel Commitment to Incorporating Work Experience 143
4.6 Brunel Financial Commitment 144
4.7 Brunel University Strategic Plan 2008 to 2012 Plan..... 145
4.8 Brunel University's Commitment to Investing in WBIS Development 146
4.9 The Management Structure of Brunel University 146
4.10 Student Services within Brunel University 147
CHAPTER 5: Data Analysis..... 149
5.1 The Data Analysis of an Interpretivist 149
5.2 What Constitutes Satisfactory Data Analysis?..... 150
5.2.1 The Interpretivist Data Analysis Process 151
5.3 The Interpretivist Understanding of the Student Research Handbook AR Cycles 166
5.4 Mixed Combination of Student Services & Student Research Handbook..... 182
5.5 Summary of Mixed Combinations 197
5.6 Additional Sources of AR Data..... 197

5.7 Concluding Remarks 214
CHAPTER 6: Development of the Kadar Matrix 216
6.1 Introduction 216
6.2 Data Analysis & Development of Kadar Matrix 219
6.3 Initial Interpretation of the Data 220
6.4 Kadar Matrix as the application of the Deferred Model of Reality 221
6.4.1 Emergent Organisation as defined in the Kadar Matrix 227
6.4.2 Web-based Aesthetics as defined in the Kadar Matrix 227
6.4.3 Internet Speed as defined in the Kadar Matrix 228
6.4.4 Web Developer's Ability as defined in the Kadar Matrix 229
6.5 Explanation of Kadar Matrix Quadrant Types 229
6.6 The use of Kadar Matrix in Practice 231
6.6.1 Combination of Different Methodology Phases (Deferred Design) 231
6.6.2 No Logical Methodology / Real World / Continuous Change (Real Design) 232
6.6.3 Specified Methodology (Specified Design) 232
6.6.4 Combination of Different Methodologies Phases (Deferred Design) 232
6.7 Summary of Data Generation and Kadar Matrix Development 233
CHAPTER 7: Conclusions, Contributions and Further Research 234
7.1 Introduction 234
7.2 Assessing the Aim and Objectives against the Research Outcomes 234
7.3 Answering the Research Questions 238
7.4 Learning Points: Student Services and Student Research Handbook AR Cycles 242
7.5 Contribution to Knowledge through Theory and Practice 245

7.5.1 The Central Contribution 245
7.6 Directions for Further Research and Limitations of Thesis 249
7.7 Reflecting on the Action Research Approach 250
7.8 Concluding Remarks 253
References 254
8 Appendices 278
8.1 Appendix 1: Action Research Sample 278
8.1.1 Action Research Cycle: Sample A 278
8.1.2 Problem in Development 278
8.1.3 Action in Development 278
8.1.4 Solution in Development 278
8.1.5 Experiencing, Reflecting, Interpreting and Tacking Action 278
8.1.6 Evaluating the Action and Assessing the Learning Points 279
8.2 Appendix 2: Semi-Structured Interview 279
8.2.1 K's Questions Semi-Structured Interview 280
8.3 Handbook Report 283
8.3.1 Access Executive Summary 283
8.3.2 Phase 1 – Expert Interview 287
8.3.3 Phase 2 – Survey 288
8.3.4 Phase 3 – Usability Study 290
8.3.5 Phase 4 – Card Sorting Study 305
8.3.6 Discussion and Recommendations 311
8.3.7 References 313

8.3.8 Appendix A: About the authors of Student Research Handbook 313
8.3.9 Survey Questions 315
8.3.10 Appendix B: Sample demographics and results for survey 318
8.3.11 Research Handbook Experience Survey results 319
8.3.12 Appendix C: Sample demographics for the usability study 323
8.3.13 Appendix D: Sample demographics for the card sorting study 326
8.3.14 Appendix E: Suggested Outline Design SRH 330
8.4 Gaining the Scope of the Problem through the Interview 359
8.5 Node Analysis of Student Services 379
8.6 Total Node Summary of Student Services 394
8.7 Student and Research Handbook Node Analysis 396
8.8 Total Node Summary of Student and Research Handbook 413
8.9 Additional Action Student Services Node Analysis 414
8.10 Total Node Summary of Additional Action Student Services 440
8.11 Interview with Dr M Node Analysis 440
8.12 Total Node Summary of Dr M Interview 468
8.13 K's Questions Node Analysis 468
8.14 Total Node Summary of K's Questions 473
8.15 Brunel University Management Structure 474

List of Figures

Figure 1: Thesis Structure 33

Figure 2: Theory of Deferred Action (Source Patel, 2007) 76

Figure 3 Student Services & Student Research Handbook Data Analysis Strategy 113

Figure 4 Additional Data Sources – Analysis Strategy 114

Figure 5 The Growth of Brunel University 140

Figure 6 Brunel University Student Numbers 147

Figure 7: Student Services AR Cycles 1 and 2 (SS1 & SS2) 157

Figure 8: Student Services AR Cycles 2 and 3 (SS2 & SS3) 158

Figure 9: Student Services AR Cycles 3 and 4 (SS3 & SS4) 159

Figure 10: Student Services AR Cycles 1 and 3 (SS1 & SS3) 163

Figure 11: Student Services AR Cycles 1 and 4 (SS1 & SS4) 164

Figure 12: Student Services AR Cycles 2 and 4 (SS2 & SS4) 165

Figure 13: Student Research Handbook AR Cycles 1 and 2 (SRH 1 & SRH 2) 170

Figure 14: Student Research Handbook AR Cycles 2 and 3 (SRH 2 & SRH 3) 171

Figure 15: Student Research Handbook AR Cycle 3 and 4 (SRH 3 & SRH 4) 173

Figure 16: Student Research Handbook AR Cycle 1 and 3 (SRH1 & SRH3) 178

Figure 17: Student Research Handbook AR Cycle 1 and 4 (SRH1 & SRH4) 179

Figure 18: Student Research Handbook AR Cycle 2 and 4 (SRH2 & SRH4) 180

Figure 19: Combined SS & SRH Frequency 183

Figure 20: SS AR Cycle 1 & SRH AR Cycle 1 (SS1 & SRH1) 184

Figure 21: SS AR Cycle 2 & SRH AR Cycle 1 (SS2 & SRH1) 185

Figure 22: SS AR Cycle 3 & SRH AR Cycle 1 (SS3 & SRH1) 185

Figure 23: SS AR Cycle 4 & SRH AR Cycle 1 (SS4 & SRH1) 186
Figure 24: SS AR Cycle 1 & SRH AR Cycle 2 (SS1 & SRH2) 186
Figure 25: SS AR Cycle 2 & SRH AR Cycle 2 (SS2 & SRH2) 187
Figure 26: SS AR Cycle 3 & SRH AR Cycle 2 (SS3 & SRH2) 187
Figure 27 SS AR Cycle 4 & SRH AR Cycle 2 (SS4 & SRH2) 188
Figure 28: SS AR Cycle 1 & SRH AR Cycle 3 (SS1 & SRH3) 188
Figure 29: SS AR Cycle 2 & SRH AR Cycle 3 (SS2 & SRH3) 189
Figure 30: SS AR Cycle 3 & SRH AR Cycle 3 (SS3 & SRH3) 189
Figure 31: SS AR Cycle 4 & SRH AR Cycle 3 (SS4 & SRH3) 190
Figure 32: SS AR Cycle 1 & SRH AR Cycle 4 (SS1 & SRH4) 190
Figure 33: SS AR Cycle 2 & SRH AR Cycle 4 (SS2 & SRH4) 191
Figure 34: SS AR Cycle 3 & SRH AR Cycle 4 (SS3 & SRH4) 192
Figure 35: SS AR Cycle 4 & SRH AR Cycle 4 (SS4 & SRH4) 193
Figure 36: Frequency of All Sources 200
Figure 37: SRH AR Cycles 1 to 4 and SS AR Cycles 1 to 4 (SRH1-4 & SS1-4) 201
Figure 38: AASS and SS AR Cycles 1 to 4 (AASS & SS1-4) 202
Figure 39: K’s Questions and SS AR Cycles 1 to 4 (K's Q & SS1-4) 203
Figure 40: Dr M’s Interview and SS AR Cycles 1 to 4 (Dr M's Int & SS1-4) 203
Figure 41: AASS and SRH AR Cycles 1 to 4 (AASS & SRH1-4) 204
Figure 42: K’s Questions and SRH AR Cycles 1 to 4 (K's Q & SRH1-4) 205
Figure 43: Dr M’s Interview and SRH AR Cycles 1 to 4 (Dr M's Int & SRH1-4) 206
Figure 44: K’s Questions and AASS (K's Q & AASS) 207
Figure 45: Dr M’s Interview and AASS (Dr M's Int & AASS) 208

Figure 46: Dr M’s Interview and K’s Questions (Dr M's Int & K's Q) 209

Figure 47: Adopted from Patel (2006) gDRASS Matrix Design Types 225

Figure 48: Kadar Matrix - Adaptation of gDRASS Matrix 226

List of Tables

Table 1: Suitability for Developing WBIS for Emergent Organisations 61

Table 2: A Taxonomy of Theory Types in IS Research (Gregor, 2006) 69

Table 3: Contextualisation of Action Research 90

Table 4: Strengths & Weaknesses of Case Study Method (Yin, 1994) 91

Table 5: Time Periods 101

Table 6: First Study 102

Table 7: Second Study 103

Table 8: Student Services (SS) and Student Research Handbook (SRH) 118

Table 9: Student Services (SS) Cycles – Sequential and Non Sequential 154

Table 10: Sequential Combination of the Student Services (SS) Cycles 156

Table 11: Non-Sequential Combination of the Student Services (SS) Cycles 160

Table 12: Three Interrelated Constructs Categorised Under ToDA 162

Table 13: Patterns found that confirm deferred action constructs 163

Table 14: New Categories in Student Research Handbook through ToDA 166

Table 15: Sequential Combination of the Student Research Handbook Cycles 167

Table 16: Student Research Handbook Sequential and Non-Sequential Combination 168

Table 17: Web-based Aesthetics through ToDA 172

Table 18: Four New elements through ToDA 174

Table 19: Non-Sequential Combination of the Student Research Handbook Cycles 175

Table 20: Four interrelated cycles: SRH Sequential and Non-Sequential through ToDA 177

Table 21: Four constructs from SRH Sequential and Non-Sequential cycles through ToDA 181

Table 22: All Combinations of SS and SRH Cycles 182

Table 23: Mixed Combinations: Student Services and Student Research Handbook Cycles 194

Table 24: Additional Sources of Information Gathered 198

Table 25: All Sources of Data..... 211

Table 26: Action Research Cycle 217

Table 28: gDRASS Design Types (Patel, 2006)..... 224

Table 29: Kadar Matrix Quadrant Types..... 230

Table 30: Contribution of Research Process..... 245

List of Abbreviations

AASS	Additional Action Student Services (Research Cycles)
AR	Action Research
CSS	Cascading Style Sheet
Dr M's Int	Interview with Dr M
EIS	Executive Information Systems
gDRASS	Generalised Deferred, Real, Autonomous and Specified Systems
HTML	Hyper Text Markup Language
ICDM	Internet Commerce Development Methodology
IDM	Intranet Design Methodology
IS	Information Systems
ISD	Information System Development
ISDM	Information System Development Methodology
IT	Information Technology
K's Q	Interview with K
KM	Kadar Matrix
KMS	Knowledge Management Systems
LAP	Language Action Perspective

OOHDM	Object-Orientated Hypertext Design Method
PGR	Post Graduate Research
RAD	Rapid Application Development
RMM	Relationship Management Methodology
SRH	Student Research Handbook
SRH1	Student Research Handbook (Action Research Cycle) 1
SRH1-4	Student Research Handbook (Action Research Cycle) 1 to 4
SRH2	Student Research Handbook (Action Research Cycle) 2
SRH3	Student Research Handbook (Action Research Cycle) 3
SRH4	Student Research Handbook (Action Research Cycle) 4
SS	Student Services
SS1	Student Services (Action Research Cycle) 1
SS1-4	Student Services (Action Research Cycle) 1 to 4
SS2	Student Services (Action Research Cycle) 2
SS3	Student Services (Action Research Cycle) 3
SS4	Student Services (Action Research Cycle) 4
ToDA	Theory of Deferred Action
VIS	Vigilant Information Systems
WBIS	Web-based Information Systems

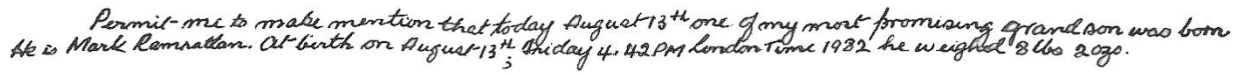
WBISD	Web-based Information Systems Development
WISDM	Web Information Systems Development Methodology
WSDM	Web Site Design Method
WWW	World Wide Web

In Loving Memory of

Mr Kadar Bhiro (1928-2006)

My Grandfather (Mother's father).

My Grandfather wrote on the 13th August 1998:


Permit me to make mention that today August 13th one of my most promising grandson was born
He is Mark Ramrattan. At birth on August 13th Friday 4.42 PM London Time 1932 he weighed 8 lbs 2 ozs.

My mother advocates; when I was 6 years old I promised my grandfather that I would become a doctor. Herein lays the name of my contribution to knowledge.

Mrs Balkumarie Ramrattan (1914-1990)

My Grandmother (Father's mother).

My Grandmother brought up 8 young children on her own after my Grandfather's death.

Mr Phagumaraj Ramrattan (1898-1953)

My Grandfather (Father's father).

My Grandfather was a priest and unfortunately passed away at an early age.

Mr Suruj Rattan (1938-1964)

My Uncle (Father's brother).

Uncle Suruj Rattan was the inspiration for my Uncle Lall Beharry, my Dad and I to pursue higher academic studies.

Mrs Latchmin Permanand (1925-2004)

(Adopted Grandmother) I called her "Nanee". She was kind and loving.

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Ramrattan, M., and Patel, N.V. (2009) Web-based Information System Development and Organisational Change: The Need for Emergent Development Tools, *European and Mediterranean Conference on Information Systems,* Crowne Plaza, Izmir, Turkey.

CHAPTER 1: Developing WBIS in Emergent Organisations

1.1 Introduction

This chapter sets out the purpose and context of the study. Business organisations have been developing and using web-based information systems (WBIS) for nearly twenty years. Advancements in our knowledge of how to develop WBIS have come from practitioners and researchers. This research acknowledges the advancement of WBIS development and looks to improve our knowledge for practitioners and researchers. Business organisations are continuously adapting to changes in their environment and require the use of information and communication technology to process and improve the quality of information in this changing environment.

Brunel University is experiencing much change and, in this context, it is trying to transfer documented information to a web-based platform. Transitioning to a web-based platform is a problem that the action researcher, a web developer at Brunel University, has to manage amidst this organisational change. Brunel's information system development problem is how to effectively develop web-based information systems in a continuously changing higher education organisation. This problem is the responsibility of the web developer in two significant areas of Brunel University's web-based IS, namely student services and the student research handbook.

Developing WBIS requires balancing the goals of the organisation and the requirements of the information systems development methodology (ISDM). ISDM is a highly systematic and ordered methodology that is problematical to apply in a continuously changing organisation. The added pressure on the web developer of meeting changing organisational demands can affect the effective and efficient use of WBIS methodologies. The WBIS methodologies could not be followed by the web developer as stipulated i.e. from start to finish, because of the intense focus on time by the organisation. The web developer found a problem with accommodating the speed at which the organisation required systems to be developed. The organisation placed web-based

aesthetics, as a high priority and exhibited some dynamic characteristics, including a continuously changing requirement for the development of the student services WBIS. The research aimed to understand these dynamics and aid the web developer in overcoming the problems they caused. The action research methodology enabled the researcher to address and to some extent resolve these problems.

1.2 The Research Problem

The knowledge gap highlighted by this investigation is around how the web developer develops WBIS in the context of a changing organisation or emergent organisation. This knowledge gap is both a practical issue and research problem. The practical problem is how the web developer develops WBIS in this context and deal with two predominant problems: internet speed and web-based aesthetics. These are discussed in section 1.3.

The research problem concerns the debate in relevant literature on the need for new analytical development tools to aid the web developer in the context of organisational change. The debate raises problems around technique and technology. Rapid application development (RAD) methodology is a technique used by web developers. The problem with the RAD technique is that it involves building the wrong site multiple times until the right site falls out of the process (Howell & Carroll, 2000). The technologies used to develop WBIS include pre hypertext processor (PHP), hyper text mark-up language (HTML) and cascading style sheet (CSS). The technology problem relies on the web developer's ability to incorporate the rapid development of scripting languages i.e. PHP, HTML, and CSS within WBIS. Scripting languages can enable the web developer to rapidly develop WBIS. If web developers can continuously enhance their knowledge on scripting languages, then they can accommodate the fast-paced demand placed on them.

Understanding WBIS development within continuous organisational change is important for organisational survival. In this context, information technology (IT) systems must also be sufficiently flexible and adaptable to incorporate continuous change. Due to the increasingly diverse nature of information systems and the ways in which they are applied, information systems development (ISD) approaches based on linear development are regarded as unsuited for developing WBIS for changing organisations (Truex, Baskerville & Klien, 1999; Berger & Beyon-Davies, 2009). Linear development is the lack of iteration between any stages of the development process (Howcroft & Caroll, 2000). Researchers have established that web-based development process is significantly different than traditional IS development and identify the need for web developers to adopt new approaches (Isakowitz, Stohr & Balasubramanian, 1995; Howcroft & Carroll, 2000). For example, Howcroft & Carroll (2000) found that the waterfall methodology involves a series of cascading steps that cover the development process with a small level of iteration between each stage. The small level of iteration is a major problem for WBIS development. This is not possible for WBIS development. The waterfall methodology needs flexibility in the development process. The action researcher's stance is that methodologies used for the development of Web-based projects must be flexible enough to cope with change (Howcroft & Carroll, 2000).

Brunel University experienced continuous organisational change between 1995 to 2009. This change involved increases in student enrolment, staff, new buildings, and more internationalisation. This type of organisational change is termed *emergent organisation* in this research. The investigation reported in this thesis was undertaken within the student services department of Brunel University. The student services department sought to provide continuously better support for the students whilst developing web-based student services dynamically. To accomplish this, the manager and the web developer have to make collective agreements on desired characteristics of the web-based system, whilst at the same time managing other services and end-user demands. Understanding how the department develops WBIS, manages organisational change, increasing fast-paced deadlines and web-based aesthetics, are all important in improving students web-based experience.

Brunel University has many different departments requiring a web-based platform for disseminating information to staff, students and the public. The different departments include accommodation, student services and finance. The web development team has to work on different projects individually within these departments. The action researcher works for only one department i.e. student services and can seek advice from Brunel University's main web development team. The action researcher is the web developer and is also employed as a single web developer in the student services department.

The action researcher used an appropriate theory to inform the research. Without an appropriate theory, there is greater risk that the investigation may become more fragmented and inconsistent. Appropriate theory provides the action researcher with a better understanding of the problem and how to undertake the research. The web developer used the theory of deferred action as the foundational framework for conducting the action research investigation. The theory enabled the web developer to understand how emergence affects the web developer's role. The theory's core constructs enabled the action researcher to understand emergence by developing an analytical development tool for WBIS development in emergent organisations.

Researchers argue that web developers not only need appropriate theory but also new analytical development tools for developing WBIS in emergent organisations (Baskerville, Pries-Heje & Ramesh, 2007). Further, other research suggests that WBIS are produced in an ad-hoc-like manner, without much attention to development methodologies, systematic planning and management practices (Murugesan et al., 2001; Avison & Fitzgerald, 2003b; Kautz, Madsen & Norbjerg, 2007). Baskerville & Pries-Heje (2002) investigated WBIS development projects in USA and Denmark. Their research found the following WBIS development problems: high time pressure created by a desperate rush to market, use of prototyping, parallel development, the need for good people and a flexible approach to quality assurance (Kautz, Madsen & Norbjerg, 2007). This means traditional ISD methods and management techniques are unfit for the development of WBIS. Therefore, researchers argue that there is a need for new methods and

analytical development tools for WBIS development (Murugesan et al., 2001; Baskerville & Pries-Heje, 2002; Baskerville, Pries-Heje & Ramesh, 2007).

The web developer requires a new skill set (e.g. marketing, graphic design, and or film production) because of the fast-paced deadlines and demand for multimedia (Lang, 2002). This skill set addresses a key problem in WBIS development in emergent organisations and is essential for the web developer's job role within Brunel University. The research resulted in the development of an analytical development tool for developing WBIS in continuously changing organisations based on the theory of deferred action. This tool was developed to overcome inadequate web-based methodologies. The web developer applied this tool to develop WBIS for Brunel University. This analytical development tool helped the web developer and his manager select appropriate methodologies for WBIS development. It helped the web developer meet fast paced deadlines with continuously changing system specifications.

1.3 The Rationale for the Research Investigation

The problem is that web developers find it difficult to accommodate emergence in WBIS development. Researchers in Information Systems Development (ISD) find existing ISD methodologies unable to accommodate emergence (Truex, Baskerville & Klien, 1999; Bello, Sorrentino & Virili, 2002; Baskerville, Pries-heje & Ramesh, 2007). This is because the development methods available are not tailored to the organisational requirements. One major example of ISD failure is the London ambulance service computer-aided despatch system (LASCAD). Beynon-Davies (1999) work highlights that IS failure needs to look beyond technical aspects. The information systems development failed because of the nature of the organisation. Understanding the changing organisational aspects is important in overcoming the IS failure of the London ambulance service (Beynon-Davies, 1999). The web developer concurs with Beynon-Davies (1999) view i.e. understanding organisational change is important to the successful implementation of IS.

For example, the waterfall methodology is not designed to accommodate the effect of organisational change on the development process (Howcroft & Carroll, 2000). Researchers argue that the system development life cycle (SDLC) is inappropriate for the highly dynamic environment, short development cycles and unstable requirements typical of web-based ISD (Baskerville & Pries-Heje, 2002; Kautz, Madsen & Norbjerg, 2007).

Researchers also argue that web developers, developing WBIS, require new methodologies, new development tools and techniques to accommodate emergence (Avison et al, 1999; Baskerville, Pries-heje & Ramesh, 2007). They claim existing ISD methodologies are inadequate for overcoming web-based development problems in organisations that change continuously. Web developers are encountering new challenges which are considerably different to those encountered by IS developers, such as shorter development cycles and changing system specifications. For example, the web developer experienced parallel development with short time scales throughout the student services WBIS development process.

Other researchers do not encourage the development of new development tools for WBIS (Kautz, Madsen & Norbjerg, 2007). These researchers argue that lessons can be learnt from existing IS research. They state that ISD is "prone to fads, fashion and frequent claims about the revolutionising nature of the latest developments in IT" (Kautz, Madsen & Norbjerg, 2007). The contemporary ISD problems are seen as an accentuated evolution rather than revolution for WBIS development. If these contemporary ISD problems were an evolutionary problem web developers would still use methodologies. Fitzgerald et al (2002) identified that IS developers know different methodologies but choose not to use them. The action researcher's stance is that developers reject methodologies based on their awareness of methodologies limited contribution to the development process (Fitzgerald et al, 2002). The researcher agrees that the problems are essentially the same (Kautz, Madsen & Norbjerg, 2007), but argues that solutions are indeed different because of the intense focus on reduced time in WBIS (Baskerville, Pries-heje & Ramesh, 2007)

IS methodology literature indicates that developers are knowledgeable about methodologies and do not reject them purely out of ignorance (Fitzgerald, 1998a). On the contrary, developers have valid reasons for rejecting methodologies, which are based on their awareness of methodologies' limited contribution to the development process (Fitzgerald et al, 2002).

The present action researcher's stance is that new development tools are required. The action researcher found that there are new challenges that are not addressable by existing ISD methods. For example, the intense focus on time is a new challenge. Baskerville et al (2007) stated that the combination of practices and intensity with which they are applied is different. The software developers interviewed by Baskerville et al (2007) regarded their practices as different. The existing methods (waterfall methodology, structures system analysis and design method, prototyping, rapid application development, incremental prototyping and relationship management methodology) have not worked at Brunel University. For example, prototyping was initially used for the development of the student services WBIS. This method was not completed by the web developer from start to finish. The development process couldn't accommodate the broad group of users. The prototyping development process would need collective agreement from 22 different departments. This process was not achievable, in the given timescale, for the development of student services WBIS.

There are new challenges arising from the WBIS development process. The new challenges include shorter development cycles and increased demand on the web developer for speedier development i.e. internet speed and sophisticated use of web technology involving multiple data sources and digital media which is termed 'web-based aesthetics' (Lavie & Tractinsky, 2004). Brunel University student services wants to provide better support continuously to the students. This is through the development of a student services WBIS, wherein many different informational services are incorporated for students. Student services have to develop the WBIS whilst at the same time managing changing budgets and resources. Further, the organisation and web developer have to manage the fast-paced deadlines, whilst accommodating the demand for improving the level of web-based aesthetics.

Thus, two problems encountered by the web developer in an emergent organisation are internet speed and web-based aesthetics. For example, alongside the development of the student services WBIS, parallel development of the student research handbook needed to be implemented. This involved a short development cycle of one month. The intense focus on time had to conform to the criteria of better web-based aesthetics. Emergent organisations are those that are in continuous evolution and transformation (Bello, Sorrentino & Virili, 2002). Internet speed is the fast-paced change of the web-based communication platform and the intense demand for delivering information to get products or service to market on time – 'time-to-market' (Baskerville & Pries-Heje, 2002). Web-based communication platforms are the collection of internet and web technologies used by organisations to communicate and work effectively. The second problem faced by the web developer is web-based aesthetics. Web-based aesthetics add pressure on the web developer for multimedia features to be incorporated into the WBIS, which puts a completely different perspective on WBIS development. Examples of multi-media include the incorporation of video podcasts, flash videos, audio clips and high resolution graphics.

An appropriate theory is needed to explain the phenomenon of WBIS development at internet speed and with web-based aesthetics in emergent organisations. The theory of deferred action is invoked as an appropriate theory for informing WBIS development in emergent organisations. The theory explains how to develop WBIS in emergent organisations. It is comprised of three main design dimensions that explain the changing nature of emergent organisation from an IS perspective, and provided the theoretical framework for undertaking the research.

1.4 Objective of this Research

This research aims to understand the role of the web developer in an emergent organisation, Brunel University, through the theory of deferred action. The web developer is seeking to develop WBIS for student services. The emergent nature of organisations is the reason why current methodologies are inadequate (Howcroft & Caroll, 2000). The theory of deferred action

enabled the action researcher to understand the emergent nature of information in an emergent organisation. It is applied to the development process of WBIS for Brunel University student services. Therefore, the theory is applied to practice through the action research methodology to understand and develop a new analytical development tool to develop WBIS for student services.

1.5 Research Question

The research question is:

How does a web developer working in an emergent organisation, develop web-based information systems, with increased demand on the web developer for web-based aesthetics at internet speed?

The research question is designed to gain new knowledge and understanding on how the web developer develops WBIS in emergent organisations. Researchers have questioned the effect of organisational change on IS development (Truex, Baskerville & Klien, 1999; Baskerville et al, 2007; Berger & Beynon-Davies, 2009). The rapid development of technology has changed researchers understanding and knowledge of developing WBIS within emergent organisations (Truex, Baskerville & Klien, 1999). A root cause of this problem, i.e. changing organisation, is the notion of emergence. Emergence is a theory of social organisation that does not assume that stable structures underpin organisations (Truex, Baskerville & Klien, 1999). Truex, Baskerville & Klien (1999) indentified that to support the rapid development of IS new practices are needed. The research question posed is designed to bring new understanding and knowledge of the emergence phenomenon. This research problem is based in both practice and theory. The research outcome is to develop an analytical development tool to overcome current inadequate analytical WBIS development tools (Baskerville, Pries-heje & Ramesh, 2007).

1.6 Sub Questions

The sub-questions are:

- How much influence does the web developer have within the organisation?
- How can the web developer improve the development process to cope with internet speed?

The information systems domain has seen many investigations within a wide range of contexts. For example Vidgen's (2002) research on WBIS development within a food and drink company is inappropriate for a web developer in a higher education context. This is because the problems encountered in the food and drink company are completely different to those problems experienced in a higher education organisation. Further, Baskerville, Pries-Heje & Ramesh, (2007) identify the need for further qualitative investigation in overcoming the difficulties encountered in WBIS development.

1.7 Structure of Thesis and Order of Presentation

The dissertation is structured into seven chapters.

The thesis argumentation is presented in chapter one. The research problem and rationale for the investigation is discussed. The objective of the research is explained. This is followed by the research questions and layout of the thesis.

In chapter two the literature is critically examined thoroughly in the areas of emergent organisations, WBIS development, and the theory of deferred action. The main issues of the study viz. the importance of understanding emergent information requirements, changing

structures, processes and resources, web-based aesthetics and internet speed for WBIS development are presented in the context of the literature.

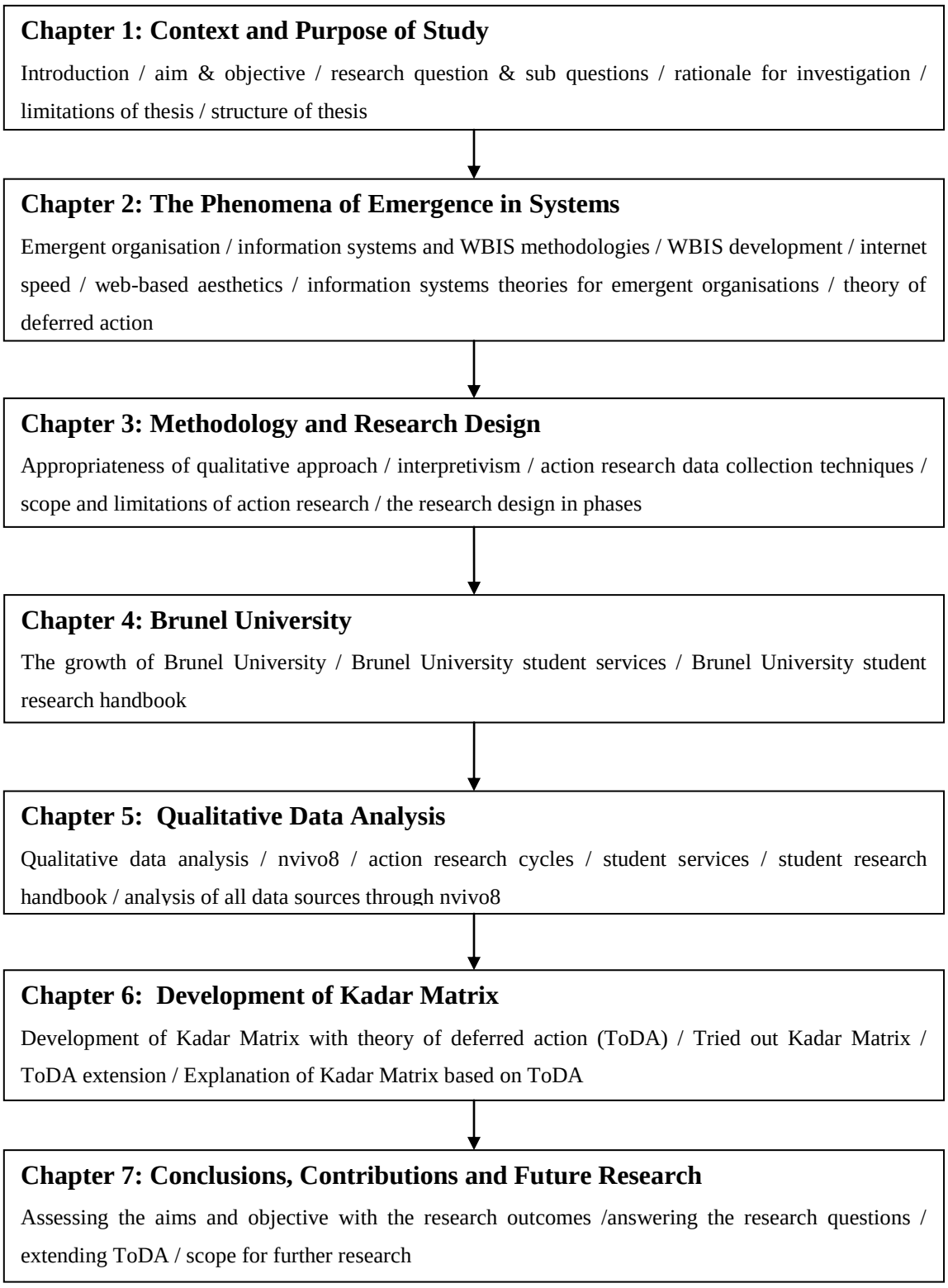
The research methodology is the justification for the research method and is presented in chapter three. The action researcher's philosophical and epistemological approach is explained. The research design, the data collection and data analysis methods are detailed. The real world problem, the growth of Brunel University and its transition to the web-based platform, is presented in chapter four. This chapter presents the reader with insights into how the organisation developed over the years. Aligned with the development of the University, the real world problem is presented to highlight its significance for WBIS.

The data analysis of the student services and student research handbook is presented in chapter five. The research ethics are presented. Nvivo8 is introduced. Nvivo8 is the qualitative data analysis tool used for analysing the data.

The Kadar Matrix, an analytical development tool, is presented in chapter six. Its usefulness to practice is discussed. The theory of deferred action is used to aid the development of the Kadar Matrix. The Kadar Matrix is illustrated using the action research data. Further, the theory of the three deferred action design dimensions are used to explain the Kadar Matrix.

The results of this action research investigation are explained in chapter seven. The action research aims and objectives are assessed. The main research questions and sub questions are examined with the action research outcomes. The limitations of the action research investigation are discussed. Finally, this chapter identifies directions for future research investigation.

Figure 1: Thesis Structure



CHAPTER 2: The Phenomena of Emergence in Systems

2.1 Introduction

This chapter is a critical discussion of the literature on WBIS and related IS development. The main purpose is to critically review the notion of emergent organisations, WBIS methodologies for emergent organisations, and characteristics of the Internet that reflect emergence like the notion of 'internet speed' and 'web-based aesthetics'. The focal theory that informs the research, the theory of deferred action, will be elaborated in this context to show how it provides the appropriate theoretical lens to research the development of WBIS in emergent organisations.

Since action research, the methodology used in this research, is the researcher's perspective on the research problem, the published research is reviewed both objectively, in the interest of thorough science, but also from the action researcher's perspective, as a web developer working in a real organisation, Brunel University. This is because action research always involves two goals, to solve a problem and contribute to science (Coghlan & Brannick, 2005).

The literature identifies aspects of internet speed and web-based aesthetics as significant web-based IS development problems. These development problems require further investigation in different WBIS contexts. Further, these problems are directly experienced by the web developer when developing WBIS within the organisation. Therefore, the research investigation is focused on the web developer. The literature review enabled the action researcher to better understand the web developer's problem of developing WBIS in an emergent higher education context.

This literature review established the investigation in its theoretical context. The reason for this is that WBIS is established in the extant literature which provides an appropriate theoretical context. The importance of the review is to not only identify but also justify an appropriate theory that is capable of explaining the phenomenon of emergence as it affects organisations and its IT-based systems. The review will support the use of theories and models within the

investigation (Maylor & Blackmin, 2005, p.117). This is in agreement with the web developer's stance i.e. that putting theory into practice is needed to improve our knowledge and understanding of emergence.

This literature review covers three major areas emergent organisations, web-based development and IS theories. Truex, Baskerville & Klien's (1999) work is a major study identifying that organisations exhibit continuously changing characteristics i.e. emergent organisations. This notion of emergent organisation revealed the use of inadequate development methodologies for WBIS development. Continuously changing characteristics (emergence) makes the implementation of methodologies inadequate in meeting the demands of the organisation (Truex, Baskerville & Klien, 1999). To overcome this problem Baskerville, Pries-Heje & Ramesh (2007) argue that new solutions are needed to combat the intense focus on time to market. They argued that current WBIS development process needs new analytical development tools to combat this new problem.

To more accurately understand the emergence phenomenon, appropriate theory is needed to aid the web developer (Gregor, 2006). She states that theory is needed to better inform practice and that it helps researchers to improve understanding and knowledge. The action researcher will further discuss these major areas later in this chapter.

Researchers argue about the nature of organisations from different points of views. For example, in the emergent organisations the Truex, Baskerville & Klien (1999) stance is that organisations exhibit continuous change. However, Truex & Klien (1991) argued that organisations do not exhibit changing structures, processes and resources. The action researcher supports Truex, Baskerville & Klien (1999) in that organisations do exhibit continuous change. In support of this argument, Feldman's (2000) data revealed that even set routines are subject to change. Her data revealed routines that changed as participants respond to outcomes of previous iterations of a routine. She claimed that organisational routines have a great potential for change even though

they are often perceived, even defined, as unchanging. She suggests that there is an internal dynamic to routines that promotes continuous change.

Baskerville, Pries-Heje & Ramesh, (2007) argue that persistent web-based problems cannot be completely understood by existing IS knowledge. This is in reference to IS development methodologies (Howell & Carroll, 2000; Baskerville, Pries-Heje & Ramesh, 2007). Baskerville, Pries-Heje & Ramesh, (2007) call for researchers to conduct further studies for deeper contextual insights into organisational change and WBIS development in this context. They also support the development of new analytical WBIS development tools through research, which are required for today's continuously changing organisational environment. Further, they contend that the need for these changes may seem obvious, but the problems and conditions facing today's changing organisations are different from the challenges previously experienced. For example, Baskerville, Pries-Heje & Ramesh (2007) describe this difference as the intense focus on time-to-market for WBIS products and services. The web developer supports this stance. These problems and conditions need to be understood both theoretically and in practice, and then practice can be based on sound understanding of the emergence phenomenon.

From a reading of this literature, the researcher derived the research questions. According to Hart (1998, p.198) the literature review demonstrates a clear understanding of the research topic. The research question not only arises from critically reading the published literature, but also from the problems experienced by the web developer (or action researcher) in practice. This synthesis of literature review aligned with practice makes a good research question because the question posed is grounded in practice and has theoretical import.

Therefore, carrying out a critical literature review on emergent organisations, WBIS methodologies, internet speed, web-based aesthetics and the theory of deferred action is essential to answering the research questions. The research question is a consequence of the following factors: lack of sufficient knowledge on how web developers accommodate emergence in WBIS

development, to have a deeper understanding of the problem of emergence through experience and meet the call for further research by leading researchers e.g. Baskerville, Pries-Heje & Ramesh (2007). Thus, the central research question and sub questions are derived from the literature review and are stated below.

How does a web developer working in an emergent organisation develop web-based information systems, with increased demand on the web developer for web-based aesthetics at internet speed?

How much influence does the web developer have within the organisation?

How can the web developer improve the process to cope with internet speed?

The literature review identified that emergent organisations have an impact on the web developer. The impact has resulted in inadequate development tools for WBIS development. Further investigation is needed to address the web developer's problem of developing WBIS in emergent organisations. The problems of internet speed and web-based aesthetics are other contributing factors to the web developer's problem. The research sets out to address the web developer's problems and to gain new understanding and knowledge. This involves answering the main research question and sub questions.

The literature was reviewed to identify an appropriate theory that explains emergence. The researcher examined available design and action theories within IS. The theory of deferred action is chosen as a suitable theory. This is because the problem being investigated concerns the notion of emergence within WBIS development and its effect on WBIS. The theory has emergence as one of its key constructs. It also explains how to rationally develop WBIS in an emergent organisation. This theory is the best fit available to inform the web developer throughout the WBIS development process.

The literature was reviewed to identify a research methodology that can be used to address the real world problem and contribute to science (Coghlan & Brannick, 2005). The researcher examined available methodologies that solved real world problems and contribute to science. The action research methodology fitted the criteria to answer the research questions. The action researcher uses Coghlan & Brannick (2005) action research methodology to conduct the research. This methodology is designed for doctoral students carrying out investigations within their organisation.

2.2 The Ontology of Organisations

The term organisation is defined from the IS domain. It is described by Patel (2006, p.8) as: social action where participants pursue predetermined objectives as a corporate identity, individuals have intentions and beliefs, people work in groups or collaborate with other groups and partners, and where there are power relationships to ensure that action is directed to achieve objectives.

The literature is divided on whether organisations should be regarded as specified or emergent. This is significant because it affects the type of WBIS development tools required. According to Patel (2006) organisations can be termed specified. Specified organisations assume that company resources, structures and business processes are stable. If a web developer viewed an organisation as being specified, then specified web-based development processes e.g. the waterfall system development life cycle can be applied. However, researchers argue that web-based projects are problematic in an emergent organisation (Truex, Baskerville & Klien, 1999). The reason for this is that it can lead to a disproportionate, rigid, uncomfortable format that makes it difficult to move and adapt to the changing requirements.

Applying WBIS methodologies reveals problems that question the notion that organisations are stable. This is in contrast to specified organisations. These organisations are termed emergent organisations. This type of organisation exhibits continuous transformation characteristics (Truex, Baskerville & Klien, 1999). The notion of "emergent" is essential to describe the characteristics of the environment of WBIS development. "Emergent" refers to the state of continual process improvement, never arriving but always in transition (Truex, Baskerville & Klien, 1999). This is opposed to "Emerging" which assumes that the organisation will reach a static point in the process (Truex, Baskerville & Klien, 1999). This definition is supported by Corning (2002) who defines emergence as "the arising of novel and coherent structures, patterns and properties during the process of self-organisation in complex systems"

2.3 Emergent Organisation

The web developer's position is that organisations are emergent. Consequently, there is a need for appropriate WBIS development tools to reflect emergent organisations. There is much evidence in the literature to support the emergent organisation proposition. As stated above, regarding organisations as emergent is significant for the kind of tools needed for developing WBIS. The debate in relevant literature concerns how we define organisations and the effect of emergence on WBIS development.

Emergent organisation is 'a theory of social organisation that does not assume that stable structures underpin organisations' (Truex, Baskerville & Klien, 1999; Truex and Klien, 1991). The action researcher agrees that stable structures do not underpin organisations. For example, the action researcher's experience at Brunel University is that routines, procedures and available resources are changing daily. By characterising an organisation as being emergent, researchers are able to learn from other researchers who experience the emergent nature of organisations. This enables researchers to build on what is already known about organisations to further understand the phenomenon of emergent organisations.

Patel (2007) describes an emergent organisation as differing from organisation that can be 'specified'. He argues that an emergent organisation cannot be determined, predicted and specified. This is because of its constantly evolving nature. The emergence characteristics of an organisation affect routines, structure and process information needs. Patel (2007) notion of an emergent organisation is aligned with Truex, Baskerville & Klien (1999) definition. This notion is in agreement with Truex, Baskerville & Klien (1999) in that 'social organisations don't assume that stable structures underpin organisations'.

Instability is a prevalent characteristic of emergent organisations. Truex, Baskerville & Klien (1999) define the notion of instability within an organisation as "constantly seeking stability, while never achieving it". It is this organisational instability that Truex, Baskerville & Klien (1999) classify as being "emergent". For example, the web developer experienced frequent changes to the requirements of the student services WBIS throughout the development process. This involved parallel development within student services department to accommodate the changing demands of the organisation.

Bello, Sorrenttino & Virili (2002) also agree that the organisational instability is a result of an "emergent organisations". They state that emergent organisations are in continuous evolution and transformation. Parallel to this transformation, Truex, Baskerville & Klien (1999) found that rapid development of commercial technology and re-engineering within the organisation, gives rise to a recognition that organisations are continuously adapting to their shifting environment.

Truex & Baskerville (1998) suggests that 'in an environment of continual change, Information System Development (ISD) should strive to achieve goals of continuous re-development, continual change, dynamic requirements negotiation and incomplete or purposefully ambiguous specifications'. They describe these emergent characteristics as the key characteristics of emergent organisations. The action researcher agrees that the managers within the organisation should set achievable goals to accommodate the emergent changes within organisations. For example, delivering the final version of the student services WBIS required flexibility by the

manager to allow the web developer to carry out parallel development. This enabled the web developer to accommodate the emergent changes within the organisation.

Alato et al (2002) describe emergent organisations as the very opposite of stable organisations. They agree with and argue that Truex, Baskerville & Klien (1999) found that designing stable and emergent IS is fundamentally different. Truex, Baskerville & Klien (1999) categorise this difference in stable organisations under five goals. These goals are: economic advantages of lengthy analysis, user satisfaction, abstract requirements, complete and unambiguous specifications and new system projects (Truex, Baskerville & Klien, 1999; Alato et al, 2002). They look upon the completion of these stable organisational goals as achievement. When these goals are viewed from an emergent perspective the desired outcome will not be achieved because the organisation will have evolved. This is why IT systems need to continuously adapt to their changing environment.

Researchers categorise emergent organisations under four goals. These goals are: dynamic requirements negotiations, always analysis, usefully ambiguous specifications and continuous redevelopment (Truex, Baskerville & Klien, 1999; Alato et al, 2002). This knowledge gives rise to the question of what dilemmas WBIS developers encounter in emergent organisations.

Researchers have carried out work on emerging technologies to address the inadequate methodological problem for WBIS development in an emergent organisation. They advocate empirical investigations within the domains of intranet and web-based development (Balasubramanian & Bashian, 1998; Bansler et al 2000). They call for further studies to be carried out over a longer period of time (Bansler et al, 2000; Baskerville & Pries-Heje, 2002; Baskerville, Pries-Heje & Ramesh, 2007). The action researcher supports further studies to be carried out over a longer period of time. The researcher's action research lasted seven months.

2.4 Managing the Web Development Process in an Emergent Organisation

Clegg et al (2005) identified issues that affect the management of emergent organisations. One of these issues is the notion of emergence. Understanding the emergence phenomenon in context can generate deeper insights on how managers carry out the decision making process. How managers manage their organisation is changing structures, processes and resources is an integral part of the decision making processes in organisations. These aspects reflect the ongoing concerns of managers to manage the aspects of continuity and change when developing WBIS projects within organisations.

The manager has to overcome other issues in managing organisational change. Clegg et al (2005) identified these other issues as 'business processes, organisation structures and working practices, employee empowerment, new business models, the management of change, the need to evolve new ways of thinking and behaving and organising'. Clegg et al (2005) organisational change issues relating to ISD failure is an existing research problem. Further, Ewusi-Mensah and Przasnyski (1991) research agrees with Clegg et al (2005) findings that the manager has to overcome organisational change issues. The action researcher has experience in developing WBIS in an emergent organisation and it is necessary for the manager to overcome these issues to manage the effect of organisational change on the WBIS development process. For example, the student services manager had to re-organise the schedule for delivering the student services WBIS project. This is because management restructured the heads of the different departments. Further, this resulted in a reduction to the available budget to carry out the student services WBIS development project.

2.5 Defining Information Systems in Emergent Organisations

An information system in an organisation provides processes and information useful to its members and clients (Avison & Fitzgerald, 2006). The content of the information system may or

may not relate to customers, suppliers, products, equipment, procedures and operations (Avison & Fitzgerald, 2006). For example, Brunel University student services WBIS provides students with the different student services contact information and an explanation of the process of enrolling on the different courses. This information is intended for both students and staff.

The information systems in Brunel are intended to help the organisation operate more effectively. Information systems in a higher educational setting, for example, concern student guidelines for their courses, the operation of its services for students and the efficient running of its departments. The role of an IS should be clearly defined to enable the organisational members to understand the intended purpose of the IS. There are many different types of IS in an organisation. For example, management information systems (MIS), decision-support systems (DSS), Executive support systems (ESS), etcetera. The research will address web-based information systems.

Avison & Wood-Harper (1990, p.3) define IS as: "an integrated man-machine system for providing information to support the operations, management and decision making functions in an organisation. The system uses computer hardware, software, manual procedures, management and decision models and a data base." This means that ISD should cover many aspects i.e. people, organisation, and technology, in order to retain and balance each of these important elements to address business problems and achieve business goals. The action researcher agrees with the Avison & Wood-Harper (1990, p.3) definition of an IS. This research invokes the Patel (2009c, p.165) definition of IS as composing of people, organisation and information technology.

There is ongoing debate among practitioners and researchers concerning the area and definition of "Information Systems" and "Information Technology"; it can be differentiated as follows:

Information systems combine people and their requirements including their activities (Korpela, Mursu & Soriyan, 2001), data, processes, and the use of IT, which interrelates to collect, process, store, retrieve, transmit, manipulate and display information relating to the business and organisational needs; whereas Information Technology is a combination of computer hardware, software, telecommunication, and other physical devices (Alter 1996, Laudon & Laudon 1998, Whitten, Bentley & Dittman 2001 and Whitten, Bentley & Dittman 2004).

2.6 Development Methodologies and Emergent Organisation

Researchers questioned whether current development methodologies are adequate for accommodating today's emergent organisations. Truex, Baskerville & Klien (1999) argue that emergent organisations exhibit continuously changing structures, processes and procedures. This makes it difficult to implement development methodologies from start to finish. However, Kautz & Norbjerg (2003) argue that IS developers do not need new development approaches for WBIS development. They argue that the problems faced by IS developers have been previously experienced. They state that current researchers should use the understanding drawn from previous IS research to answer the WBIS development problems encountered by today's web developers.

Bello, Sorrentino and Virili (2002) highlighted the increase in today's fast paced changing environment and the need for development methodologies to accommodate technological innovations. The present action researcher, as a web developer at Brunel University, supports the Bello, Sorrentino and Virili (2002) argument. This is because the web developer experienced the need for new technical innovations requiring new development methodologies. For example, an electronic tool was needed to inform the Brunel University student services stakeholders of the parallel projects simultaneously. The electronic tool enabled effective communication among stakeholders.

Critically, Baskerville, Pries-Heje and Ramesh (2007) demonstrate that WBIS have specifically different characteristics to other types of IS development. These IS characteristics are different for WBIS development because of the intense focus to deliver the project on time (Baskerville, Pries-Heje and Ramesh, 2007). Baskerville, Pries-Heje and Ramesh (2007) contradict the Kautz and Norbjerg (2003) provocative stance which urges IS researchers to look at current development methodologies for advice on how to cope with today's dynamically changing organisational problems.

The web developer found it problematic to deliver the WBIS project on time. It may seem that delivering the project on time is obvious on the surface level, but this problem and the condition facing emergent organisations is not trivial (Baskerville, Pries-Heje and Ramesh, 2007). The web developer was under extreme pressure to deliver the project on time because of the increased demand for more multimedia features. These features include: video, audio and graphics. Lang (2002) identified that this can make existing development methodologies inadequate. Further, Barry & Lang (2001a) reveal that the graphic design role is a significant process within the WBIS development cycle to accommodate multimedia features. More crucially, Barry & Lang (2001a) found that web developers and graphic designers have different perceptions and values of the development process. They identify a need to create a common resolution of cross-cultural paradigms.

Emergent properties hindered the web developer's ability to deliver the WBIS projects on time. Patel & Hackney (2008) argue that this is a result of the lack of understanding emergent properties. They stated that incorporating emergent properties within methodologies is logically flawed. This is because the very act of modelling assumes it can be predicted (Patel & Hackney, 2008).

The action researcher agrees that emergent properties affect the development of methodologies for continuously emergent organisation. Patel & Hackney's (2008) argument states that a stable structure does not underpin the organisation. Further, the action researcher views current WBIS

methodologies as inadequate for developing WBIS in continuously changing organisations. Therefore the present research seeks to address this gap. New development tools are needed to develop WBIS for emergent organisations.

2.7 Inadequate Information Systems Development Methodologies

Information systems development methodologies (ISDM) are not appropriate for WBIS. Avison & Fitzgerald (2003a) define ISDM as a tool kit of ideas, approaches, techniques and tools which system analysts use to translate organisational needs into appropriate IS. Further, they argue that an ISDM is a "recommended collection of philosophies, phases, procedures, rules, techniques, tools, documentation, management, and training for Developers of Information Systems".

Avison & Fitzgerald (2003b) regard ISDM as inadequate for developers. ISDM methodology literature indicates that developers are knowledgeable about methodologies and do not reject them purely out of ignorance (Fitzgerald, 1998a). On the contrary, developers have valid reasons for rejecting methodologies, which are based on their awareness of methodologies limited contribution to the development process within organisations (Fitzgerald et al, 2002).

Fitzgerald (1997a) indicates that many traditional ISDM are based on outmoded concepts dating back to the 1970s. These outmoded concepts include the rigidity of the waterfall methodology and lack of iteration between stages in the development process (Howcroft & Caroll, 2000). Waterfall methodology is a series of cascading steps (Howcroft & Carroll, 2000). These outmoded concepts are limited since they were never intended to be used for this purpose (Powell 1998). Howcroft & Caroll (2000) identified that ISDM were developed for IS and not for WBIS development. The researcher agrees with their argument that ISDM are unsuitable for WBIS development because they are not only limited but also outmoded concepts.

Whilst it would be inappropriate to import these ISDM wholesale for web-based development, nevertheless some of the principles remain applicable (Dennis 1998). Avison & Fitzgerald (2003b) states that ISDM are not well-known by practitioners, or are known but many avoid using them. However, two methodologies have incremental approaches to development. These two methodologies are rapid application development (RAD) and incremental prototyping. These methodologies are discussed later in this section. The methodological principles may remain applicable to the changing nature of web technologies and therefore applicable to WBIS development.

The ISDM waterfall methodology is an outdated methodology for web-based development and regarded by many developers as obsolete (Avison & Fitzgerald, 2003b). Howcroft & Carroll (2000) identified that the waterfall methodology involves a series of cascading steps that cover the development process with a small level of iteration between each stage. They described the major problem of the waterfall methodology for the development of WBIS (and also IS) as the rigidity of its structure and lack of iteration between the stages except adjacent stages. Further, Howcroft & Carroll, (2000) states that any methodology used for the development of web-based projects must be flexible enough to cope with change.

Another inappropriate ISDM for web-based development is the Structures System Analysis and Design Method (SSADM). Howcroft & Carroll, (2000) state that SSADM was not designed for web-based development. They state that SSADM is designed for traditional, fairly large IS projects. They argue that SSADM is inappropriate for WBIS development because the emphasis is placed on just two aspects of the project. These two aspects are the analysis and design stages which are carried out with the expectation of reducing costly errors and omissions (Howcroft & Carroll, 2000).

The prototyping ISDM is regarded by Howcroft & Carroll (2000) as unsuitable for web-based development. Prototyping can help web developers to assess a version of a working system, rather than assessing a description of an imagined future system. Howcroft & Carroll (2000)

state that it is most useful for the development of "interactive applications" where the user is more concerned with the screen layout than the actual functionality of the system. However, they also highlight potential problems of using prototyping for the development of WBIS. Firstly, prototyping has a tendency towards adding components on to the project that are outside the initial system requirements. This can lead to the problem of never knowing when the project is finished, as the WBIS would be in a constant state of change. Secondly, the target audience of a web-based project is much more diverse than that of a traditional IS. Therefore, the interface must be designed for a broad group of users, which gives rise to a problem when defining a set of users to evaluate the prototype. The researcher agrees with the Howcroft & Carroll (2000) evaluation of the ISDM type prototyping being unsuitable for WBIS development.

The Rapid Application Development (RAD) ISDM is unsuitable for WBIS development (Howcroft & Carroll, 2000). RAD is a form of prototyping that involves building several small "throwaway" prototypes for the system and then discarding them once they have been analysed (Howcroft & Carroll, 2000). This means that the prototype is never developed into the finished system. Powell (2000) discusses how RAD is failing the web developer. He stated that RAD methodology is one of the worse culprits for inadequate ISDM: "RAD involves building the wrong site multiple times until the right site falls out of the process".

The Incremental Prototyping ISDM is regarded by Howcroft & Carroll (2000) as suitable for large WBIS systems, but not appropriate for the development of small systems. It allows large systems to be developed in phases, which avoids delays between specification and delivery (Howcroft & Carroll, 2000). The most important features of the system are developed to completion first, and then less important features are added to the system at a later stage (Howcroft & Carroll, 2000). This can speed up the time taken to implement the project. The incremental approach examined by Howcroft & Carroll (2002) has dynamic and emergent attributes which are appropriate for large WBIS but are not suitable for small WBIS development. Baskerville, Pries-Heje & Ramesh (2007) state that WBIS grow both in size and functionality, so a methodology that utilised this incremental approach could not only speed up

the development process but also help to incorporate new features as the enabling technologies emerge.

2.8 ISD Methodologies and Web Revolution

ISDM were not designed to accommodate the web revolution and therefore web developers use of them is limited (Avison & Fitzgerald, 2003b). Avgeriou and Retalis (2005) state that a methodology for constructing ISDM should consist of a set of process models, methods, tools, documentation aids and guidelines that help the developer to build quality projects, whilst at the same time, adhering to the constraints imposed by time and resources. They argue that such a methodology, is not a mere collection of elements but advocates specific development philosophy and offer specific benefits, such as: risk mitigation, quality assurance and the ability to manage change. Therefore, the development of a WBIS within a specific time frame and financial resources demands effective development methodologies.

Fitzgerald (1994) estimated more than 300 system development methodologies associated with ISDM have been recommended since the 1970s. He also states that development methodologies in the area are still being developed. Both practitioners and researchers continue to create and recommend new methodologies (Fitzgerald, 1994). These new methodologies are intended to facilitate the development of ISDM using new technology. The current shift in development is to support changing organisations and their use of web technology (Baskerville, Pries-Heje & Ramesh, 2007).

Research has shown that U.K. organisations modify ISDM to cope with the web revolution. Fitzgerald, Phillippidis & Probert (1999) survey of U.K. organisations found that 57% of the sample claimed to be using ISDM for systems development, but only 11% reported using an unmodified commercial development methodology. They also found that 30% reported using a commercial methodology adapted for in-house use, 59% used a methodology they claimed as

unique to their organisation, often internally developed. They argued that methodologies were in relatively widespread use, though they were often developed in-house rather than as commercial products. Avison & Fitzgerald (2003b) commented that despite the claims of being unique, many were clearly influenced by existing commercial methodologies.

Prior to web technology, existing ISDM were available to practitioners for web-based development projects. During that period of development large enterprises were willing to pay huge sums of money for ISD (Howcroft & Carroll, 2000). Howcroft & Carroll (2000) declared that there was a need for one enterprise to gain a competitive advantage over its competitors. They found that to achieve this goal, methodologies had been adopted for the efficient development of their computer-based IS. The researcher agrees with Howcroft & Carroll (2000) that the web revolution has reduced the costs for system development. Further that the web revolution started with e-commerce, moved onto websites, then to portals and is now fused with e-Business.

2.9 The World Wide Web Revolution

Vidgen et al (2002, pp.16) describes the web revolution as starting with the World Wide Web (WWW) in 1991 through Tim Berners-Lee work at CERN. They describe this work as enabling the development of the Internet. They also explain that it was Tim Berners-Lee's intention to facilitate the sharing of documents and information over the Internet. Leiner et al (2009) described the internet as a world-wide broadcasting capability, a mechanism for information dissemination, and a medium for collaboration and interaction between individuals and their computers without regard for geographic location. Paynter & Pearson, (1998) described the web revolution in the late 1990's as enabling small businesses and individuals to create their own computer applications including a website. They found the inception of the WWW as a strategic business tool, driven by commercial interests of companies. Google.com, Yahoo.com and Amazon.com are very good examples of companies that have taken advantage of the WWW

(Evans, 2007). Liang et al (2009) identified that Google development through the web was gained through developing innovative services. They demonstrated that Google has a more dominate market share than Yahoo. Although Liang et al (2009) stated that customer loyalty from Yahoo users is a main factor for Yahoo continued competitiveness via the Web. Evans (2007), stated that Google have taken advantage of the Internet and web technology to drive their business so that the web now has become a strategic part of their business.

Merorio-Cerdan & Soto-Acosta, (2007) found that many companies have tried to at least have a website and require it to function within a short period of time. They argue that the development of a website is the starting point for a firm to achieve the benefits derived from the Internet. As a result of the web revolution in the 1990's websites and WBIS development are placed at the forefront of new business systems development (Merorio-Cerdan & Soto-Acosta, 2007). The development of new business systems via the web need appropriate guidance throughout the development process (Oates & Fitzgerald, 2007). Fitzgerald et al (2002) identified that there are many web development methodologies available to practitioners, although they are not well-known, or are known but many developers avoid using them.

While it is beyond the scope of this research to study every available methodology, the action researcher will focus on WBIS development methodologies in the following section and also examine well accepted IS methodologies in order to find issues relevant to the problem.

2.10 Comparison of Web-based Development and Information Systems Development

Isakowitz, Bieber & Vitali (1998) stated that web-based development is an alternative type of medium to information systems development. They describe web-based development as extending the channels of communication. This includes online publishing, selling, communicating, and virtual learning for the purpose of internal and external stakeholders. In

contrast, the purpose of the ISD or Information Systems is to facilitate business transactions and the workings of an organisation (Isakowitz, Bieber & Vitali, 1998).

Howcroft & Carroll (2000) demonstrate that the development life cycle of a general Information Systems is a long cycle, while a short life-cycle of web-based development is quite common for many web-based projects. For example Brunel University student services would require the development of a web-based induction section created within weeks rather than an IS development process of months.

Gnaho (2001) describes web-based development as content intensive and composed of unstructured information use, while the structured information use and its flow are the major focus of traditional IS. Further, Lang (2005) found the rich graphical approach in WBIS is a major difference to IS development. The rich graphical approach is normally an option for most ISD projects (Lang & Fitzgerald, 2007).

In summary, web-based development methodology is different from the traditional ISD. The action researcher agrees with Isakowitz, Bieber & Vitali (1998) that web-based development is an alternative type of medium to IS and that IS has longer development cycles than WBIS development (Howcroft & Carroll, 2000). The significance between WBIS and IS development is to demonstrate that current ISD development methodologies are inadequate for WBIS development. This inadequacy is a reason for conducting this research.

2.11 Ad-hoc Web Developers and Web-based Methodologies

Linden & Cybulski (2004) found in most cases, web developers start to create a document on the ‘editor software’ without hesitation in order to create design and analysis. They describe this approach as ‘ad-hoc’. This is a problem for proposers of methodologies in the web-based development process (Linden and Cybulski 2004). Similar to word processing applications,

modern HTML editors allow web developers to easily create, edit, update and publish the documents directly to their online websites. As a result, Linden and Cybulski (2004) found a broad range of web developers, who may have none or little technical background in system development, will have an advantage and seamlessly be able to create their own sites without hiring programmers. Their argument is that web developers can develop their own WBIS without additional technical help. This gives the web developer more control in developing WBIS from start to finish with a small budget and basic knowledge of web-based development (Linden and Cybulski, 2004).

Powell (2000) stated that ad-hoc web developers should adopt web-based methodologies. He finds that web developers should adopt applicable web development methodology and information systems development methodology. The IS methodologies he recommends for adoption are: the Waterfall Model, Modified Waterfall and Joint Application Development (JAD) to web-based development. Although there is no clear explanation of a procedure and method for doing so, there is a recommendation of the site-building methodology for web design and development which gives guidelines for users, websites, and page and user-interface design (Powell, 2000).

2.12 Web-based Information Systems Methodologies

This section examines the applicability of eight WBIS methodologies. These methodologies include: relationship management methodology, object-orientated hypertext design method, web information systems development methodology, website design method, internet commerce development methodology, Takashi-Liang WBIS analysis & design, Howcroft-Carroll's methodology and intranet design methodology. The purpose of examining these methodologies is to assess the effectiveness of these methodologies for the web developer in an emergent organisation.

2.12.1 Relationship Management Methodology

Relationship Management Methodology (RMM) is one of the hypermedia development methodologies and it is the most widely accepted for developing web applications (Scharl, 1999). Scharl (1999), views "hypermedia as a vehicle for managing relationships among information objects" and proposed RMM in order to accommodate the design and development of hypermedia applications. Though authors Isakowitz, Bieber & Fabio (1998), mentioned that there are some limitations of this development methodology, particularly in relation to the WBIS projects. These limitations are: poor slice contents, lack of context in navigation, top-down design only, and loss of the big picture. The extended version of RMM therefore, was introduced to overcome these limitations. Lang & Fitzgerald (2005) revealed that just two percent of respondents had ever used RMM and only another five percent were otherwise aware of the methodology. RMM use of hypermedia is a combination of rich texts, graphics, audio, video, and so forth (Coda et al, 1998). Hypermedia design and development methodology can be adopted for WBIS development (Coda et al 1998).

2.12.2 Object-Orientated Hypertext Design Method

The Object-Orientated Hypertext Design Method (OOHDM) was originally developed by Daniel Schwabe and Gustavo Rossi who recommend an object-oriented approach to Hypermedia application design including web-based applications (Schwabe and Rossi 1995; Schwabe and Rossi 1998a; Schwabe and Rossi 1998b). This development methodology was claimed to be suitable for building large and complex hypermedia application e.g. websites (Rossi, Schwabe and Lyardet 1999).

The OOHDM methodology consists of four major activities, namely, conceptual, design, navigational design and abstract interface design (Rossi, Schwabe and Lyardet 1999). A separation of activities allows designers and developers to focus on each activity individually.

However, a sequential order of each activity is necessary because the outcome of each activity is related to the next activity. A requirements gathering phase was introduced to capture stakeholder requirements (Rossi, Schwabe and Guimares, 2001).

2.12.3 Web Information Systems Development Methodology

The Web Information Systems Development Methodology (WISDM) was developed by Richard Vidgen and the inventors of Multiview, viz. David Avison, Bob Wood and Trevor Wood-Harper (Vidgen 2002, Vidgen et al 2002, Avison and Fitzgerald 2003a).

According to Vidgen et al (2002), the framework of WISDM consisted of the development method matrix in order to help the development of WBIS. However, there is no sequential ordering of each phase of the development process. The development method matrix is two dimensional: socio (organisation and people) and technical, and analysis (of 'what' is required) and design ('how' it will be accomplished) (Vidgen et al. 2002). In fact, one dimension represents a hard approach and the other represents a soft approach to web development (Vidgen et al. 2002). Vidgen et al (2002) describes the hard approach as the generation of requirements specification and its stepwise refinement into a software model. He further identifies the soft approach as the socio aspect which includes the organisation and people.

Additionally, Vidgen et al (2002) explains that the WISDM method matrix uses the metaphor of a still camera, where the focus of attention changes as the camera zooms in and out to find the aspect and situation. He likened it to the motion of the camera which can move from one aspect to another when the situation requires. Madsen et al (2006) identified that the method matrix comprises a collection of formalised methods and techniques organised according to five different aspects of ISD. These aspects are organisational analysis, work design, information analysis, technical design and human computer interface design (Madsen et al, 2006). These five

aspects are described by Madsen et al (2006) as being potentially seen at the same time, but the level of resolution may be different.

Vidgen et al (2002) WISDM method matrix is presented as methods and techniques. These methods and techniques are general tools that can be drawn upon in a specific situation by particular people to create a local methodology in practice (Vidgen et al, 2002). The IS development methods are contained within the WISDM matrix (Vidgen et al, 2002).

Madsen et al (2006) found that the WISDM or multiview framework aided the development process. Further, their investigation found that the multiview framework incorporated the socio-technical aspect of system development which would have been neglected without its use. Madsen et al (2006) criticism is that the method matrix may zoom in on a particular aspect but other aspects pertaining to the method matrix can still be present in the minds of the developers.

2.12.4 Web Site Design Method (WSDM)

The Web Site Design Method (WSDM) is designed to develop adaptive websites. The WSDM has two major methodological characteristics (De Troyer & Casteleyn, 2003). Firstly, De Troyer (2001) demonstrates that it has a user-centred approach (‘audience-driven’) to web development. Secondly, the conceptual design phase focuses more on the technical aspects (De Troyer 2001).

De Troyer & Casteleyn (2003) have revised the conceptual phase of WSDM to handle more complex web applications. Their method gives added depth to the process of each task with regard to the users and their requirements. They contend that the benefit of this methodology is the adaptive behaviour of the method for emergent organisations. This adaptive behaviour is determined by the web developer (De Troyer & Casteleyn, 2003). Conversely, the adaptation specification language has limitations on the web developer’s ability to generate an adaptive

development process (De Troyer & Casteleyn, 2003). De Troyer & Casteleyn (2003) agrees that further research is needed to substantiate its applicable use within practice.

2.12.5 Internet Commerce Development Methodology

Standing (2001) claims that Internet Commerce Development Methodology (ICDM) can be adapted for WBIS development. He summarises this methodology as: the major objectives of ICDM are to focus on different aspects of the development, which includes both technical and organisational issues and providing a framework for developers (Standing, 2001; Standing, 2002). In relation to ICDM he considers e-business development as part of an organisation. Therefore, ICDM needs to address organisational aspects, such as, business strategy, managerial and organisational culture issues in the development process (Standing, 2002).

Standing (2002) identifies developer problems of inflexible guidelines and insufficient support for industry specific factors. Further, his investigation found that practitioners require more detail guidelines on how to stimulate innovative thinking and widespread adoption of e-commerce initiatives.

2.12.6 Takahashi-Liang's Web-based Information System Analysis and Design

Takahashi and Liang (1997a, 1997b) Web-based Information System Analysis and Design approach focuses on the architectures and functions of the websites rather than the visual interface of the website. They mentioned that most web development methodologies cannot answer clearly the following aspects: how the users will accomplish the business goals, how the WBIS development process will respond to user inputs and how people will communicate to each other by using WBIS.

Takahashi & Liang (1997a, 1997b) Web-based Information System Analysis and Design consider the users' goals as part of the scenario analysis that is included in their methodology. Ruppel & Konecny (2000) suggest that to apply this methodology the researcher must identify all the users of the site and ascertain their related goals to determine access patterns and design an appropriate architecture.

2.12.7 Howcroft-Carroll's Methodology for Web Development

This development methodology was proposed by Howcroft and Carroll (2000). Their methodology consists of four phases: analysis, design, generation and implementation. Additionally, all four phases are aligned in a sequential process, which can be summarised as follows:

Analysis

Howcroft & Carroll (2000): the analysis stage aims to decrease the risk of a project failure by setting the project objectives and goals. They state that the website will be designed to achieve these objectives and goals. In this analysis phase, they describe many related areas, such as: strategy, technology, information, skills, users, cost and defining risk. This analysis phase includes the following steps: development of a Web strategy, defining the objectives, and objective analysis (Howcroft & Carroll, 2000).

Design

After completion of the analysis phase, the designing phase can commence (Howcroft & Carroll, 2000). They state that the major aim of this second phase is to design many parts of the Website. This design stage is further divided into two other stages. The first of these stages is the information and graphic design stage. The second of these stages is the testing of the Website

design against the set goals and objectives. In the testing stage, if the outcome of the tests is not satisfactory, then the process will start again from the first step (Howcroft & Carroll, 2000).

Generation

Howcroft & Carroll (2000) state that the generation phase will follow the design phase, but after the documentation has been completed. They mention four steps in this phase: resource selection, design review, code generation and installation and testing. These processes are viewed from a technical viewpoint. Howcroft & Carroll (2000) mentioned that website testing is extremely complicated when compared with the traditional IS testing. This is because website testing involves a wider audience.

Implementation

Howcroft & Carroll (2000) identified that once the website has been completely developed, it is now ready to be implemented. However, they state that this phase includes maintenance and objective review in order to ensure the website complied with the aims and objectives of the project.

Vidgen (2002) identified that Howcroft-Carroll's methodology incorporated the look and feel (user interface) but didn't address the wider aspects of WBIS. He contends that the Howcroft & Carroll methodology needs to integrate with existing back office applications within the organisation, and often need to connect with trading partners and other stakeholders (Vidgen, 2002). Kautz, Madsen & Norbjerg (2007) also identified that Howcroft & Carroll (2000) methodology is focused on user interface. Researchers argued that websites and systems are a part of the way a company presents itself and markets its products or services to the rest of the world. These researchers identified this new requirement as 'look and feel' (Bansler et al, 2000: Murugesan et al, 2001; Vidgen, 2002; Kautz, Madsen & Norjberg, 2007).

2.12.8 Intranet Design Methodology

The Intranet Design Methodology (IDM) was developed by Lee (1998). He states that the methodology emphasised the navigation and user-interface design. Further, he said that this methodology enables the development of an intranet within an organisation. He affirms that the intranet users are employees of the organisation (Lee, 1998).

Lee (1998) IDM provides a set of feedback loops. He states that these feedback loops are located in several sections within the methodology. For example, the feedback loops are flexible to facilitate the quality of the design. He claimed that the methodology enables the designer to alternate use between top-down and bottom-up approaches. He supported this by saying that it is because the information is categorised into local and global aspects. He contends that the application components can be evaluated and redesigned accordingly using this methodology Lee (1998).

2.12.9 The Eight WBIS Methodologies

The eight WBIS methodologies are listed in Table 1. The table provides comments on the suitability on each of these WBIS methodologies.

Table 1: Suitability for Developing WBIS for Emergent Organisations

WBIS Methodology	**Comments**
Relationship Management Methodology	RMM can be used for WBIS but its limitations of poor slice content and top-down design only are unsuitable for this research.
Object-Orientated Hypertext Design Method	The methodology uses sequential ordering of each activity which is inadequate for emergent organisations.
Web Information Systems Development Methodology	The methodology may zoom in on a particular aspect but loses focuses on other aspects. This limitation would hinder the web developer when encountering continuous change.
Web Site Design Method (WSDM)	WSDM has problems with adapting its specification language which can hinder the web developer in the emergent development process.
Internet Commerce Development Methodology	Inflexible guidelines and insufficient support for emergent organisation factors makes this methodology unsuitable.
Takahashi-Liang's Web-based Information System Analysis and Design	This methodology doesn't accommodate the web-based aesthetics aspect needed for WBIS development.
Howcroft-Carroll's Methodology for Web Development	The methodology incorporates the visual aspects but doesn't have good integration for existing back office applications required by organisations.
Intranet Design Methodology	The methodology uses feedback loops that enable better navigation and user-interface design.

2.13 Critical Factors in WBIS Development

The WBIS development literature identifies factors that affect the development process (Baskerville & Pries-Heje 2002; Lavie & Tractinsky, 2004). Two critical factors that have a significant impact on WBIS development are discussed in this section. These factors are web-based aesthetics and internet speed. These factors are not explicitly covered by any of the eight previous WBIS methodologies as predominant factors when developing WBIS.

2.13.1 Web-based Aesthetics

Lavie & Tractinsky (2004) called the sophisticated use of web technology 'web-based aesthetics'. For example, researchers have identified web-based aesthetics as often including advanced graphics and multimedia features such as sound, animation and video streaming (Bansler et al, 2000; Cartensen & Vogelsang, 2001; Murugesan et al, 2001; Holck, 2002; Vidgen, 2002; Kautz, Madsen & Norbjerg, 2007).

Lavie & Tractinsky (2004) argue that web-based aesthetics are an essential factor required of web developers when developing WBIS. Lang (2002) further identifies that the increased demand for web-based aesthetics puts the web developer under extreme pressure for multimedia features (e.g. video, audio, graphics). He states that this additional pressure on the web developer can hinder the WBIS development.

Barry and Lang (2001b) reveal that creating web-based aesthetics is a significant process within the development cycle. They mention that web developers and graphic designers have different perceptions and values relating to web-based aesthetics. They advise the development of a common resolution among web developers and graphic designers. This is a problem because web developers are recruited from areas such as marketing, graphics design and video or film production to meet the new types of demands of web-based aesthetics (Kautz, Madsen &

Norbjerg, 2007). Additionally, Vidgen (2002) mentions that web developers have to accommodate the development of WBIS in various domains e.g. Health, Law and Higher Education. This is a problem because different domains may require bespoke solutions.

2.13.2 Internet Speed

Baskerville & Pries-Heje (2002) state that 'Internet Speed' arose with the birth of the WWW and the dot com explosion in the 1990s. This paradigm gave new focus to the meaning of time-to-market, customer focus and the ability to respond to changing business needs (Baskerville & Pries-Heje 2002). Aligned with business organisational context, Information Systems is concerned with delivering business value fast. The alignment between IS plans and business plans is necessary to ensure that the IS function, supports organisational goals and activities at every level (Lederer & Mendelow, 1989a; Teo & Ang, 1999).

There are ten properties of Internet Speed (Baskerville & Pries-Heje 2001). These ten properties characterise the factors that the web developer is facing when developing at WBIS at Internet Speed. These are:

Time Pressure:	Minimising time to market (Delivering project on time)
Vague Requirements:	Inability to have predefined requirements
Prototyping:	Build the wrong system several times until the right one is achieved
Release Orientation:	Track changes to new features
Parallel Development:	Development must be simultaneous
Fixed Architecture:	Basis for distributing work
Coding your way out:	Invent your own programming language
Quality is negotiable:	Functionality is desired faster
Dependence on good people:	Recruiting high quality developers

Need for new kinds of structure: As resources grow, quality needs to grow with it

Internet Speed is a critical factor because of the dramatic increase in the influence of time on the WBIS development process, and the dominance of "time-to-market" (Baskerville & Pries-Heje, 2001). Its initial conception was driven by the fast paced change of the Internet. For example, a research carried out by the Atlanta Constitution (2001) identified that it took 30 years (1920-1950) for the telephone to reach a 60% penetration in the USA and that it took 15 years for computers to reach a 60% penetration. However, it took only two years for the Internet to reach 60% penetration. Baskerville and Pries-Heje (2001) described this phenomenon as an exploding bomb and construed the notion of "e-bomb". This is due to the frantic speed that companies are developing applications for the Internet. Driven by the risk of becoming obsolete, the notion of "Internet time" is generated. The origin of both internet time and internet speed were coined at Netscape and first publicized by Cusumano and Yoffie (2000).

Baskerville and Pries-Heje (2001) found that the discovery of Internet Speed generated a metamorphosis in the migration of the meaning of "methodology" in certain development sectors. They also identified that this reformulation was due to the dramatic increase in the influence of time on the WBIS development process. The dominance of "time to market" changed not only the definition of methodology for all web developers, but generated a new form of philosophical foundation. This new form of philosophical foundation implies a change in the meaning of methodology for web developers (Baskerville & Pries-Heje, 2001). This new form implies that web developers use WBIS methodologies to accommodate the WBIS development aspect of time to market. In the last decade the practicality of methodology has been questioned altogether. For example, Fitzgerald (1997b, 1998a, 2000) and Wynekoop and Russo (1997) questioned this tenuous relationship of methodologies to the practice of ISD. Truex, Baskerville & Klien (1999) mentioned that the development issue of internet speed needs better management for WBIS development. The need for better management is to overcome methodological issues of predefined sequence, control, rationality and the thought of universality (Truex, Baskerville & Travis, 2000).

Baskerville & Pries-Heje (2002) demonstrate from their study that internet speed has changed the development process. They identify four aspects which are considered a resultant cause of internet speed. Firstly, the analysis must be done differently, because the requirements are 'fluid and ambiguous'. Secondly, that good design and layout is necessary for scalability. Thirdly, that detailed design is different, as it is based on tools and components capability. Fourthly, that urgency to code is enveloped as a substitute for unambiguous requirements. Their attitude towards maintenance is different, because maintenance was generally ignored in some of their research findings (Baskerville & Pries-Heje, 2002).

2.14 The Importance of Web-based Aesthetics and Internet Speed

The critical factors of web-based aesthetics and internet speed are important because web developers encounter these problems in WBIS development (Baskerville & Pries-Heje, 2004; Kautz, Madsen & Norbjerg, 2007). Understanding these factors in practice will enable the web developer to develop an appropriate analytical development tool (Baskerville, Pries-Heje & Ramesh, 2007). The web-based methodologies reviewed by this research did not find any methodology that could incorporate these critical factors throughout the entire web-based development process. These factors are incorporated within an emergent organisation that seeks to improve web-based aesthetics whilst accommodating internet speed (Truex, Baskerville & Klien, 1999).

However, the action researcher found different phases from the different WBIS methodologies which are useful to the development process. Howcroft & Carroll (2000) methodology caters for web-based aesthetics but not for internet speed. The WBIS methodology requires more applicable approach to incorporate these factors. It is important to incorporate these factors into methodologies (Fitzgerald et al, 2002). Fitzgerald et al (2002) identified that understanding and overcoming critical web-based factors may enable web developers to use appropriate methodologies more often. Baskerville, Pries-Heje & Ramesh, (2007) mention that the use of

appropriate methodologies can be facilitated by the development of an analytical development tool. He urges researchers to conduct research in order to enhance knowledge and understanding to this phenomenon. This research takes up this call from other researchers to develop an analytical development tool.

2.15 Adopting an Appropriate WBIS Methodology

This research strongly supports the idea that an appropriate context-based WBIS methodology should be applied to the WBIS development process (Baskerville, Pries-Heje & Ramesh, 2007; Kautz, Madsen & Norbjerg, 2007). The research reviewed eight methodologies. All eight methodologies reviewed had both positive and negative aspects. The web developer tried to utilise these methodologies in practice. None of these eight methodologies could be implemented in practice from start to finish.

Lang (2002) recommends that trial-and-error approaches of WBIS methodologies must be abandoned so as to adopt more appropriate methodical and systematic engineering approaches for WBIS development. The researcher views Lang (2002) argument as problematic, because of the changing nature of organisations (Truex, Baskerville & Klien, 1999). The use of amethodical and systematic approach is logically flawed (Patel & Hackney, 2008). This present research seeks to adopt an iterative methodology in order to understand WBIS development in a changing organisation (Coghlan & Brannick, 2005).

2.16 Amethodical WBIS Development Problem needs Action Research

To understand amethodical WBIS development process, action research is used as an iterative form to understand this development process. Truex, Baskerville, & Travis (2000) question the WBIS development problem of not developing methodically. The term denoting this problem is amethodical. This problem is a negative construct that suggests an open set of attributes that are

essentially not methodical (Truex, Baskerville, & Travis, 2000). The researcher uses their amethodical notion to explain that the methodical process may reject structure, but does not imply anarchy or chaos.

Building amethodical WBIS needs management and orchestration of WBIS development without predefined sequence, control, rationality, or claims to universality (Truex, Baskerville, & Travis, 2000). They describe an amethodical development activity as unique and unpredictable. To gain knowledge and understanding of this phenomenon the action researcher used an action research method to capture the unpredictability inherent in WBIS development.

Avison et al (1999) argue that researchers should go beyond developing methodologies, case studies and theories by trying them out in practice. They state that in action research the researcher wants to try out a theory with practitioners in real situations, gain feedback from this experience, modify the theory as a result of this feedback, and try it again. The iteration of this action research process adds to the theory so that it is more appropriate for a variety of situations (Avison et al, 1999). Therefore, it is essential to not only document what is occurring in the real world, but also to test its relevancy in practice. An action research approach would be a suitable research method that informs both theory and practice (Coghlan & Brannick, 2005).

2.17 Summary of Web-based Information Systems Development

Web developers realise that a single development methodology may not fit all situations that occur in WBIS development (Fitzgerald et al, 2002). This section has reviewed selected development methodologies, which are used for WBIS development. Although the characteristics of the eight methodologies are different, their major objectives are considered the same as they assist the web developer in the WBIS development process.

The sub questions in the present research places emphasis on documenting the web developer's influence and ability on how to improve the development process. This knowledge will generate deeper understanding and ultimately add insights into the current web-based development methods from a web developer perspective.

In order to systemise the knowledge of how to develop WBIS, a good theory is needed to build up knowledge cumulatively (Weick, 1995). The reason for a good theory is that it will demonstrate what is agreed and it will help to identify the areas where further work is needed. The often quoted dictum of Kurt Lewin (1945) is that "nothing is so practical as a good theory", remains relevant today. Without good theory, there is greater risk that research studies may become more fragmented and inconsistent. Good theories provide researchers with better understanding to undertake the research study (Sutton & Straw, 1995). In Dwivedi et al (2009) Dale Goodhue describes it as "a theory is 'a stool' that you stand on to get a better view". The use of suitable theory to inform the present research is critically discussed in the following section.

2.18 Information System Theories for Emergent Organisations

The IS discipline, uses information system theories to understand organisational information flow and the construction of organisational IS in emergent organisations (Truex & Baskerville, 1998). According to the Association for IS (AIS) there are currently eighty-three theories in the IS domain as of May 2009 (AIS, 2009).

Weick (1995) debates what makes a good theory and comments that researchers need theories that are relevant for their given context. Bacharach (1989) argues that the very essence of good theory is formed by constructs and their relationships. The importance of constructs and relationship to theory development appears to be widely accepted by both IS researchers and by those working in other disciplines (Bacharach, 1989). Conversely, Sutton & Straw (1995) argue

about what theory is not and describe the need for sound explanations as opposed to purely development of constructs and relationships. The action researcher agrees with the perspectives of Weick (1995), Bacharach (1989) and Sutton & Straw (1995). The action researcher uses theory as necessary to inform the design and development of WBIS in and for emergent higher education organisations.

Gregor (2006) examined the structural nature of theory presented in fifty IS articles from March 2003 to June 2004. She identified five different types of theories, all of which are interrelated, though none more significant than the other. To clearly distinguish between the different types of theories, a table from Gregor (2006) work is presented in Table 2.

Table 2: A Taxonomy of Theory Types in IS Research (Gregor, 2006)

Theory Type	**Distinguishing attributes**
Analysis	Says "what is". The theory does not extend beyond analysis and description. No causal relationships among phenomena are specified and no predictions are made.
Explanation	Says "what is", "how", "why", "when", "where". The theory provides explanations but does not aim to predict with any precision. There are not testable propositions.
Prediction	Says "what is" and "what will be" The theory provides predictions and has testable propositions but does not have well-developed justificatory causal explanations.
Explanation and Prediction	Says "what is", "how", "why", "when", "where" and "what will be". Provides predictions and have both testable propositions and causal explanations.
Design and Action	Says "how to do something" The theory gives explicit prescriptions (e.g., methods, techniques, principles of form and function) for constructing an artefact.

The advantage of identifying different types of theory encourages practitioners and academics to think clearly about what type of knowledge is being generated (Gregor, 2006). Further, the aim

and objectives set out in chapter one are aligned with Gregor's (2006) identification of different types of theory. The aim in chapter one is to answer a "how to do something" question. Therefore, the type of theory needed is a design and action theory (Table 2). This enabled the action researcher to focus accurately on what type of theory is needed for this action research investigation.

The present research focuses on theories for design and action which explain "how to do something" (Gregor, 2006). This type of theory emanates from Walls et al's (1992) work, which postulates that: the IS discipline needs to articulate and develop a class of "design theories". They describe design theories as prescriptive theories with theoretical underpinnings which say how a design process can be carried out (Walls et al, 1992). Further, they state that by utilising an applicable good theory it can provide understanding and focus on addressing the problem. Hambrick (2007) further emphasizes the importance of theory in research as theory helps researchers to: "organise our thoughts, generate coherent explanations and improve our predictions". However, in the work of Dwivedi et al (2009) Dr Robert M Davison cautions researchers to pay particular attention to the process of selecting a theory for specific contextual use. He also advocates that researchers should evaluate the theories that may be: more practical, useful or relevant for their given context. The action researcher agrees with Hambrick (2007) and Dwivedi et al (2009) that the use of theory is necessary to inform the design and development of WBIS in and for emergent higher education organisations.

2.19 Theories in Information Systems

Dwivedi et al (2009) identifies seven strands of theory in IS. These seven strands are:

- Theory development and extension,
- Information System Development,
- Innovation, Adoption and Diffusion,

- Management Theories,
- Marketing Theories,
- Sociological and Cultural Theories
- Psychological and Behavioural Theories

Among these seven strands, the information system development strand is the most appropriate strand for the present research, given the context of the research. Through Dwivedi et al's (2009) work, the action researcher can select an appropriate ISD theory to inform practice. Dwivedi et al's (2009) work identified appropriate theories (e.g. language-action perspective and the theory of deferred action) for understanding the process and practice of ISD. Further, Gregor's (2006) research enabled the action researcher to identify whether the appropriate theories (e.g. language-action perspective and the theory of deferred action) are considered as design and action theories. This is important because the action researcher needed to ascertain whether the design and action theory is appropriate to answer the research question.

Walls et al (1992) outlined a design theory of vigilant information systems (VIS) which is intended to provide rigorous and valid guidance for executive information systems (EIS) design. Their design theory of VIS does not address the problem of how to rationally develop WBIS for emergent organisations. Their design theory fails because it does not incorporate the emergence phenomena of organisations. However, they do present an approach to build and test design theories in the IS domain. Their approach can be useful as a method for validating design theories. They postulate seven characteristics of a design theory, which are:

1) Design theories must deal with goals as contingencies
2) A design theory can never involve pure explanation or prediction
3) Design theories are prescriptive
4) Design theories are composite theories which encompass kernel theories from natural science

5) While explanatory theories tell "what is". Predictive theories tell "what will be", and normative theories tell "what should be", design theories tell "how to/because"
6) Design theories show how explanatory, predictive or normative theories can be put to practical use.
7) Design theories are theories of procedural rationality (Simon, 1981)

Further, Nagel (1961) states a design theory must be subject to empirical refutation if it is to be a good theory. An assertion that possession of a particular set of attributes will enable the theory to meet the goals can be verified by building and testing the theory (Walls et al 1992).

Dwivedi et al (2009) identifies three types of theory that might be appropriate for a research investigation. These three theories are Schoop's (2001) language action perspective, Markus et al's (2002) design theory for systems that support emergent knowledge processes and Patel's (2006) theory of deferred action.

Schoop's (2001) Language Action Perspective (LAP) is an alternative foundation for analysing and designing effective IS. Schoop's LAP provides guidance for researchers to gain understanding on how people use communication to coordinate their activities to achieve common goals. The LAP approach can be used as a theoretical guidance to analyse and resolve web service problems. The aim of web services is to support communication among services to achieve business goals (Umpathy & Purao, 2007a). There is a close match between web services and the LAP approach (Schoop, 2001). However, the rationale of how to develop WBIS in an emergent organisation is not addressed by LAP. The action researcher needs a theory that gives guidance in the form of design constructs on how to design rationally a WBIS for emergent organisation.

Markus et al (2002) proposed a design theory for systems that support emergent knowledge processes. Their Information Systems design theory is for a class of user requirements which they call emergent knowledge processes (EKPs). Markus et al (2002) stated that emergent

knowledge processes are organisational activity patterns that exhibit three characteristics in combination: deliberations with no best structure or sequence; highly unpredictable potential users and work contexts; and information requirements that include general, specific, and tacit knowledge distributed across experts and non-experts. They give examples of their theory which include basic research, new product development, strategic business planning, and organisational design. However, their design theory lacks good theoretical understanding of what is an IS.

Patel et al (2009c, pp.165) describes two types of IS. These are simple and complex IS. An Information System is termed simple when what is wanted is perfectly known and when complete and predictable information and knowledge is available to organise the available resources to achieve it (Patel, 2009c, pp.165). Conversely, he states that complex IS has much design uncertainty. The web developer experienced incomplete and imperfect information and knowledge about the WBIS at the development stage. Web developers work with incomplete knowledge of what is wanted, imperfect information about how to design and develop, as well as incomplete information on available resources and how to organise them (Patel, 2009c, pp.165). Therefore, the type of IS developed by the web developer is termed complex IS.

Both organisation structure and resources are unpredictable because they operate in a constantly changing environment (Feldman 2000; 2004). The present research needs theory from an IS background that answers the question of: how to design IS that have no predetermined structure and function when such structure takes shape in context (Patel, 2009c, pp.166). One such theory that addresses this problem is Patel's (2006) theory of deferred action.

2.20 Theory of Deferred Action

The theory of deferred action explains the effect of emergence on the rational design of information systems (Patel, 2009c, pp.164). As a theory to inform practice it provides guidance

in the form of design constructs on how to design, in a rational way, information systems for emergent organisation (Patel, 2009c, pp.164).

The purpose of the theory of deferred action is to facilitate the design of IT artefacts that will be used by individuals and organisations to act purposefully or to achieve objectives (AIS, 2010). The theory is used in IS as cited by Association for Information Systems (AIS, 2010).

Patel, (2009c, pp.164) states that design theories for normal organisations exist but are borrowed from other disciplines (Walls, et al, 1992; Markus et al, 2002). The theory of deferred action enabled the action researcher to overcome the lack of good theoretical understanding of information systems (Patel, 2009c, pp.165). Theory helps to provide theoretical bases and inform design of IS for emergent organisations. The theory of deferred action fills these two criteria. The theory of deferred action is drawn from the information systems discipline to inform practice and design for emergent organisation (Patel, 2009c, pp.164).

Patel (2009b) describes the theory of deferred action (ToDA) as a design and action theory which facilitates the development of IS & IT artefacts. He states that the theory (which informs practice) is based on complexity theory. This meets one of Walls et al's (1992) criteria for design theory that they are composite theories which encompass kernel theories from natural science; complexity theory is a natural science theory that explains complex systems. Patel's (2009b) theory focuses in particular on complex adaptive systems. The attributes of human dimension to advance and improve design quality are incorporated within ToDA (Patel, 2009b). The incorporation of complexity is used to understand emergence in information systems and design processes (Patel, 2009b). A key element of complexity theory is emergence, a constant "phase change" arising from emergence (Patel, 2009c, pp.166). McMillan (2004) states that emergence requires adaptive systems for IS.

Design principles stemming from the theory of deferred action are used to develop a research agenda based on the concept of deferred design (Purao et al 2003). Deferred systems design is freezing the system until the user decides what the system will become at the time of use (Patel 2002). Patel's (2009a) ToDA can be used to provide suitable design constructs and design processes for developing WBIS in emergent organisations. His three design constructs are planned action, emergence and deferred action. He describes these constructs as meta-design dimensions for designing informational and knowledge artefacts for emergent organisation (Patel, 2009c, pp.175).

The construct planned action is organisational behaviour devised from some formalism, 'it prescribes actual action as predetermined moves' (Patel, 2009c pp.175; Patel, 2006, pp.73). Therefore, it assumes stable organisational structure and processes. For example, a three year strategic plan for a WBIS is planned action because it has specific goals that need to be achieved.

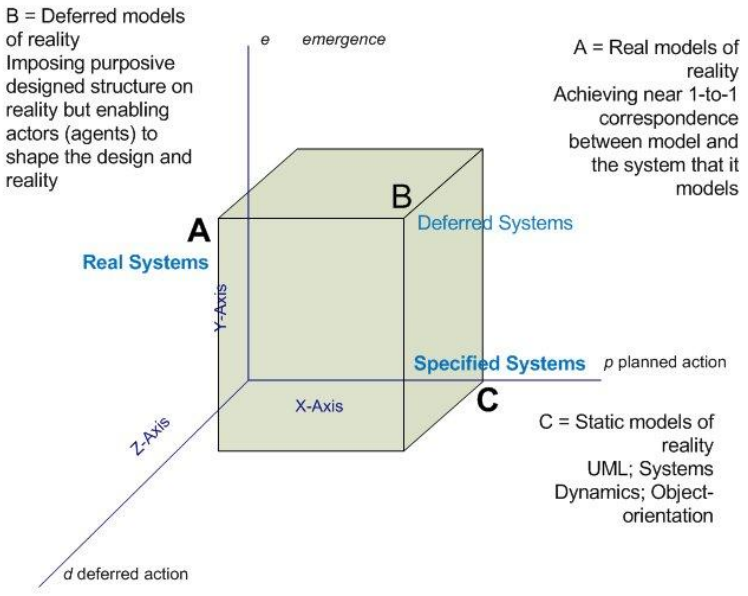
The construct emergence is 'the occurrence of unplanned and unpredictable human events out of bounds of rational analysis and therefore off-design' (Patel, 2006, pp.116). Emergence is the pattern that arises through interactions of people and WBIS within their organisation. McMillan (2004, pp32) states that emergence is 'the phenomenon of the process of evolving, of adapting and transforming spontaneously and intuitively to changing circumstances and finding new ways of being'. However, Checkland (1999) views emergence as applicable to the whole organisation and not meaningful when applied to parts of the organisation. Checkland (1972) Soft Systems Methodology implicitly recognises emergence, but is flawed because the very act of modelling it assumes it can be predicted (Patel & Hackney, 2008).

The construct deferred action is the synthetic outcome of relating planned action and emergence (Patel, 2009c, pp.176). Patel (2009a) states that deferred action is the synthesis of planned and situated action. He contends that deferred action enables people to modify an IS within the particular context of its use. Deferred action relates current emergent action with planned action (Patel 2006, pp.96). Further, deferred action is the theoretical understanding of requirements for

web design (Patel, 2009a). This means that deferred action explains how web developers understand the requirements necessary in an emergent organisation. ToDA purposefully incorporates the mechanism of deferred action which enables growth of the design within actuality (Patel, 2009b). The researcher agrees with Patel (2009b) that deferred action enables the web developer (designer) to shape the WBIS in a live context.

The relationships among these three constructs (planned action, emergence & deferred action) are illustrated in Figure 2. ToDA as in Figure 2 is also known as the deferred model of reality.

Figure 2: Theory of Deferred Action (Source Patel, 2007)



Patel (2009b) describes these dimensions of planned action (rational design), emergence and deferred action as the three constructs of ToDA. He states that these three constructs, when amalgamated result in different design models of reality. One example of this is depicting the

implementable different system types: real systems, deferred systems, and specified systems (Patel, 2007).

Patel (2007) illustrates from Figure 2 that there are three model types: real models, deferred models and static models of reality. Point A is real models. Real models of reality achieve near perfect replication between the model and the system. Point B is deferred models. Deferred models impose design structure on reality. It enables agents to shape the design to actual reality. Point C is static models. Static models are specified models of reality i.e. UML (Figure, 2). (Patel, 2007)

Patel (2009b) argues that real systems are designed in real-time by reflective designers, technical specialists and are not predetermined but designed during use in actuality. Further, he states that a real system is enacted in the situation by active developers, agents in the situation, with the overall objective set as plans by reflective developers (Patel, 2009c, pp.180). An example of a real system would be air traffic control because it is dependent on events in real-time (Patel, 2006, p.104).

Patel (2009b) identifies that deferred systems are characterised by high emergence, high level of deferred action, and low capacity to plan system functionality and information needs centrally. He states that deferred systems function within their environment in response to emergent factors. Their functionality is not pre-specified but arises from the intentions of individuals or groups who interact with it in context (Patel, 2007). Therefore, a deferred system is deferred until the actor decides what the system will become (Patel, 2009c, pp.178-179). An example of a deferred system is the World Wide Web. As the capacity to plan how the system is used is low because of emergence and the consequent need for deferred action (Patel, 2006, p.106).

Patel (2009a) explains that specified systems are designed and shaped prior to use. He states that complete design knowledge is assumed at the start of the development process. Specified systems admit no emergence and assume high capability for specification design (Patel, 2009c,

pp.181). An example of a specified system includes payroll and sales involving routine data processing (Patel, 2006, p.104).

Patel (2007) explains the three interrelated dimensions. He describes the first dimension as planned action, which states that organisations plan. The second dimension is emergence, which explains the changing nature of organisations and its effect on the use of Information Technology (IT) (Patel, 2007). The third dimension is deferred action, which is how action is taken by actors to overcome emergence in organisational context (Patel 2009b). Patel's (2007) three dimensional analysis enabled the web developer to understand the phenomenon of emergent organisation and WBIS development more accurately.

2.21 ToDA's Applicability to Practice

Patel et al (2009a) work identified that the deferred action construct of ToDA is used by researchers and practitioners (Sotiropoulou and Theotokis, 2005; Stamoulis and Kanellis, 2001). He stated that Dron (2005) invoked deferred systems to design systems that have changing functionality. He further stated that Elliman and Eatock (2005) developed the online E-Arbitraton-T system capable of handling workflow for any legal arbitration case, therefore meeting the emergence criteria. Elliman and Eatock (2005) applied the deferred design decisions principle to manage the open and changing system requirements. This enabled users to make design choices rather than the system developer.

The ToDA has been used by IS researchers. There are two main exemplars of the ToDA's applicability to practice. These are within the domains of legal arbitration and organisational learning.

Elliman and Eatock (2005) developed the online E-Arbitration-T system capable of handling workflow for any legal arbitration case. Their research aimed to develop an online system for

European Small Medium Enterprises (SMEs). They also sought to resolve disputes internationally. They applied the deferred design principle, to manage the open and changing system requirements and making their system an open system. Their research enabled users to make design choices rather than the system developer.

The deferred action construct is reflected in deferred learning systems. Dron (2005) invokes deferred systems to design systems that have 'emergent structure', allowing the system to have changing functionality. His system was not designed from requirements but takes shape in response to the actions of the users. He developed a self-organising e-learning web-based system called CoFIND. Self organisation in CoFIND results in emergent structure which the system needs to reflect. He mentioned that CoFIND is not designed from requirements but takes shape in response to the actions of the people that use it.

Patel & Hackney (2008) identify emergence from general systems theory (GST) and systems thinking as a critical feature of systems analysis and design. Their work notes that there is little theoretical understanding of emergence in systems analysis and design and that there are no practical techniques to model emergence. They use the theory of deferred action based on the three dimensional analysis of their resultant constructs to enable systems analysis of emergence and its development for systems design.

Future development of ToDA

Deeper empirical investigation is planned to test the effect of emergence on rational design (Patel, 2009c, pp.186). He advocates that data to validate deferment points is needed and to clearly define the operational principle of deferred design decisions. Deferment point is clearly stating when the action developer should defer the design process. This is to be supported with empirical data (Patel, 2009c, pp.187). Further, development of new theoretical constructs from data is needed to improve rational design in emergence (Patel, 2009c, pp.187).

The present research takes ToDA as the focal theory. Its three main correlated constructs are used to explain the web developer's WBIS development process. These constructs are planned action, emergence and deferred action. The resultant deferred system model is the basis for investigating WBIS in an emergent organisation. The constructs of ToDA assisted the web developer to more accurately inform the manager. This was done by developing an analytical development tool through ToDA. The analytical development tool is intended to assist the web developer in understanding emergence in a higher educational WBIS development context.

2.22 Summary of Theory for Web-based Information Systems

The theoretical section of this chapter demonstrates that there are different types of IS theory available to the researcher. It is critical for the researcher to select an appropriate and applicable theory from the eighty-three available theories in the IS domain (Patel et al, 2009c). It was argued above that the design and action theory type is relevant for the present research and that the ToDA, which is a design and action type, is the most appropriate theory.

Gregor (2006) establishes that IS has problems of its own in relation to theory. She states that this is so because it's an interdisciplinary field, which is concerned with both the study of technology and human behaviour. Gregor (2006) argues that many scholars have backgrounds in diverse fields, from mathematics, to management and the natural sciences. Reconciling the different views depends on our goals and the necessary critical steps which are needed to move the IS discipline forward (Gregor, 2006).

The action researcher in the present research uses the ToDA to inform practice and improve the rational development of WBIS for emergent organisations. Gregor (2006) labels the IS community as: 'still struggling to identify strong theories that are unique to IS'. Patel's (2009b) work is identified as a unique theory to IS.

The qualitative action research investigation added rigour to the use of ToDA in an emergent organisational context. For ToDA to become a strong theory, Nagel (1961) argues that ToDA needs to be tested both qualitatively and quantitatively.

2.23 Concluding Remarks

The literature review chapter brings together three main parts viz. understanding emergent organisations, WBIS development and suitable theory to investigate this phenomenon of WBIS development for emergent organisations. The review identifies the use of ToDA as a suitable theory to inform practice (Patel, 2009b). Aligned with Hambrick (2007), ToDA enabled the researcher to: organise thoughts, generate coherent explanations and improve predictions.

CHAPTER 3: The Methodology of Action Research

3.1 Introduction

This chapter establishes why the interpretivist researcher used action research (AR) methodology for this investigation. The AR methodology was used to answer the research questions. The main research question is a real world operations and management problem faced by the web developer and his manager in an emergent organisation. The action researcher discusses the use of AR as opposed to an alternative method for conducting the research viz. case study method. The relevance of the AR methodological approach for understanding the problem is discussed. The AR methodology is used to accommodate the changing nature of Brunel University as an emergent organisation. This enabled the web developer to propose possible solutions to WBIS development problems encountered. The AR data permitted the researcher to capture appropriate qualitative data. This AR data was used in the data analysis process by the action researcher to answer the research questions and to contribute to the extension of ToDA for practical use.

The methodology identifies the time periods for conducting the investigation. The action researcher's statement for good ethical practice is presented. The theoretical and practical benefit derived by conducting the AR is given. The action researcher's approach as an interpretivist researcher is explained. Finally, why other epistemologies are not relevant are discussed.

3.2 Ontology and Epistemology

The action researcher views deferred systems as a model of reality. Therefore, the action researcher's ontology is that reality is emergent but it can be moulded by humans to achieve predetermined goals. The action researcher views social action (organisations) as emergent. However, organisations can be planned rationally to achieve specific goals (designed rationally). The action researcher's epistemology is that the knowledge of his ontology can be obtained

through action research. The action researcher's choice of interpretivist epistemology, using the qualitative action research method, is informed by his stance that organisations and their use of IS are eventually emergent.

Moses & Knutsen (2007, pp.1) argue that the action researcher's selection of a methodology is influenced by his ontological and epistemological perspective. They state that the ontological and epistemological beliefs of the researcher influence the structure and processes of social research. This is evident in Vidgen's (2002) work. He aligned his ontological and epistemological perspective through the use of AR in constructing a web based information system development methodology. Machamer (2002) states that ontology and epistemology provides explanations in the area of philosophy of science. Sarantakos (2005) explained that ontology informs methodologies as to "what" social research is supposed to study. He sees ontology as a term from theology and is concerned with the nature or essence of things. Ontological assumptions focus on issues around being human within the world and whether a person sees social reality or aspects of the social world as external, independent, given and objectively real or instead as socially constructed and subjectively experienced (Wellington et al, 2005).

However, epistemology is the theory of knowledge. Epistemology constitutes knowledge; from where it comes; whose knowledge it is; what kind of knowledge is possible to know, understand and represent (Bryman & Bell, 2003). Bryman & Bell (2003) stated that an epistemological issue concerns the question of what is considered as acceptable knowledge in a discipline. Epistemology informs methodologies about the nature of knowledge, or about what counts as a fact and where knowledge is to be sought (Sarantakos, 2005).

Methodology as a research strategy translates ontological and epistemological principles into guidelines that show how research should be conducted (Cook and Fonow, 1990, p.72). The action researcher agrees with the Cook and Fonow, (1990, p.72) stance. The interpretivist ontological and epistemological assumption is the deferred model of reality. It is affected by

emergence and is aligned with the AR strategy used. This AR strategy involved using only qualitative data as opposed to quantitative data. The use of purely qualitative data is aligned with the action researcher's interpretivist ontological and epistemological perspective on the emergent nature of organisations.

3.3 Appropriateness of Qualitative and Quantitative Methods

Researchers argue that there is a division between qualitative and quantitative research methods (Myers 1997a, Myers 1997b, Myers and Avison 2002). However, some interesting examples that help to establish the researcher's position are discussed below.

Myers & Avison (2002 p.4) states that the field of natural sciences used quantitative research methods originally to study natural phenomena. They contend that quantitative methods include survey methods, laboratory experiments, formal methods (for example, econometrics) and numerical methods such as mathematical modelling. However, they argue that qualitative methods enable researchers to study social and cultural phenomena. Myers & Avison (2002 p.4) contend that qualitative methods help researchers to answer research questions in live contexts. Further, that qualitative research includes action research, case study research and ethnography. The particular data collection methods with these research methods include: interviews, questionnaires, documents, texts and the researcher's impressions.

Mason (1996, p.6) argues that qualitative research methods should not be seen as a unified body of philosophy and practice. She states that qualitative methods cannot be seen simply either as supporting or in opposition to quantitative research. Further, that the justification for selecting one or combing research methods should be aligned with the researcher's aims and objectives. However, Myers & Avison (2002) mentioned that the word 'qualitative' is not a synonym for 'interpretive'. Actually, 'qualitative' research can be 'positivist', whereas 'quantitative' research can also be viewed from an 'interpretive' perspective (Kaplan & Duchon, 1988).

Bryman (2007) suggests that many researchers place themselves solely on one side of this divide, as either quantitative or qualitative researchers. He states that researchers adhere to one research approach. He mentions that a survey questionnaire is used by quantitative researchers, while interviews and observations are more commonly adopted as the data collection instruments for the qualitative researcher. However, Creswell (2003) supports the combination of quantitative and qualitative methods (mixed methods) to increase the effectiveness of the results and findings, which can be validated through the triangulation technique. Liying (2005, pp.72) defines triangulation in social sciences as being used to indicate that two or more methods are used in a study with the intention of checking the results. Triangulation helps to determine a reliable and valid conclusion. Mingers (2001) argues that researchers should use mixed methods. He claims that combining the methods will lead to richer and more reliable research results.

The action researcher finds it incoherent to mix together methods from different paradigms. This is because the action researcher views research methods as being bound to particular paradigms. 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).

Myers & Avison (2002) recognise that all research both qualitative and quantitative research approaches, need to refer to some principal assumptions. These principal assumptions concern what represents valid research that determines the methods that can be adopted for data collection. Myers (1997a), Carroll & Swatman (2000), Myers & Avison (2002) stated that there is a set of research paradigms which are to be considered when conducting research. These are positivist and interpretivist research paradigms.

3.4 An Interpretivist Stance on Research Paradigms

The action researcher used the interpretivist qualitative action research methodology. The interpretivist action research methodology was used to answer the research questions and aligned with the action researcher's epistemological and ontological perspective. This action research methodology is undertaken from an interpretivist perspective. Myers & Avison (2002), characterisation of positivist and interpretivist is discussed in the following sub section.

3.4.1 Positivist Research

Myers and Avison (2002 p.6) contend that positivists believe that "reality is objectively given and can be described by measurable properties, which are independent of the observer (researcher) and his or her instrument". They state that "positivist studies generally attempt to test theory, to increase the predictive understanding of the phenomena". Their view of positivists assumes that there is a real world situation out there, independent of our experience of it and that we can gain access to that world by thinking, observing and recording our experiences carefully. This process helps scientists reveal patterns that exist in nature but are often obscured by the complexities of life (Moses & Knutsen, 2007).

This positivist epistemology is not aligned with the researcher's ontological stance. The research problem involves understanding social action. Therefore to investigate the phenomena the researcher cannot be independent of the observer as stated from a positivist perspective. The researcher is required to delve into the processes of subjective interpretation, acknowledging the specific motivations and the interests of the participants. This is a key perspective of the interpretivist research paradigm.

3.4.2 Interpretivist Research

Walsham (1995) stated that interpretivists normally begin with the assumption of socially constructed reality attempt to understand phenomena through the meaning people assign to them. Interpretivists argue that simple fundamental laws, characteristic of positivism are insufficient to understand the whole complexity of social phenomena. More importantly, Walsham (1995) claims that an objective observation of the social world is impossible; as the social world has a meaning for human beings and is constructed by intentional behaviour and actions. Interpretivists contend that knowledge is developed and theory built by developing ideas induced from the observed and interpreted social constructions (Walsham, 1995). The researcher's emphasis on making sense of what is occurring during the research process sometimes generates unexpected findings which are beyond the current common scientific knowledge.

Walsham (2006) explains that interpretivists attempt to understand subjective realities and to offer interpretative explanations, which are meaningful for the participants of the research. He states that the involvement of the researcher in the research is most apparent in action research. Action research is where the researcher engages in active collaboration with participants to address real-life problems in a specific context, and aims to offer and implement feasible solutions to the problem (Coghlan & Brannick, 2005).

Walsham (2006) stated that interpretivists reject the notion of value-free research. Axiology is concerned with the values of researchers. He believes that researchers offer a value-laden interpretation of how people interpret the social world. He also sees the researcher's interpretation as socially constructed, which reflects researchers' motives and beliefs. Habermas (1970) stated that human interests not only channel our thinking, but also guide how we investigate the world (i.e. what questions we ask) and how we construct our knowledge (i.e. how we formulate the answers found). Further, Habermas (1970) stated that the action research approach is used to research social phenomena. This reflects the researcher's common construction of his knowledge through his basic beliefs to do with the world.

Interpretivism implies the following assumptions Walsham (1995, 2006):

- The social world is observed by seeing what meanings people give to it and interpreting these meanings from their viewpoint.

- Social phenomena can only be understood by looking at the totality.

Walsham (2006) contends that interpretivist's research social phenomenon by making sense of how people interpret the social world. He argues that this requires the researcher to delve into the processes of subjective interpretation, acknowledging the specific motivations and the interests of the participants. He also states that compared to natural phenomena; social phenomenon are characterised by a high complexity and are often unique, as they result from multiple circumstances which are constructed by many individuals.

This means that Walsham's (2006) definition of interpretivism does not attach a great deal of importance to the generalisability of findings. He states that the world and especially the business world are constantly changing, and what seemed sensible three years ago may not hold at all now. Hence, in an ever changing world, generalization, even over short periods of time, becomes questionable (Walsham, 2006).

Vidgen (2002) undertook an interpretivist research investigation that spanned two years and involved building an e-commerce application for a UK-based small to medium enterprise (SME). This investigation established the appropriateness of using the multiview framework methodology for WBIS development. Other notable interpretivist work relating to WBIS include Baskerville & Pries-Heje (2004). Their work establishes the notion of internet speed through an analysis of two studies in the US and Denmark. These two studies from 2000-2001 revealed that the nature of IS development has changed with the coming of internet speed. Baskerville & Pries-Heje (2004) reveal that systems are continually growing to adapt to emergent organisation

where requirements are fluid, architecture and components are key, and maintenance never rises as a concern.

Myers (2009) contends that just as there are various philosophical perspectives which can inform qualitative research, so there are various qualitative research methods. He states that a research method is a strategy of inquiry which moves from the underlying philosophical assumptions, to research design and data collection. He states that the choice of research method influences the way in which the researcher collects data. Further, he states that specific research methods also imply the need for different skills, assumptions and research practices. Finally, these characteristics will be discussed further in the following section.

3.5 Justifying Action Research or Case Study as a Qualitative Method

Researchers could implement either action research or case study method to address research questions in IS (Clark 1972; Checkland 1991; Wood-Harper 1992; Levin 1994; Yin 1994; Baskerville and Wood-Harper 1996; Avison et al 1999; Baskerville and Pries-Heje 1999; Davison, Martinsons and Kock 2004).

This section debates whether action research or case study method is suitable for answering the research questions posed in this investigation. Both methods follow an interpretive perspective (Walsham, 2006) in investigating the phenomenon of how a web developer develops WBIS in an emergent organisation. Therefore, the argument that the researcher is an integral part of the research needs to be a prominent characteristic within either action research or case study. Further, not only is the study of the problem within emergent organisation important, but also that an iterative process of refinement, by which the research ideas could be developed, pruned and tested iteratively, is needed.

Table 3: Contextualisation of Action Research

	Positivism	**Action Research**
Scope Dynamic	Context-free	Context based
Method	Cause-effect relationship	Insights which may not be quantifiable
Role of Researcher	Detached observer	Actively involved
Goal	Set by researcher and selected participants	Negotiated with whole client group
Outcome	Laws, generalisations	Context-dependant insights

Wood-Harper's (1992) Table 3 identifies the difference between positivism and action research through five criteria. These criteria are the scope dynamic, method, role of researcher, goal and outcome. These criteria assist in the argument for using action research through an interpretivist perspective (Wood-Harper, 1992). The characteristics of the action research approach, as seen from Table 3, facilitate the achievement of the main research objective. The main research objective is the development of an analytical development tool. The researcher is actively involved in negotiating with the whole client group when developing this analytical tool.

The action researcher used Coghlan & Brannick (2005) recommendation for action research that the investigation should be conducted through two studies. This involved the action researcher documenting the issues in the first study, then reflecting on them and utilising the result in the second study. A more detailed account of how the action researcher's studies were conducted is detailed in this chapter's research design section.

Yin (1994) describes the strengths and weaknesses of using the case study method (Table 4). However, the case study method is inadequate to answer the research questions. This is because firstly, that the problem requires an iterative approach and secondly that the researcher needs to be actively involved. For example Table 4 identifies the weakness of documentation. This weakness relates to access of the documents which may be deliberately blocked.

Table 4: Strengths & Weaknesses of Case Study Method (Yin, 1994)

Method of data Collection	Strengths	Weaknesses
Documentation	Stable – can be reviewed repeatedly Unobtrusive – not created as result of case study Exact – contains exact names, references and details of an event Broad Coverage – long span of time, many events and many settings	Retrievability – can be low Biased selectivity – if collection is incomplete Reporting bias – reflects bias of the author Access – may be deliberately blocked
Archival records	Same as above for documentation Precise and quantitative	Same as above for documentation Accessibility due to privacy reasons
Interviews	Targeted – focuses directly on case study topic Insightful – provides perceived causal influences	Bias due to poorly constructed questions Response bias Inaccuracies due to poor recall Reflexivity – interviewee gives what interviewer wants to hear
Participant observation	Reality – covers events in real time Contextual – covers context of events Insightful into interpersonal behaviour and motives	Time consuming Selectivity – unless broad coverage Reflexivity – event may process differently because it is being observed Cost – hours needed by human observers Bias due to investigators manipulations

3.6 Action Research Methodology

Baskerville, Pries-Heje & Ramesh, (2007) argue that understanding how a web developer develops WBIS needs an appropriate research methodology to learn about the actual and situated practice of WBIS development through first-hand experience. They state that an appropriate

research methodology is critical to the development of practically applicable knowledge. This is because once it is incorporated in the research investigation it helps to: draw on theory, gain feedback, modify theory to practice and test possible solutions iteratively. They advocate that by using this type of investigative action research methodology, new insights can be gained to understand the problem in its context and creating practically applicable solutions.

3.7 Initiating an Action Research Method

Coghlan and McDonagh (2001) recommended that to investigate how a web developer develops in a continuously changing organisation, the researcher needs to utilise action research to solve this problem. Specifically, they state that action research relates to the integration of information technology into continuously changing organisations and can make a major contribution to solving their problem.

Checkland & Holwell (1998) perspective on AR aims to improve the real world situation and the acquisition of knowledge. Their perception requires a recoverable research process based upon a prior declaration of epistemology. The action researcher agrees with Checkland & Holwell (1998) conclusion and has stated prior to the initiation of an AR investigation that his approach is an interpretivist epistemological stance. A declared epistemology therefore is a recoverable research process.

Coghlan & McAuliffe (2003) stated that the action research method incorporates data-gathering techniques which are designed to fit both the organisational setting and the research objective. They advocate three main types of research data all of which were collected and compiled in connection with the development of the student services WBIS. These research data types are: documenting action research cycles, work documents and conducting semi-structured interviews. These data collection techniques as they relate to the present research are discussed in the action research data collection techniques section.

3.8 The Action Research Method

The present research used Coghlan & Brannick's (2005) action research (AR) approach, to inform the interpretivist researcher in learning about the 'actual and situated practice' of WBIS through first-hand experience. Their AR approach enabled the action researcher to avoid the distorting lens of a purely theoretical approach in relation to the study of WBIS development (Truex, Baskerville & Travis, 2000). Coghlan & Brannick's (2005) invoke a good definition of AR from Rappoport (1970:499) who stated that: 'Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joining collaboration within a mutually accepted ethical framework'.

Oates (2006) identified that there was a change in paradigm shift during the latter part of the 20th Century towards an interpretive AR approach. He labelled this shift as a "linguistic turn" of social science. He believed that it was brought about through the difference between the world itself and the interpreted experience of the world or interpretivism. He stated that interpretivism is where reality exists and that it can be accessed through social constructions, such as, language, shared meanings and understanding. Further he states that interpretive studies examine people in their social settings to understand phenomena through the meanings people assign to them. Checkland and Holwell (1998, pp.22) describe the interpretivists aim as "an organised discovery of how human agents make sense of their perceived worlds, and how those perceptions change over time and differ from one person or group to another".

AR has been used by researchers since as early as Lewin's (1948) work on social change. His contribution on social change and social conflicts was further developed by the Tavistock Institute. This work is labelled socio-technical theory (Emery & Trist, 1960). Checkland (1981) through his human activity systems approach utilised Lewin's (1948) work to develop the soft systems methodology. Since Lewin (1948) work on AR, Shani & Pasmore (1981, pp.439) have defined action research as an emergent theory inquiry process in which applied behavioural science knowledge is integrated with existing organisational knowledge and applied to solve real

organisational problems. Further, Avison & Wood-Harper (1990) built on the development of AR to develop the multiview IS development methodology. Avison et al (1999) argues that researchers should conduct more action research investigations, and states that it is insufficient for academics to only read about systems development, write case studies, and build their own methodologies. The action researcher concurs with this statement and for the purpose for this research invokes arguments for the use of action research within emerging organisations.

Avison et al (1999) identified that in action research the researcher wants to try out a theory with practitioners in real situations, gain feedback from this experience, modify the theory as a result of this feedback and test it again iteratively. The action researcher, in this research, used the theory of deferred action to develop WBIS for Brunel University student services. This enabled the action researcher to modify the theory of deferred action through AR to develop a practically applicable analytical development tool to support WBIS development in emergent organisations. The researcher then tested this analytical development tool again in practice. Through this iterative process the action researcher was able to apply the theory through practice to develop a tool based on theoretical understanding of the effect of emergence on organisations and IS.

3.9 Action Research Data Collection Techniques

This section examines the data collection techniques used in the action research investigation. It is common practice to combine data collection techniques in action research (Coghlan & Brannick, 2005). The data collection techniques are documenting action research cycles, work documents and conducting semi-structured interviews. Coghlan & Brannick (2005) stated that an action research cycles is comprised of a pre-step, context/purpose and four basic steps viz. diagnosing, planning action, taking action and evaluating action. They contend that the AR cycles reveal details on the meaning behind the action researcher's findings rather than merely generating statistics. These three data collection techniques are used to answer the research questions (i.e. main and sub questions) and objective. The research objective is to develop an

analytical development tool to aid the web developer when developing WBIS for emergent organisation. These data collection techniques were applied to two different WBIS projects e.g. student services and student research handbook projects.

Coghlan & Brannick (2005) action research cycles form the basis for data collection. It is composed of two different action research cycles of which the first AR cycle is diagnosing, planning, taking action and evaluating the data in relation to the project. The second AR cycle reflects on the first AR cycle iteratively. This is done through continually inquiring into each of the four main steps of the cycles to improve the subsequent steps. Zuber-Skerritt & Perry (2002) call the second AR cycle as the 'core' and the 'thesis' part of the action research methodology. Coghlan & Brannick (2005) action research cycles place emphasis on self-reflection. Their methodology allowed the action researcher to write down his experiences, through reflecting, interpreting and tacking action. This process enabled the action researcher to reflect on what had been learnt and then comment on the significance of the results. These action research cycles are presented later in this chapter.

The first data collection method is work documents. These contain information concerning the development of WBIS for both student services and student research handbook. These are official documents of the organisation. An example of a work document viz. the student research handbook can be seen in appendix 8.3. This includes a report given to the web developer for implementing changes to the student research handbook WBIS. These work documents are important in understanding the problems faced by the web developer. They give new insights into, for example, the speed at which new requirements are needed. These work documents provide new knowledge and understanding of what aspects of the WBIS development process are more important when compared to others.

Semi-structured interviews were necessary to gather insights from colleagues involved in the WBIS development process (See appendix 8.3). Bryman & Bell (2007 pp.474) state that semi-structured interviews are where the action researcher has a list of questions on fairly specific

topics to be covered, often referred to as an interview guide, but the interviewee will have a great deal of leeway into how to reply. They state that questions may not follow on exactly in the way outlined on the schedule. They continue that questions that are not included in the guide but maybe asked as the interviewer picks up on things said by the interviewees. Further, that all the questions will be asked and a similar wording will be used from interviewee to interviewee. The semi-structured interview technique was used to add insights on points not covered by the work documents and action research cycles and also other points that were raised by the interviewees. The use of un-structured interviews was unattainable due to the time-scale involved for conducting this action research and the amount of time given by the interviewees.

3.10 The Research Design

Research design "is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible" (de Vaus, 2001, pp. 9). The action researcher invokes de Vaus to design, guide and maintain focus on the research question. The design of the action research enabled the researcher to capture qualitative data. The problem encountered by the web developer is captured within the collected qualitative data. The qualitative data was then analysed; not only to uncover underlying patterns, but also to develop associations through categorisation. This process of generating associations can help to increase understanding (Moses & Knutsen, 2007, pp.17). The action researcher sought to establish 'meaning' and then develop associations through the data analysis process. The action researcher then implemented the data analysis technique of categorisation to develop associations. This was done to achieve the research objective (i.e. to develop an analytical development tool).

The researcher used a deductive approach as opposed to an inductive approach to carry out the action research investigation. Saunders et al (2003) state that there are two approaches inductive and deductive. They describe the inductive approach as: understanding meanings of human behaviour to actual events, understanding of the research context, qualitative data and flexible

structure to permit changes and the researcher participation in the research process itself. Further, Thomas (2003) states that the inductive approaches are intended to aid an understanding of meaning in complex data through the development of summary themes or categories from the raw data ("data reduction"). Neuman (2006) describes the deductive approach as "an approach to developing or confirming a theory that begins with concrete empirical evidence and works toward more abstract concepts and theoretical relationships" (Neuman, 2006). The problem being investigated needs a deductive approach which is an approach to developing or confirming a theory (Neuman, 2006).

The research design followed four phases. The order of these phases is literature review (phase one), preliminary student services action research (phase two), primary student research handbook action research (phase three) and testing the of developed analytical development tool (phase four). These four phases are discussed individually in the order stated.

3.10.1 Phase One: Literature Review

The literature review is an important introductory task to gain adequate information and perspectives on the relevant area of the action research (Kumar 1996). The literature review carried out by the action researcher studied and defined the notion of emergence within organisations and systems. This involved understanding emergent organisations, WBIS methodologies and factors such as 'web-based aesthetics' and 'internet speed'. Additionally, Kumar (1996) mentions the benefits of doing a literature review, which can be summarised below under the following headings: incorporating clarity and focus to the research problem, overcoming problems of methodology from the literature and broadening the knowledge base in the research area.

3.10.2 Incorporating Clarity and Focus to the Research Problem

Kumar (1996) identifies that the literature review clarifies the understanding of the research area and helps the action researcher to improve the conceptualisation on the problem. Additionally, he sees the relationship between the research problem and the body of knowledge as necessary for both clarity and understanding of the research problem. The understanding drawn from the research area shows that web developers find it difficult to implement WBIS development methodologies because organisations are continuously emerging.

3.10.3 Overcoming Problems of Methodology from the Literature

Kock (2007) identified that action research suffers from a lack of trust. To overcome this problem he recommends that the action researcher spend time developing trust with all stakeholders in the organisation. The action researcher spent three months building trust on each project to overcome this problem. This involved the action researcher working with the manager and colleagues on other WBIS development projects. Additionally, Kumar (1996) stipulates that understanding the pitfalls and problems detected from previous research can help the action researcher apply a more applicable research methodology.

3.10.4 Broaden the Knowledge Base in the Research Area

Kumar (1996) identifies that the body of knowledge is very important to researchers. He finds that the literature review helps the researcher to be able to gain a broad perspective in the research area. Additionally, he states that the literature review helps the researchers to place the findings in its proper context within the existing body of knowledge.

The action researcher had undertaken the understanding and knowledge from a wide range of sources including: hard-copy journals, electronic journals, conference papers, internet literatures, reports, and books. Further, that the literature review is drawn from various disciplines such as: IT, IS, WBIS, organisational studies, human-computer interaction, system development, web

development, web design, web programming, portals, cultural issues, research methodologies and people & behaviour. The action researcher used the knowledge base to understand the phenomenon of emergence, available web-based methodologies and appropriate theories to contribute better understanding in the WBIS development process.

3.10.5 Phase Two: Development of Student Services via Action Research

The preliminary study of student services (phase two) at Brunel University student services AR is used to understand the problems of emergence in WBIS development. These included internet speed & web-based aesthetics. This phase enabled the action researcher to initially clarify the problems encountered and in turn, improve the development of the student research handbook (phase three).

3.10.6 Phase Three: Development of Student Research Handbook via Action Research

Phase three is the main action research investigation where the web developer developed the student research handbook. The results from phase two are used in phase three. These results aided the web developer in overcoming the WBIS development problems of internet speed and web-based aesthetics. This AR phases generated themes, patterns and associations which guided the web developer in developing the analytical development tool. Phase four consists of testing the analytical development tool to assist the web developer.

3.10.7 Phase Four: Constructing the Web-based Analytical Development Tool

Phase four comprises of the development and testing of the analytical development tool that aided both the web developer and manager when developing WBIS in the emergent organisation. Coghlan & Brannick's (2005) AR framework, in phases two and three, assisted the action

researcher to develop and test an analytical tool to generate an appropriate WBIS development solution. The methodology enabled the action researcher to generate explanations from the data by developing associations which aided the development of the analytical development tool (e.g. gDRASS matrix). The development of associations was critical to the development of an applicable WBIS practically useful analytical development tool for emergent organisations.

3.11 Time Periods

After gaining ethical approval on the 25th June 2008, the action researcher used the next three months to build trust within the organisation (Table 5). Between October 2008 and January 2009 the action researcher conducted action research on the student services department. The action researcher conducted a semi-structured interview with a colleague in November 2009. Following this the second action research cycle was conducted between January 2009 and April 2009. In March 2009 another semi-structured interview was carried out with another member of staff. Throughout the action research process work documents were gathered from October 2008 until April 2009. After gathering the data, the data analysis process of categorisation was carried out from May 2009 to June 2009. After the data analysis a six months write-up period was conducted from July 2009 to December 2009. The submission of the thesis was scheduled for January 2010.

Further observation of qualitative data analysis process is examined in the following section by the action researcher.

Table 5: Time Periods

Time Period	Ethical Approval	Trust	Student Services Action Research	Semi Structured Interview	Student Research Handbook Action Research	Semi Structured Interview	Data Analysis	Write-Up Thesis	Thesis Submission	Work Documents
2008										
Jun										
Jul										
Aug										
Sep										
Oct										
Nov										
Dec										
2009										
Jan										
Feb										
Mar										
Apr										
May										
Jun										
Jul										
Aug										
Sep										
Oct										
Nov										
Dec										
2010										
Jan										

The researcher has been carrying out action research within the field since 25th June 2008. Since the start of this period the researcher has continuously been developing his AR skills. This is necessary to capture good quality data to inform both theory and practice.

The data collection was done in phases in the two main web-based projects undertaken. The preliminary projects looked at developing the researcher's action research skills and gathering understanding on the web developer's problem. This also helped to identify problems and weaknesses in the AR methodology. These problems and weaknesses are mentioned in section 3.32.

The first study will act as a form of a sounding board for the purposes highlighted in Table 6.

Table 6: First Study

Approach	**Reason**
Practice	Give the researcher experience
Pilot Study	Acts as a test for understanding the critical factors of WBIS for the development of an analytical development tool (Kadar Matrix).
Situation Analysis	Elicit some of the issues in developing WBIS in emergent organisations
Data Collection	Gather qualitative data on the success or otherwise of the development process
Analyse and evaluate	Analyse the data, evaluate the findings and generate a resultant list of lessons learned

The first study was conducted in the student services section. This study not only acted as a pilot study for the initial understanding through the discerning of patterns and associations generated from the data, but also afforded the action researcher the opportunity to see and analyse first hand, some of the issues that occurred in practice in WBIS development.

The second study (Table 7) in the research student handbook acted as the main study. The presentation and evaluation of the findings was carried out by the action researcher.

Table 7: Second Study

Approach	Reason
Applied Practice	Apply the lessons learned from the first study
Refinement	Reapply (Applied first in Table 6) the development of the analytical development tool (Kadar Matrix)
Situation Analysis	Elicit some of the issues in developing WBIS in emergent organisations
Data Collection	Gather qualitative data on the success or otherwise of the development process
Analyse and evaluate	Analyse the data, evaluate the findings and generate a resultant list of lessons learned
Research proposition	Infer conclusions from the work

Additionally, three other AR data sources (K's Questions, Dr M's Interview and Additional action student services) are used to generate concurrence and add rigour to the new knowledge generated from these two studies.

3.12 Design and Execution Issues

The design of the research is initially affected by the type of research question as set out in Chapter 1. de Vaus (2001) describes the function of a research design as to: 'ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible'. The primary purpose of the research design is to explain how the web developer develops WBIS in an emergent organisation. The two different studies are significant for drawing out themes, patterns and associations which give added rigor to the research. Further, there are three additional sources that are used in order to generate patterns and associations and also to add rigour to the findings of the AR data. These three additional data sources (i.e. K's Questions, Dr M's Interview and Additional action student services) are examined in the latter part of Chapter 5.

The execution of the design had to overcome parallel development of the two different WBIS projects. This involved accommodating the fast pace and continuously changing structures, processes and resources of the organisation. Over time, the researcher had to develop skills to record the AR data within the emergent organisation.

An issue surrounding the uncontrollability threat was apparent. This threat involves the researcher attempting to change the environment being studied when the researcher does not have full control in the environment (Avison et al 1999). In order to overcome this threat more time was needed for the execution of the design, as the relationship between the researcher and subjects needed the development of trust. Avison et al (2001) correctly point out that "Rarely will an organisation cede ultimate authority for organisational action to an external researcher". To overcome this problem the action researcher spent months building trust within the organisation.

3.13 Placing the AR Data in Context

The AR data is contextual information, where it captures different perspectives of the development process from different participants. It focuses on the web developer's ability to develop WBIS.

It also comes through engagement with others in the AR cycles. Therefore, any acts which are intended to collect data are themselves interventions. So asking an individual a question or observing an individual within the organisation is not simply collecting data but is also generating learning data for both the researcher and individual concerned.

The data collecting template (See section 3.22) is structured in order to capture both problems and solutions. This is the main basis for generating themes from the data gathered. Having structured the data in this format, it helps to generate clear and effective themes which, in turn, helped not only to generate, but also to develop the analytical development tool.

The AR data is committed to the production of new knowledge through the seeking of solutions or improvements to "real-life" practical problem situations (Elden and Chisholm, 1993; Shanks *et al*, 1993). However, the data generated is more than solving a "real-life" problem, as the action researcher is working within a conceptual framework (Checkland, 1991; Baskerville and Wood-Harper, 1996) and the actions taken to make a situation perceived as problematic. This forms part of and stems from strategies for: developing, testing and refining theories about how the web developer develops WBIS in context (Avison, 1993; Susman and Evered, 1978).

3.14 Qualitative Analytical Observation

Authors who write about qualitative analysis (Richards, 2009, pp.133) recognise that qualitative analytical observation is an ongoing process throughout the life span of the project. The action researcher documented the reflections and decisions throughout the WBIS development process. This is part and parcel of the transformation process i.e. moving from personal experience and intuition, to knowledge. The analytic thinking may shift in direction during the project, with the final focus being quite remote from the initial problem. Alternatively, it may simply become more refined and focused as the researcher's understanding of the research problem, deepens. There is, nevertheless, a danger of becoming 'becalmed' when working right through the documents with the knowledge of knowing the data very well (Richards, 2005). Richards, (2005) also states that at this point, as mentioned above, one may stop and wonder: "What do I do now?" Richards advocates that shifting gear from coding to ways of searching and seeing the data is easier if the researcher has been doing it all along. Further, that coding is not an end in

itself; it makes sense only if the researcher can use it to search and test the ideas that have been coming out of the data.

Bazeley (2007) recommends that the researcher should start with a small question, a concept, a puzzle and explore it from there. She recommends that the researcher start with a small question and then build into bigger ones. It is essential to the researcher by constantly ask the question: "I wonder if...?" and explore, test, check back into the data and into your disciplinary literature, thereby building up the themes and patterns until clear associations from the data emerge. The secret to analysis is in asking questions of the data and then, by thinking it through, the researcher might pursue different ways of answering them from the data. If the researcher stalls in this approach, then it is advisable to return to the methodological literature seeking fresh stimulation. It is further recommended for the researcher to read other studies using the same methodology, even if they are on an entirely different subject matter in order to gain further ideas on different methods of approaching the problems. Therefore, the researcher should read appropriate theory to aid understanding on how these might help inform the investigation. Lyn Richards (2005) gives the researchers guidance on "handling qualitative data". The last few chapters in her book provide the action researcher with practical strategies for searching, querying and seeing the data. This is done as and when the project is moved forward and thereafter brought to its conclusion. Miles and Hubermann (1994) also provide a wealth of ideas about ways to displaying the data to help the action researcher to see what's evident and to visualise the patterns and draw conclusions.

The action researcher utilised Bazeley (2007) and Richards (2005) recommendations by coding the AR cycles. The action researcher also used a qualitative software tool to query the data (AR cycles, work documents & semi-structured interviews) at an early stage. This software was used to ask questions of and also to check associations within the data set.

3.15 Direction of the Research

"The ultimate excitement and terror of a qualitative project is that you can't know at the start where it will end" (Richards, 2005, pp.125). At the data analysis stage, however, the action researcher had a strong sense of where the investigation was heading. This helped the action researcher assess the relevancy of the questions posed in Chapter 1. Richards (2009, pp74) contends that the outcome of the qualitative investigation might include one if not more of the following three aspects viz. emergent theory, testing of theory or practical application. When these three aspects were taken into consideration, they gave the action researcher a strong sense of the direction of the investigation.

Emergent Theory

Richards (2009, pp74) describes emergent theory as human construction through the discovery of themes or trends in the data by good exploration and inquiry. The action researcher's task as a theory-builder is to work at identifying and making sense of the patterns and relationships within the data. The development of theory can be often small and local in the beginning; as the development of the investigation grows so will the theoretical sophistication. The action researcher needs to skilfully manage and explore the data. The reason for this is because theory will not emerge on its own. For example, the process of emergent theory is used to develop the analytical development tool for the web developer. The discovery of themes and trends arising from the data enabled the action researcher to make sense of the patterns and relationships through ToDA.

Testing of Theory

Testing of theory is less frequent as a primary goal for a qualitative research. Perhaps, it is more commonly found in projects which involve either mixed forms of data or mixed (statistical and textual) analysis. The action researcher used the qualitative software tool (Nvivo8) to try out the

analytical development tool, refine its outcome and re-try it again. This was used in conjunction with the theory of deferred action.

Practical Application

Practical application is a key part of the action researcher qualitative research as not all questions are purely theory based. Indeed, the quite concrete and practical questions of people working to make the world a better place (and wondering if what they're doing is working) can be addressed. There is also a very practical side to qualitative methods that simply involves asking semi-structured questions of people and observing matters of interesting real-world settings, in order to solve problems, improve programs or develop policies (Patton, 2002, pp.135-136). Practical application was evident through conducting semi-structured interviews. This enabled the action researcher to ensure that the results gained from the investigation were not purely theoretical enhancement but also practical improvements to assist co-workers.

3.16 Research Ethics

The action researcher takes the view that research ethics involve authentic relationships between members of the organisation and the researcher (Coghlan & Brannick, 2005, pp.12). This relationship involved the action researcher understanding the organisation's process and how he takes the appropriate action to enforce the organisations values and norms. The relationship's main focus is on how he works with the members of the organisation. He discussed these ethical aspects with the manager and completed the Brunel Business school ethical checklist on the 25th June 2008.

To conduct an action research investigation the action researcher had to complete and return the Brunel Business School ethical procedure form. By conforming to the research ethics procedures the action researcher is able to conduct the action research in a moral and responsible way (Blumberg, Cooper & Schindler, 2008, pp.154). This involved completing and returning the research ethics review checklist and reading through the code of research ethics and general ethical guidelines and procedures.

3.17 Research Ethics Statement

I, Mark Ramrattan, promise to ensure good ethical practice is incorporated in conducting my research. I promise that at all times, I shall negotiate with the appropriate authority for permission to conduct the research. I shall also respect confidentiality, and ensure participants rights to withdraw at any time from the research.

3.18 Qualitative Data Analysis

According to Patton (2002), the lines between the analysis and data collection process of quantitative research are clear, whereas the data gathering and analysis of the qualitative research is not distinct. The data gathering and analysis processes of qualitative research are often integrated. The action researcher examined three data sets namely action research cycles, work documents and semi-structured interviews. In the semi-structured interview process for example, "once the interviewee is thanked and field notes are complete, the analysis, evaluation, and tabulation or integration of the interview data can begin" (Guba & Lincoln 1981 pp.183).

Conducting organisational AR data analysis involved helping the organisation solve its problems in order to become "better" in terms of its key attributes such as: productivity, the quality of their services and working conditions. The action researcher was able to improve the WBIS development process in emergent conditions. This was achieved by using an iteration process

which involved collecting, analysing and drawing conceptual and theoretical conclusions from the organisational AR data.

Miles and Hubermann (1994) give a good indication of how to make good sense out of the data by drawing and verifying conclusions. These include: noting patterns, themes, seeing plausibility and clustering. Further, they identified that researchers make "stories" from a range of data. Although it is also noted, that it is more important to see evidence of the same pattern and remain open to disconfirming evidence whenever it occurs.

3.19 Qualitative Data Analysis Software: Nvivo8

The trustworthiness of qualitative research depends upon the integrity of data gathering and analysis, the robustness of data analysis processes and the demonstration of thoroughness throughout the process. This research uses a tool that assists a researcher to manage these tasks well. Nvivo8 data management and searching program, enables this research to demonstrate integrity, robustness and therefore, trustworthiness of the investigation.

The benefits of Nvivo8 lie in its user-intuitive interface and its extensive data storage, search and retrieval capacity. The program uses a coding system that underpins the generation of relationships between elements in the data. It is an effective relational database that provides the researcher with the flexibility to:

- Test tentative theorizing about relationships within the data;
- Discover and explore new relationships as data analysis unfolds;
- Map relationships;
- Track data analysis; and
- Log and save search results.

The action researcher used Nvivo8's inbuilt facility to record memos of the researcher's thoughts and processes alongside, but not within, the data analysis. Creating memos for this purpose provides a rich source of information about research processes, theorising and searching implications that are particularly useful when a project is protracted. Because memos are separate from the actual data, the independence and integrity of data are maintained by guarding against contamination from the researcher's perspective. In this way, trustworthiness is in-built into the data management process; provided the researcher is mindful about using the potential of the software with integrity.

These features make Nvivo8 a sophisticated addition to a qualitative researcher's toolkit, but it remains the researcher's responsibility to ensure the authenticity of the research project and output by aligning methodology, epistemology and ontology when conducting project research, as detailed earlier. Nvivo8 makes it easier for researchers to demonstrate robustness in their practice. Researchers do this by assisting the management of data and by establishing trustworthiness. This will enable the research process to become more transparent and therefore open to closer scrutiny. As a result, the researcher needs to think carefully through the methodological approach as well as the process of analysis. The aim is to ensure that the research questions are answered from the relationships emerging out of the data being searched.

Nvivo8 does not analyse data for the researcher. It is a data management tool enabling greater depth in analysis and facilitating the searching of large quantities of transcript data so that the researcher is empowered to make considered judgments. Although Nvivo8 is able to assist the researcher to manage data efficiently in rapid time frames, it takes time to learn how to utilize Nvivo8's power.

3.20 Expected Outcome of Categorisation Data Analysis

Categorisation distils or crystallises the data in ways that enabled the action researcher to interpret and make sense of the collected materials. The expected outcomes of the process are as follows:

- Unitise the data
- Sort units into categories (i.e. sort into individual categories)
- Divide categories into subcategories (i.e. where the need arises)
- Code each category using a cover term (i.e. give it a unique name)
- Identify the attributes defining each category (i.e. what it is that each category represents)

3.20.1 Strategy Employed by Action Researcher for Data Analysis

The first stage is categorising the data into individual nodes through Nvivo8 (Figure 3). The action researcher categorised the data from the four data sources into 357 different nodes.

Figure 3 Student Services & Student Research Handbook Data Analysis Strategy

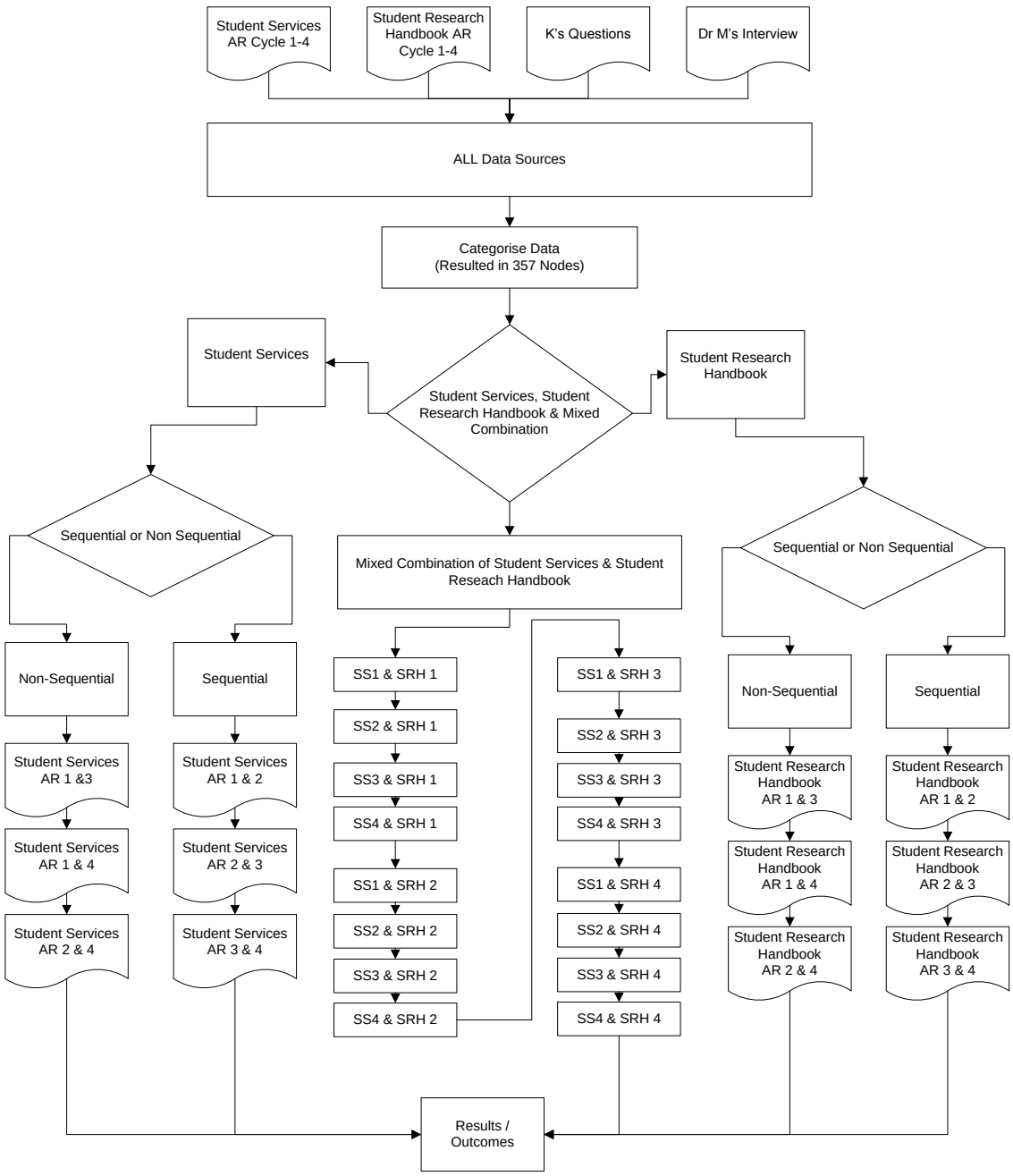
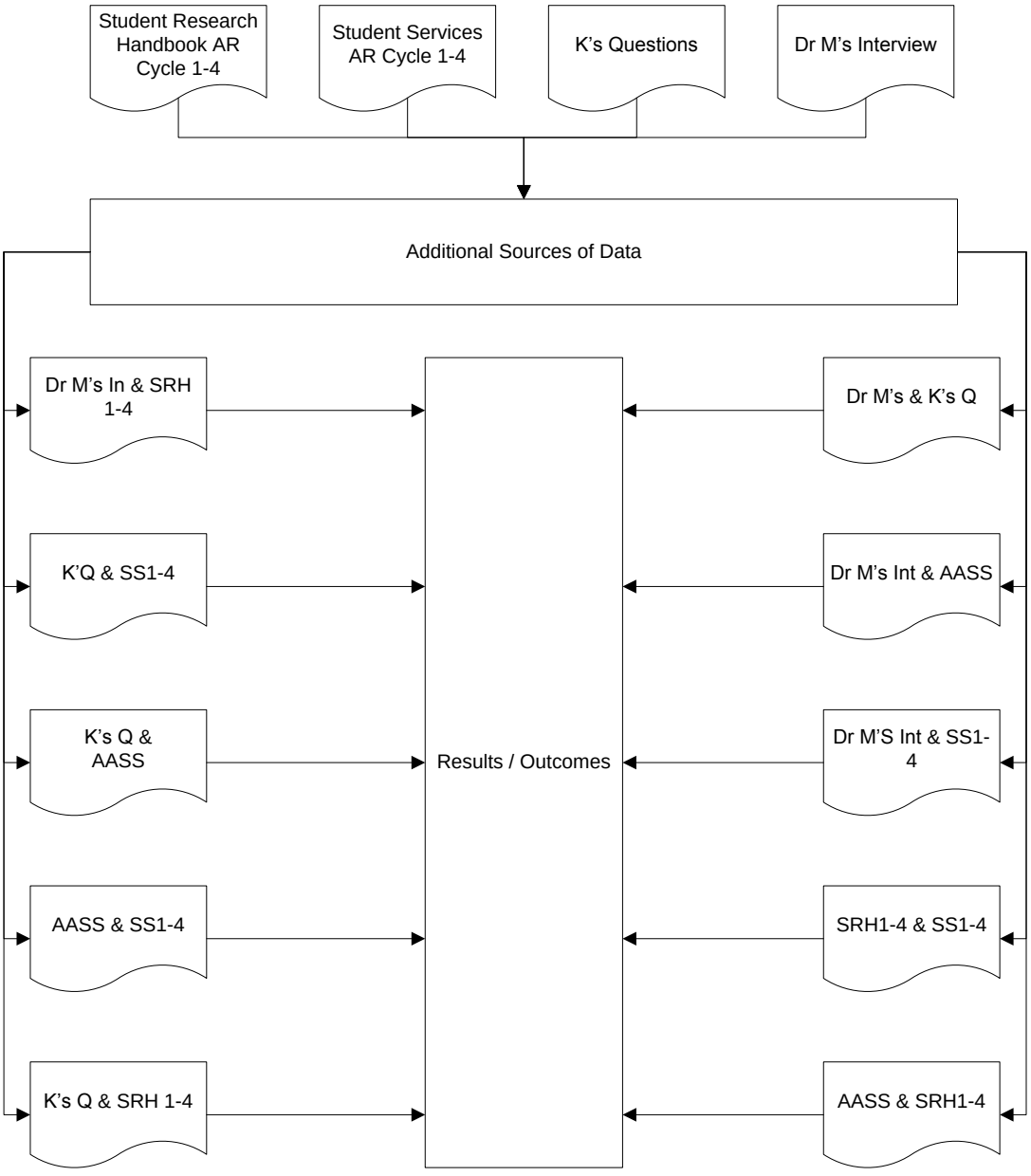


Figure 4 Additional Data Sources – Analysis Strategy



Eight main AR cycles were created from the two AR projects. These eight cycles can be seen in Table 8 (Section 3.22). The eight AR cycles form the basis for unravelling the patterns and trends from the data. Firstly, the Student Services project is coded as SS and each cycle in this SS section is labelled from SS1 to SS4 respectively. Secondly, the same process was applied to the Student Research Handbook, coded as SRH. Each cycle in this SRH section is labelled from SRH1 to SRH4. The abbreviations (i.e. SS and SRH) are used to help the researcher to easily compare and contrast the different cycles of the two projects, to assist the action research to gain deeper understanding from these cycles.

The data analysis is initially conducted sequentially to uncover associations from the patterns and trends generated from the data in both projects.

The action researcher identifies patterns from SS1 & SS2 cycles to answer the research questions posed. The main question states that there is a problem within Brunel University in the development of WBIS for an emergent organisation. The action researcher then looks at the next pattern derived from SS2 & SS3 and compares this with the patterns derived from SS1 & SS2. Following on from this the last sequential comparison of this action research cycles SS3 & SS4 was undertaken. As a follow on from the sequential cycle, the action researcher conducted non-sequential data analysis on the action research SS cycles, which are used to highlight prevalent problems that might not be taken into consideration in sequential cycles. This non-sequential data analysis lends itself to adding rigor in support of the understanding gained from the sequential cycles.

Similarly, the action researcher conducted the same sequential and non-sequential processes for the SRH cycles. Then the action researcher looked at mixed combinations between both AR projects. For example, the patterns and trends from these combinations were examined (i.e. SS1 & SRH4, SS2 & SS4).

Four major data sets viz. SS (includes all cycles 1 to 4), SRH (includes all cycles 1 to 4), Dr M's Interview and K's Questions were then examined (Figure 4). The action researcher examined these data sets through researching all the possible combinations of the data. This was used in order to draw out patterns from the data sets. These patterns were then correlated with other results in order to generate associations. These associations enabled the action researcher to answer the research questions posed at the outset of the investigation.

The action researcher carried out the data analysis in order to affirm or disprove the problems faced by the web developer and also if these are the same or different problems for different stages of the WBIS development process.

3.21 The Real World Problem

The action research investigation involved addressing a practical management problem within Brunel University. The management problem concerned communications between all the university's stakeholders (staff and students). The University's student services department employed the action researcher as a web developer to develop WBIS. The relationship between the web developer and Brunel University student services section started through the advertisement for a web developer's role. In this context, the web developer and manager of the student services section explored the methods and analytical tools necessary to improve the current WBIS.

The web developer found that initially there was no WBIS development method used in the student services section. The effect of emergence made it inappropriate for the web developer to spend time researching appropriate methods for WBIS development. The effect of emergence made the current WBIS development process ad hoc.

The action research undertaken reports on an AR investigation of the two WBIS student services created. These two WBIS services are student services web-based platform and the student research online handbook. The web-based platform exists within Brunel as an online facility for communication between both staff and students. The online research student handbook is presented as an overarching service for postgraduate research students. The needs of these students are regarded as different from undergraduate students. Therefore, Brunel requires the implementation of a separate online research student handbook to satisfy this need. These services are needed to provide continuously better support for students each year.

However, the student services section has ever changing regulations. For instance, the University wants to continuously provide better support to students and staff. Brunel does this by providing funding for the development of a student services WBIS. These student services WBIS collectively incorporates many different services.

The student services section creates WBIS whilst managing organisational change, fast paced deadlines and delivering media features. This is a problem, for both the web developer and manager, situated in both theory and practice (Baskerville et al, 2007; Kautz et al, 2007). By investigating how the web developer manages emergence throughout the development process can provide the web developer and manager with solutions to accommodate the real world problem.

The student services (SS) and student research handbook (SRH) WBIS are made available as online resource material available for all undergraduate (UG) and postgraduate research (PGR) students at Brunel University. There are two separate links, with overlapping content pages, which are available for students to access via the Brunel University intranet sites at:

- http://intranet.brunel.ac.uk/student_handbook/
- http://intranet.brunel.ac.uk/research_handbook/

The Brunel Graduate School has commissioned the WBIS development of the student research handbook. Appendix 8.3 is a Brunel Graduate School report that the web developer utilised to make the necessary improvements for the Student and Research Handbook.

3.22 The Real World Problem through Action Research

This section identifies the real world problem through four main action research cycles for student services and student research handbook. The action research data of these cycles are presented to set the context of the problems faced by the web developer and manager. Following the first student services project the second action research (SRH) project utilised the development of the analytical development tool, the Kadar Matrix, for the development of the student research handbook WBIS. The development of the Kadar Matrix is aided by the theory of deferred action. It has enabled the data analysis process to be conceptualised through the three main constructs of planned action, emergence and deferred action. Table 8 is presented to illustrate the order of the AR cycles.

Table 8: Student Services (SS) and Student Research Handbook (SRH)

Student Services	Student and Research Handbook
1. Selecting appropriate features 2. Disagreement in design requirements 3. Current development stage and methodology. 4. Development of Kadar Matrix (Analytical development tool)	1. Problems with student and research handbook. 2. Analysing problems in current handbook 3. Recommendations from Web developer and Manager 4. Designg Implementation and review using Kadar matrix

Table 8 maps out the development of eight different AR cycles. Firstly, there are four AR cycles from the Student Services WBIS. Secondly, this is then followed by four AR cycles from the Student and Research Handbook WBIS. All eight AR cycles follow sequentially in the WBIS

development process. Below are the details of the iterations for the four Student Services AR cycles:

3.23 The 1st Iteration of the Action Research Cycle: Student Services WBIS

The first iteration of the student service AR cycle involved a meeting between the web developer and the manager. The meeting was setup to discuss the selection of appropriate features for the student services WBIS. Prior to this meeting the manager met with other stakeholders to discuss appropriate features. The manager failed to secure collective agreement on the appropriate features. This hindered the selection process of appropriate features. This lack of agreement created the WBIS development problem. The action researcher used the four cycles of action research to address the development problem. These four cycles are diagnosing, action planning, action taking, evaluating (Coghlan & Brannick, 2005, pp.26). These four cycles are discussed next.

Diagnosing: The student services department manager proposed the problem of how to select appropriate features within the WBIS in higher education organisations. Here, the project consisted of developing a student services WBIS that encompasses rich information on the different services for students provided by Brunel University. The action researcher felt motivated to develop a WBIS for students. The researcher reflected on the methodologies that could be successfully applied to the project. This iteration of the AR cycle assisted in the review process for selecting relevant methodologies. This process enabled the action researcher to select an appropriate methodology.

Action planning: The student services manager met with other stakeholders and the different department heads. The agenda was to discuss the requirements needed for the different student services sections. This involved organising and arranging meetings with the heads of the different student services departments. The action researcher found that to be a time consuming

process in that it involves arranging meetings and mapping out the processes for each of the different student services departments.

Action taking: The student services manager met with several department heads to collect the requirements for WBIS development. From the information gathered, the manager mapped out the features requested by the department heads. The web developer discussed these features with the student services manager. Both manager and web developer decided what actions should be undertaken for each of the features in the development process. Two different methods (i.e. prototyping and timeboxing) of initial development were agreed upon. The selection of these two methods was based on the iterative nature of the method and speed with which the WBIS could be implemented.

The manager also looked at the incorporation of twitter feeds, facebook and social media integration which could be incorporated in the development process before meeting with the different student services managers. The web developer, however, feels that the features could be ruled out until the testing of a prototype is conducted. Apprehensive about this process the action researcher reflected on what analytical development tools could assist in overcoming the development problem. This is because different web-based aesthetics requirements and level of internet speed, needs collective agreement with the different services managers. However, at this stage no problems were encountered where one autocratic manager seeks to implement their methodology unilaterally.

Evaluating: After analysing the research data, the following conclusions were drawn and report generated. The web developer experience and knowledge of methodologies helped to incorporate features required for WBIS development. These features include video streaming and web-based aesthetics. The web developer indicated that these features need to be tested via a prototype

before implementation can take place. He mentioned this to his manager and it was discussed in the next meeting. He developed a prototype within a week's timeframe.

The action researcher found that in the student services development process, there was urgent need: to quickly develop the WBIS, for "Time-to-Market", and the demand to meet deadlines. They were equally important when compared with the initial requirements set by the manager. Both web developer and manager felt it was necessary to develop a better way of understanding the current stage of the development process and the contribution that the web developer could make towards this aspect. This is a critical stage of the action research process. The manager had the problem of selecting appropriate features for the student services WBIS. The manager gave the responsibility of advising and selecting features to the web developer. This changed the web developer role from merely building the WBIS to advising and selecting what was required. This is a form of deferred action that took place within the WBIS development process.

3.24 The 2nd Iteration of the Action Research Cycle: Student Services WBIS

The second iteration of the student services AR identifies a disagreement in the design requirements. The manager wanted to carry out the development of the WBIS without getting collective agreement from the different stakeholders. The web developer felt that the absence of collective agreement from other stakeholders would disrupt the development process during the latter stages. The web developer urged the manager to spend more time gathering collective agreements. The action researcher used the four cycles of action research to address the development problem. These four cycles are diagnosing, action planning, action taking and evaluating (Coghlan & Brannick, 2005, pp.26). These four cycles are discussed next.

Diagnosing: There was disagreement between the web developer and the manager. This concerned the design requirements for its intended purpose. For this reason, it was necessary to

develop a WBIS prototype without the incorporation of web-based aesthetics for student services WBIS. This problem made the action researcher feel apprehensive with regard to the type of design needed. The web developer and manager agreed that using CSS enabled the web developer to refine the design more appropriately.

Action planning: For the planning purpose there were ten active different student services that need to be incorporated. These ten different student services were: accommodation, arts centre, brunel international, chaplaincy, counselling service, disability and dyslexia service, diverse brunel, library services, medical centre and student centre. A consistent layout design format seems a logical approach to design the pages. The content and structure of the different student services were itemised in an idiosyncratic way as per each contributor. For example, the disability & dyslexia service wanted YouTube videos and podcast streams incorporated into their layout and design. This is opposed to the library service which wanted a more text, graphics based layout and design. This meant that the structure needed to be in a universal format whilst at the same time appealing to the different requirements of the various student services departments. The ten different student services were expanded to accommodate additional student services. To this effect, the action researcher designed the WBIS so that it could accommodate future emergence. The reason for this was not to limit the WBIS capacity for future expansion.

Action taking: The web developer reviewed the manager's feedback. The manager required: one picture per page, no more than two paragraphs of textual information and the relevant contact details. In order to incorporate the manager's specification, the web developer uses Adobe Dreamweaver software package to implement the initial design using the CSS format. Adobe Dreamweaver enabled the design to be compatible with multiple internet browsers.

The web developer has used ‘primalis’ (a content management system) before and therefore has gained prior knowledge of the coding problems experienced with the in-house built system. The web developer had concerns about the layout problems that may occur when developing this service for two different platforms. The web developer suggested that it might be worth recommending to the manager the use of a single platform to save development time and cost.

Evaluating: The CSS is used as a cross browser language for developing the WBIS infrastructure. However, the release of CSS 2.1, meant that it might be beneficial to upgrade to the improved CSS version. The reason for this is that it supports media-specific style sheets so that authors might tailor the presentation of their documents to: visual browsers, aural devices, printers, braille devices, handheld devices, etcetera. It also supports content positioning, table layout and features for internationalisation, including some properties which are related to user interface. The development of different platforms of WBIS can cause delay in the development process. The web developer has made a suggestion to the manager to develop a single platform which is believed to reduce the time taken in the development process. From the experience of the web developer the action researcher supports the views of Truex, Baskerville & Klien (1999). They state that the emergent nature of the organisation creates difficulty in implementing a rational structure for development. The manager’s awareness of the WBIS development methodologies facilitated fast paced development, with the web developer, by utilising an applicable development methodology.

3.25 The 3rd Iteration of the Action Research Cycle: Student Services WBIS

The third iteration of the AR cycle is where the web developer informs the manager of the current development stage and the methodologies available. The web developer felt that many parts of different methodologies could be applicable to the development stage. The web developer discussed these different methodologies with the manager. The web developer and the manager found that there wasn’t a single suitable methodology. The action researcher used the

four cycles of action research to address the development problem. These four cycles are diagnosing, action planning, action taking and evaluating (Coghlan & Brannick, 2005, pp.26). These four cycles are discussed next.

Diagnosing: The web developer has knowledge of eight different methodologies (viz. relationship management methodology, object-orientated hypertext design method, web information systems development methodology, website design method, internet commerce development methodology, takashi-liang WBIS analysis & design, howcroft-carroll's methodology and intranet design methodology) which can be utilised. The applicability of these methodologies for the changing nature of student services department is inadequate for the purpose. For example, RMM is focused on web application but it is not designed and tested for emergent organisations. OOHDM has a development structure strongly related to its next development stage but it is inadequate for this type of emergent organisation. This is because the methodology needs emergent characteristics to cope with the changing nature of the environment in which it operates. Vidgen et al (2002) methods matrix can provide some benefit as it has no sequential ordering of each phase of the development process. The web developer felt that there was a need for an analytical development tool to better inform the manager and web developer of the applicability of a methodology.

Action planning: Baskerville, Pries-Heje & Ramesh (2007) argue for the development of new analytical development tools. The web developer found that in this context the development of such a tool is needed. The web developer felt that for the purpose of developing an analytical tool, more research needs to be carried out to establish the use of an appropriate theory. The web developer identified appropriate theories to tackle this problem. These theories are: Language Action Perspective (LAP), Markus & Majchrzak (2002) Design Theory and Patel (2002) Theory of Deferred Action. The web developer anticipated that it would take two weeks to plan out and address the problem of selecting an appropriate theory.

Action taking: The web developer ruled out LAP and Design Theory because these two theories are described by Patel (2009c) as inappropriate. This is because the appropriate theory needs to be from an IS background. The theory should answer how to design IS that has no predetermined structure and function, when such structure takes place in context. This lead the action researcher to consider the use of the theory of deferred action (ToDA). ToDA explains the emergent aspects of system development within a dynamic organisational context. The deferred system design construct, within ToDA, is concerned with the freezing of the system until the user decides what the system will become (Patel 2002).

Evaluating: The researcher established that ToDA is a suitable theory for developing WBIS in an emergent organisation. The constructs of ToDA enabled the researcher to understand the emergence phenomena more accurately when compared to the other available theories. This meant that the web developer could focus on building the analytical development tool. The action researcher gained much insight by reviewing the different methodologies in the action planning section. This has given the action researcher a better understanding of what parts of the different methodologies are applicable to the research problem. By engaging with the manager, this enabled the web developer to obtain agreement in investigating these selected methodologies. However, this process has added more time to the development process. This extension gave the action researcher two weeks to reflect on the appropriate theory.

3.26 The 4th Iteration of the Action Research Cycle: Student Services WBIS

The fourth iteration of the AR cycle is the development of the analytical development tool for the web developer. The development of Kadar Matrix, the analytical development tool, was through ToDA and the action research data. The action researcher used the four cycles of action research to address the development problem. These four cycles are diagnosing, action planning, action taking and evaluating (Coghlan & Brannick, 2005, pp.26). These four cycles are discussed next.

Diagnosing: Current methodologies are not able to address the problems of WBIS development for an emergent higher education organisation. This is why the web developer felt that the reason for developing the analytical development tool is that current methodologies are inadequate to accommodate emergence. It has been seen from the previous iterations that whilst the existing methodologies can work in organisations that are stable or those organisations with little or no change, they fail to address the problems of emergent organisations. However, there is a need to incorporate some or all of these methodologies to enable new development ideas in order to deal with the problems encountered in the emergent higher educational organisation.

Action planning: At this stage the web developer is in the process of using the ToDA to develop an analytical development tool for student services. This is because the web developer found analysing research methodologies, informing the manager, and carrying out the WBIS development process time consuming. Here, the web developer is aiming to establish clear answers to the problems and thereby addressing the methodological short fall of the current WBIS. The web developer accomplished this through the analytical study of the gDRASS matrix (i.e. generalised, deferred, realised, autonomous, specified, systems – See Figure 47) as detailed in the theory of deferred action.

Action taking: Using the full aspect of the gDRASS matrix will help the web developer not only to understand, but also to select the most appropriate tool available to overcome critical problems in the student services WBIS and the emergent higher education organisation. The matrix shows the multi-faceted aspects of the demand placed upon emergent organisations. An examination of each of the quadrants of the gDRASS matrix is investigated by the web developer in order to develop an appropriate analytical development tool to overcome this particular WBIS problem.

Evaluating: The web developer has analysed the gDRASS matrix in relation to the student services emergent higher education organisation. The web developer has determined that, after the analysis of the gDRASS matrix, it is a useful tool for IS development. It meets the action

researcher's ontology of emergent reality. It meets the need for rational design in WBIS development and for taking action in the emergent context (i.e. deferred action). This was done by the web developer carrying out deferred action in a deferred system design process. The web developer found that examining each of the quadrants of the gDRASS matrix showed that this tool was most appropriate for organisations that change very little. The gDRASS matrix is also appropriate for dealing with problems occurring in volatile environments (i.e. where the organisation changes erratically). However, the gDRASS matrix is designed for all IS development but has not been applied to WBIS development. Therefore, the web developer set out to adapt the aid of the gDRASS matrix for the purpose of WBIS development. The adaption and development of an analytical development tool was formulated with the gDRASS matrix and the results of the AR data.

3.27 Analysis of the Action Research Method Used

As part of the evaluation of the first project it is important to evaluate the effectiveness of the AR method and the way in which it was implemented. This particular process is beneficial especially as any lessons learned could potentially be applied to the following student research handbook AR project.

Overall the research method is useful for the purposes of achieving the key research objectives as outlined in Chapter 1. Some of the resultant benefits from the four student services AR data cycles (which were presented in the previous section) are listed below:

- The action researcher gained experience by conducting AR
- The student services AR carried out by the action researcher assisted in the development of an analytical development tool to address the problem of emergence encountered by the web developer

- From carrying out the AR data analysis many issues were highlighted. These issues are: time-to-market, web-based aesthetics and inadequate development methodologies for WBIS development.

In addition to these benefits, the refection upon the experiences and the review of the methods applied during the course of the study have given the researcher two main considerations from which lessons can be learned. The two constraints that have most impact on this study are time and a change in personnel. These constraints are discussed in further detail below.

3.27.1 Time Constraint Relating to Student Services Action Research Cycle

The original agreement was to carry out this study within sixteen weeks (4 months). This time period was reduced to fifteen weeks. This reduction in time affected the action researcher ability to take action. However, the reflection process that is crucial to every action research project was incorporated despite the shorter time span. Nevertheless, the reduced time did not have an adverse effect on the data collection process. As the action researcher was able to change his schedule to match the organisation changes.

3.28 Change in Personnel

One of the factors that affected the project towards the end of the fifteenth week was the change of finance director. In the thirteenth week of the study the new finance director was introduced. Once this had taken place, the researcher's time required on the project was reduced accordingly to the time taken to complete the assigned duties.

3.29 1st Iteration of the Action Research Cycle: Student Research Handbook

The first iteration of the student research handbook AR cycle relates to the discovery of problems, arising from the feedback, from an investigation conducted by the Brunel Graduate School. The Brunel Graduate School commissioned a report to explore the current situation of the web-based student research handbook. The report is intended to highlight current problems and assist the web developer to create guidelines to improve the existing online student research handbook. The action researcher used the four cycles of action research to address the development problem. These four cycles are diagnosing, action planning, action taking and evaluating (Coghlan & Brannick, 2005, pp.26). These four cycles are discussed next.

Diagnosing: The Brunel Graduate School has compiled a student research handbook report. This report was compiled for the benefit of the web developer. The report highlighted the main problems of students' low satisfaction of the current online research handbook i.e. difficulty in accessing the WBIS, difficulty in finding information, links to pages not properly highlighted, and the inadequacy of the search function. Oztekin et al (2009) stated that rapid growth of IT should be utilised to overcome the problems faced by the user. The Brunel Graduate School report identified the problems faced by the users. The web developer agrees with Ozetkin et al (2009) stance that by investigating current IT for WBIS the users' experience will be enhanced.

Action planning: The action plan was to investigate the usability factors for WBIS development. Conducting this research is essential for improving the web-based information services. Hornbaek (2006) emphasised the importance of usability for the quality of web-based services. Usability has been identified as 'the effectiveness, efficiency, and satisfaction with which specified users can achieve goals in a particular environment' (Hornbaek, 2006). This has been highlighted as one of the most critical elements for web-based design. It is because usability refers to the extent to which a product can be used by specified users in order to achieve

specified goals with effectiveness, efficiency and satisfaction in a specified context of use (ISO 9241-11).

Action taking: This cycle of the research was conducted by an interview with the Senior Assistant Registrar (Graduate Studies) to obtain the registrar's views on the current handbook and to identify useful scenarios in which to test its appropriateness to the requirements of research students. An online web survey of Post Graduate Research (PGR) students was conducted with the intention of exploring: Firstly, the degree of awareness of the current handbook. Secondly, the degree to which the current handbook is used and finally, the level of satisfaction derived by students from the current student research handbook.

In-depth usability evaluations were conducted with a sample of PGR students, using typical usability scenarios gathered from phase one. Among the great deal of web usability research, usability evaluation has been wildly recognised as one of the major corner-stones of web design (Gerrnberg & Buxton, 2008). The supporting data can be found in the Appendix 8.3 under the title Handbook Report.

Observing the users' interaction with the current handbook and gaining their views on the usability of the handbook also took place. Finally, a card sorting research study was conducted with a sample of PGR students. Card sorting is a technique for exploring how people group items, so that you can develop structures that maximize the probability of users being able to find items. This was done with the aim of identifying the most intuitive categorisation of information within the handbook.

Evaluating: There is considerable scope to improve the current online student research handbook. The Brunel Graduate School identified the following improvements:

- Create direct links to the research handbook from appropriate locations on the Brunel WBIS / web site / intranet (including links to and from the University's main research pages)
- Rename the handbook as the research student handbook
- Remove old versions of the research handbook
- Highlight hyperlinks within the handbook text
- Ensure that font size is legible throughout
- Improve the organisation of the current material by categorising content under the following headings:

    - Introduction / Welcome
    - Admission, registration and fees
    - Policies and Procedures
    - PhD Process and Progression
    - Thesis and Viva
    - Support and Services

The following longer term recommendations were made for the improvement of the student research handbook:

- Provide drop-down menus from category headings to provide quicker access to key content
- Provide a search facility within the research handbook
- Improve look and feel of current handbook
- Provide additional content on topics such as the PhD process, thesis writing and submitting work to journals

These recommendations are categorised as follows: access, structure & information, interaction and design. The Brunel Graduate School and the senior assistant registrar pointed out that categorisation of the information is the main development issue concerning the student research handbook. The card sorting exercise (Appendix 8.3.4) helped the web developer to categorise the information.

Additionally, redesigning needed to consider the context of the handbook in relation to other material on the web and in particular any planned changes for the related 'student handbook'. A possible outline design for the web developer is included in Appendix 8.3.14 as a starting point.

3.30 2nd Iteration of the Action Research Cycle: Student and Research Handbook

The second iteration of the AR cycle involved analysing the problems with the current online handbook with the help of the Brunel Graduate School. The web developer was asked by the Brunel Graduate School Director to implement the WBIS development. The student services manager agreed to facilitate the development of this project with the provision of staff support and funding. The time period for conducting the development of the student research handbook was from January 2009 until April 2009. The action researcher used the four cycles of action research to address the development problem. These four cycles are diagnosing, action planning, action taking and evaluating (Coghlan & Brannick, 2005, pp.26). These four cycles are discussed next.

Diagnosing: The main problem identified by both student and staff were that satisfaction with the design of the current research handbook was low. Some factors related to the low satisfaction were: the difficultly in accessing the online research handbook from the Brunel WBIS, retrieving information on the basis of the current headers, the information categorisation scheme had been problematic and links within the pages of the handbook were not properly presented and were

difficult to locate. Because of the low satisfaction identified by the report, the web developer concluded that the handbook was inadequate for the retrieval of information.

Action planning: The first AR cycle is intended to provide current information requirements in order to have a better understanding of the use of the student research handbook. This involved carrying out a usability study (where users are observed interacting with the site and questioning them about their experience) and a card sorting study (with the aim of helping the researcher to better categorise the information). The usability and card sorting studies can be found in appendix 8.3.

Action taking: The action researcher has taken action to do the following: create direct links to the research handbook from appropriate locations on the Brunel intranet. This includes links to and from the University's main research pages. The researcher renamed the handbook as the research student handbook. He removed old versions of the research handbook from WBIS and highlighted hyperlinks within the handbook text. He also ensured that font size is legible and appropriate throughout the information content. The web developer has improved the organisation of the current material within WBIS by categorising the content under various headings. These headings are: welcome, introduction, admission, registration & fees, policies & procedures, PhD process & progression, thesis & viva and support & services.

Evaluating: The research handbook should provide drop-down menus from category headings to provide quicker access to key content within the handbook. It provides a search facility within the research handbook. Improvements are needed to improve the look and feel of the current handbook (web-based aesthetics). Also, additional content on topics such as the PhD process, thesis writing and submitting work to journals should be made more accessible. These recommendations are to be made for the improvement of the student research handbook.

3.31 3rd Iteration of the Action Research Cycle: Student and Research Handbook

The third iteration of the AR cycle involves the web developer and manager deciding how to develop the student and research handbook whilst accommodating the recommendations set out from the handbook report (Appendix 8.3). The Kadar Matrix is used by the web developer to inform the manager throughout the WBIS development process. The action researcher used the four cycles of action research to address the development problem. These four cycles are diagnosing, action planning, action taking and evaluating (Coghlan & Brannick, 2005, pp.26). These four cycles are discussed next.

Diagnosing: The report of the current handbook needs to be disseminated by the web developer. An agreement needs to be created between the web developer and the manager. This enabled the web developer to suggest possible WBIS methodologies to develop the current handbook. If any of the recommendations, which are specified by management, cannot be carried out, the reasons had to be stated at this stage of the development cycle. This is because major adjustments made at a later stage might not be fully incorporated into the development process.

Action planning: The action researcher encountered five main problems and determined six recommendations for implementation. The longer term recommendations are planned for implementation for the next academic year 2010/2011. Integrating both aspects fully is a cause for concern for the web developer within the time constraint. The web developer used the Kadar Matrix to review appropriate methodologies in the literature base and advocated that combinations of different methodologies (viz. prototyping and timeboxing) could be applicable to the development process.

Action taking: After investigating applicable methodologies, the Kadar Matrix is then tested again to aid the manager and web developer for student research handbook WBIS development process. The use of the Kadar Matrix is intended to match up the requirements with the applicability of the different methodologies available to the web developer. By using the Kadar

Matrix the web developer was able to eliminate inappropriate methodologies in the development process and was therefore empowered to accurately advise the manager. A more detailed account of the development of the Kadar Matrix is presented in chapter five.

Evaluating: The web developer employed the Kadar Matrix as an analytical development tool to identify the applicability of methodologies. The web developer used the Kadar Matrix to list the available methodologies and examined which ones could be implemented from start to finish with the predominant factors of web-based aesthetics, internet speed, emergent organisation and web developer's level of ability. The identification of appropriate methodologies aided the web developer to solve a real world problem within an emergent higher education organisation. Using this analytical development tool helped the web developer to identify two critical factors. These two critical factors are: internet speed and web-based aesthetics. Through conducting this investigation the action researcher experienced these factors, of internet speed and web-based aesthetics, in practice. Therefore, these results re-affirmed what has been identified in the literature review. The student research handbook project required constant monitoring by the manager. WBIS methodologies didn't directly cater for the involvement of management throughout the development process. This was because of direct and constant intervening of management in the WBIS development process. This changed the process of implementation throughout the WBIS development process.

3.32 4th Iteration of the Action Research Cycle: Student and Research Handbook

The fourth iteration of the AR cycle involved the implementation of the recommendations and review (Appendix 8.3.6) of the changes made by using the Kadar Matrix. The available methodologies are inadequate to accommodate continuous change. The manager was asking the web developer to implement continuous change in the development process. The web developer found that the available methodologies were unsuitable for accommodating this continuous change. However, the web developer found that the Kadar Matrix could deal with this

continuous change i.e. accommodating the manager's request. The action researcher used the four cycles of action research to address the development problem. These four cycles are diagnosing, action planning, action taking and evaluating (Coghlan & Brannick, 2005, pp.26). These four cycles are discussed next.

Diagnosing: The aspects of internet speed and web-based aesthetics demanded of this project is critical to the success of the project. The time span for implementing the WBIS was four months. The web developer found that actively incorporating a wholesale methodology has proved impossible in this type of emergent environment. The emergence involved the web developer having to stop working on the current WBIS project and work on another WBIS project. The web developer accommodated the implementation process as and when required. The manager regularly revisited specific problems during the development process. For example, the manager requested continual changes to web-based aesthetics aspects.

Action planning: The Kadar Matrix was used at this stage. It identified that currently there is no logical order to which recommendations to changes can be followed. The web developer interprets the stages of how the project can be completed. This involves the web developer estimating the time that is required to carry out the different requirements. The first requirements are prioritised so that the one that requires the least amount of time is dealt with first. This gives the web developer a feeling that the objectives set out are being achieved.

Action taking: Once the first recommendation is completed, the web developer engages in parallel development in relation to internet speed and web-based aesthetics constraints. Therefore, web developer had to simultaneously manage WBIS development process and improve the web-based aesthetics. This put added pressure on the web developer to meet very tight deadlines. As the development process moved closer to its completion deadline, the web developer communicated to the manager that not all the requirements could be implemented. This was acknowledged by the manager who felt that at least some of the requirements were

implemented. After the development process was deemed acceptable the manager gave permission to publish the WBIS even though all of the intended requirements were not fully incorporated.

Evaluating: The evaluation aspect is a continuous iterative cycle in the WBIS development process. Even though the terms of reference are set for this project, new and alternative demands by the manager are regularly placed upon the web developer. This aspect of changing requirements hampered the web developer's ability to deal with continuous change within the development process. The web developer found this 'start & stop' aspect difficult to accommodate in this continuously changing environment. However, this was a new requirement that is placed on the web developer in this emergent higher education organisation setting. The web developer had some comfort in rationalising this phenomenon by utilising both ToDA and its extension the Kadar Matrix. Whilst ToDA provides understanding of the phenomenon of emergence, the Kadar Matrix assisted the web developer in focusing more on web-based aspects for WBIS development in emergent organisations.

3.33 Scope and Limitations of Action Research

Wood-Harper (1992) views action research methodology as context dependant thus, his claims of the AR data findings being applicable to different contexts are problematical. For example, other web developers might not have the same level of trust as the action researcher did within his organisation. Therefore, this would make it more difficult for other web developers to implement WBIS development in emergent higher education organisations. The researcher's stance is that AR can be used to generate further knowledge within different research contexts. For example, Vidgen (2002) work used action research to learn about the actual and situated practice of WBIS development through first-hand experience.

Matthew (2002) finds that the direct participation of the researcher in AR neglects the critical distance of a researcher, which may be construed by different methods, such as positivist case study, as essential for conducting good academic research. Coghlan & Brannick (2005) view direct participation in AR as essential to the discovery of the different types of problems that occur in practice. Coghlan & Brannick (2005) is aligned with the action researcher's ontology that to understand these problems, direct participation is needed.

Avison, Baskerville & Myers (2001) state that AR is designed to change the environment, but researchers rarely have full control of the environment. They contend that having limited control on the organisation hinders the researcher's ability to successfully effect change. Therefore, the action researcher spent considerable time building trust within Brunel University student services to overcome this problem. This enabled the action researcher to change the student services environment.

3.34 Concluding Remarks

In this chapter the researcher assessed the appropriateness of the qualitative research method, in particular action research, to answer the research questions. Coghlan & Brannick (2005) AR methodology was chosen as an appropriate methodology because it enabled the action researcher to answer the research questions. Further, this AR methodology was aligned with the researcher's ontological and epistemological perspective of interpretivism. The action researcher found that this AR approach was not only appropriate and aligned to the research question but suitable for undertaking research within organisations that are continuously adapting to emergent organisations.

CHAPTER 4: Brunel University Growth

4.1 Introduction

This chapter describes Brunel University's growth and the implicit problems of communications between student services and student services management of information. The growth of Brunel University has caused an increase in the need for communication and created management problems as a result. Electronic communication was chosen by management to reduce cost and provide an alternative platform for staff and students to access information more efficiently and effectively. The advent of the internet was intended to address these problems. Many paper documents are generated for employees, students, and the sharing of these documents amongst staff and between staff and students are necessary. The distribution of paper documents has been the preferred choice of student services management since its inception. However, Brunel continued growth has resulted in the organisation seeking to transform its information towards a web-based platform.

4.2 Growth of Brunel University

The growth of Brunel University has caused an increase in communication and the management of this communication is a managerial problem. The University has seen a steady growth of student recruitment over the years. Brunel University growth stems back to its first inception in 1966. In 1985 there was a student population of only 2,310 undergraduates (plus about 1,500 post-graduates, part timers and other students). In 1995 the University expanded by integrating with West London Institute of Higher Education and adding the campuses in Osterley and Twickenham. This resulted in an increase in the size of student body to over 12,000. By 2010, Brunel University accommodates nearly 15,000 students.

Figure 5 The Growth of Brunel University

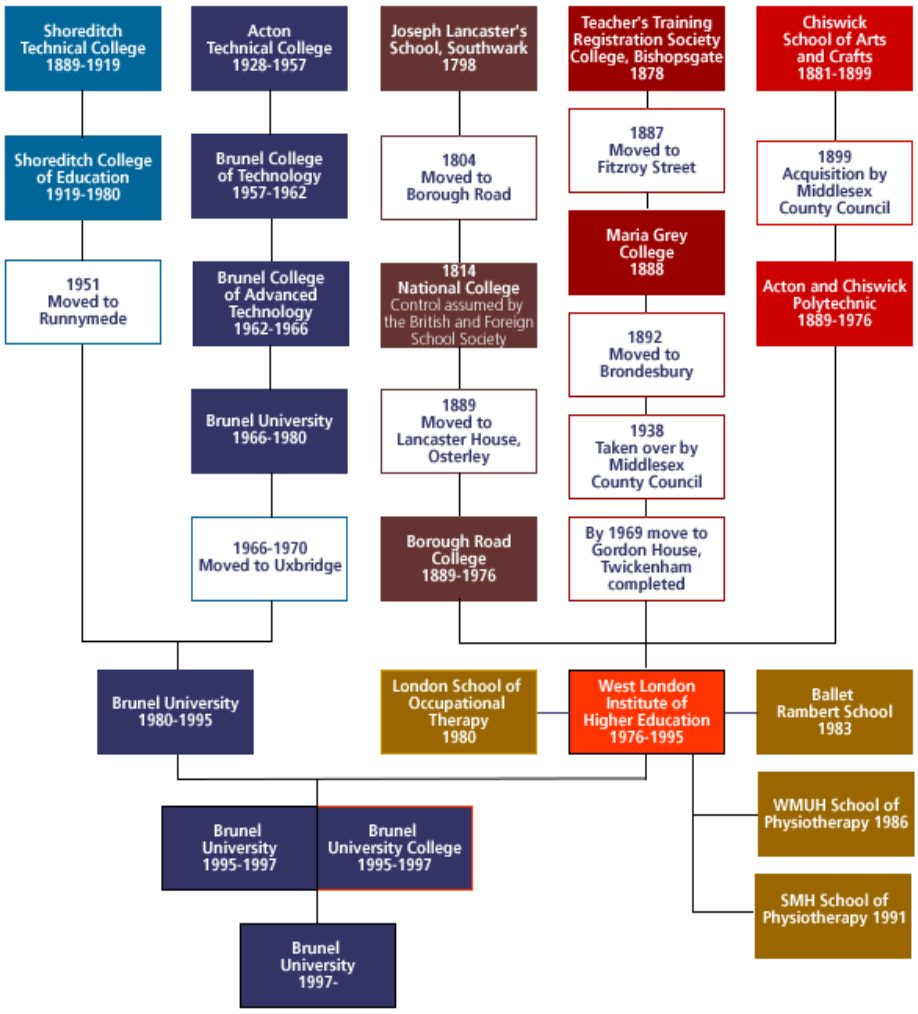


Figure 5 illustrates the evolving structure of Brunel University. Notable continued growth can be seen from 1966 – 1970 where Brunel was formed at the Uxbridge campus. In 2009, Chris Jenks (Vice-Chancellor) stated that a major factor for Brunel's continued growth is the shift from being purely a teaching university to becoming more research focused. Jenks (2009) stated that Brunel is one of the UK's leading research universities and that Brunel is well known for the quality of

teaching. Further, he states that this growth has enabled the University to continually invest in the latest technology for students and staff on campus. Even with Brunel's investment in the latest technology, its main form of organisational communication is paper based. There are many paper documents distributed between staff and students. Keeping track of the latest version of a document is a very slow and cumbersome process. This is also a prominent problem between staff and students. For example, Brunel University has eight different schools i.e. arts, social science, business school, etcetera and each of them issue paper-based handbooks for students. Further, the University had to make a collective overall handbook for current undergraduate and postgraduate students.

To overcome the problem of many paper based handbooks, the University looked into using an electronic form of communication. The reason for employing an electronic format is due to a number of factors viz. to minimise the cost of printing 15,000 handbooks, provide staff with an easier way to edit and update the content, and provide the students with an alternative platform to access the information. Further, the electronic format is a preferred means of communication for most students.

Brunel in the early 1990s initiated the development of the web-based platform for communication with its stakeholders, students and staff. This included an external and internal web-based platform. The purpose of having the different web-based platforms was to differentiate the information among stakeholders, students and staff. The organisation needed a way of separating the content for external and internal use. Brunel currently uses student record database (SITS) and IntraBrunel WBIS for administration of its students. Brunel also uses u-Link (Blackboard Learning System) and eVision as learning and teaching WBIS for teaching staff and students.

4.3 Brunel University Switching from Paper-based to an Electronic Format

Brunel document management system is currently a mixture of paper-based and electronic network drive storage system. These systems are continuously being updated to make the process of document management more efficient. The paper-based system requires vast storage space. The storage of paper-based documents is a current problem in Brunel. This has provided greater incentive for Brunel to switch to a more efficient electronic document management system.

Brunel University is switching from a paper-based system to an electronic format. Therefore many departments within Brunel University are looking for new web-based means of communication to transfer information at internet speed to its students. For example, Brunel's commitment to transform it's communications into an electronic format can be seen by the allocation of more of its departmental budget to the development of the student services WBIS. The development of these WBIS for student services involved hiring a web developer. The present web developer is faced with many problems throughout the development of the WBIS. These include selecting an appropriate development methodology, incorporating web-based aesthetics at internet speed whilst at the same time accommodating emergence.

Brunel in 2011 is moving from a paper based system to an electronic format. The current intranet has enhanced communication between staff and students. The implementation of the electronic systems enabled Brunel to separate information for stakeholders, both internal (intranet) and external (internet) communications. This enabled the University to maintain confidentiality over sensitive information of all stakeholders.

4.4 Times Newspaper Report on Brunel University

A special report by the Times newspaper on Monday 28th January 1985 described Brunel University's objective as "a method that puts students in front". This means that Brunel is

listening to what it students require and delivering services to students' requirements. Brunel University was developed from the Acton College of Advanced Technology. Its philosophy is the application of knowledge and the pursuit of new knowledge.

Historically Brunel University was considered by the Times newspaper as consistently sitting at or near the top of the graduate employment tables. For example, in 1983, a particularly difficult year when national graduate unemployment was 12 per cent, only five per cent of Brunel's graduates failed to find jobs. The other 95 per cent entered a variety of occupations, including the police force and software engineering.

4.5 Brunel Commitment to Incorporating Work Experience

Brunel was one of the first universities to incorporate work experience within the course structure. Employers were encouraged that graduate students possessed professional work experience given to undergraduates by Brunel's unique "thin sandwich" system of education. This "thin sandwich" system requires all students to spend half of each of their first three years in companies, local government and other organisations where they are given a structured transition from the academic environment to that of workplace experience.

Brunel has closer links with industry than most other universities. By its very nature, the "thin sandwich" system requires liaison to be maintained on a continuous basis, with around 3,000 employing organisations which provide work placements for the students. Within the university there is a strong emphasis on practical application of learnt knowledge through undergraduate project work, particularly in the faculty of technology. In addition, numerous research programmes require liaison with external organisations on an almost daily basis.

The university coordinates its relationships with external organisations through an industrial services bureau which has overall responsibility for the consultancy activities of staff as well as

for grants and contracts to fund research. Proximity to Hillingdon Hospital and Heathrow Airport is also helpful. Numerous medical projects, including the treatment of malaria and other tropical diseases, are funded by organisations such as the UK Department for International Development (DFID) and Cancer Research Campaign as well as the Department of Health and Social Security and various other area health authorities.

Private sector organisations providing grants include Unilever, BP and Elf Aquitaine UK. There are eight teaching company schemes involving organisations e.g. De la Rue, IBM, GKN, Boosey & Hawkes and Polylina and these behave almost as subsidiary departments to the university.

Brunel is known for investing heavily in its facilities over the years. For example, in 1985 Brunel had one of the largest technological libraries in Europe. 'There is a computing unit to provide research assistance with programme preparation and an audio-visual centre stocked with broadcast standard equipment' (Times, 1985).

4.6 Brunel Financial Commitment

Brunel University had a commemorative year in 2006. Brunel raised £100 million over a 35-year period to finance its new student residences. Through the use of long term hedging arrangements, Brunel took advantage of historically low long-term interest rates which protected it from future rate rises. The vice chancellor, Lord Wakeham, at that time (2006) stated that investment of £170 million was allocated to new buildings and infrastructure. He viewed the survival of Brunel University as requiring financial commitment to be competitive in the higher education market place.

Changes in how undergraduates pay for their education will make them more discerning than ever in their choice of university. Lord Wakeham remains adamant that Brunel has to maintain its edge against strong competition. He stated that the preparation for Research Assessment

Exercise (RAE) and its implications for research funding are vital for Brunel's strategy in becoming research-led. He said Brunel is already rising to the challenges ahead.

These challenges involve the setting up of scholarships to attract excellent national and international students from the widest possible backgrounds. He contended that the University continues to carry out ground-breaking research that has a positive impact on society. He remarked that the university was praised by the Quality Assurance Agency (QAA) for the quality of its teaching and diversity community of students.

4.7 Brunel University Strategic Plan 2008 to 2012 Plan

The strategic plan for 2008 to 2012 was published in 2008. The University aims to move towards 2012 with academic confidence, financial security and a growing national and international reputation, outlining the mission of the University. The university's mission is:

"To advance knowledge and understanding, and provide society with confident, talented and versatile graduates"

Brunel has five strategic imperatives that help crystallise and assess its progress towards the vision of being a world-class creative community. These are: Encourage and support a vibrant research community that is research intensive; creative and collaborative; and engaged with the world at large. Enhance the student experience by focussing on the needs of our students. Compete globally through collaborations and partnerships, encouraging staff and students to be global citizens. Enhance the enterprise culture by encouraging stronger business awareness and expanding enterprise and knowledge transfer activities. Provide an enabling environment where staff contribution, retention and development are valued.

4.8 Brunel University's Commitment to Investing in WBIS Development

Brunel University sees the improvement of its WBIS as central to its plans for improving the University's reputation. Because the registry department and the graduate school had concerns that some information was difficult to find in the current version of the student research handbook, an investigation was commissioned to determine the problems and make recommendations for improvement. Improvements to the research handbook were needed to improve the experience for research students and also to reduce the workload of registry and student services departments. These departments deal with queries that could be answered by a better designed handbook. To address this problem Brunel University employed a web developer to implement the development changes necessary for both the student services and student research handbook. The web developer is the present action researcher.

4.9 The Management Structure of Brunel University

The management structure of Brunel University in 2011 consists of five main principal offices (See chart at Appendix 8.15). These are: strategy and development, external relations, student experience & staff development, research and director of resources & operations. The office of resources & operations is responsible for the development of the student services and student research handbook WBIS. They set the allocated budget for developing the WBIS. The setting of the budget is aligned with the growth of the University. Demand for student places at Brunel University demonstrates growth with overall student numbers during 2008/09 being 14,878 representing an overall increase of 7.2% on 2007/08 (See Figure 6).

Figure 6 Brunel University Student Numbers

Student Numbers	2008/09			2007/08		
	Home/EU	Overseas	Total	Home/EU	Overseas	Total
Undergraduate non degree	331	167	498	340	123	463
Undergraduate	9,429	910	10,339	9,068	799	9,867
PGCE	354	5	359	313	10	323
Postgraduate Taught	1,489	1,323	2,812	1,354	1,019	2,373
Postgraduate Research	462	408	870	530	327	857
Total	**12,065**	**2,813**	**14,878**	**11,605**	**2,278**	**13,883**

Figure 6 shows that Brunel University undergraduate student population increased by 4.8%, with further significant growth being achieved in the Postgraduate Taught category of 18.5%. The student population of Postgraduate Research grew marginally, though within that the decline in home postgraduate research student was more than offset by the growth in overseas postgraduate research students. This reflects the successful marketing of the University in the international higher education market.

The increasing demand for places at Brunel, as well as growth in research funding awarded to the University, is evidence of its success, which inevitably leads to the education of able and confident graduates who, in turn, increase the reputation of Brunel in the world at large.

4.10 Student Services within Brunel University

The relationship with Brunel University student services section, started through the advertisement of a web developer role to develop WBIS. Student services have one overall manager and she has to work collectively with 20 different student services. Each student

services section (i.e. disability and dyslexia service) has a manager. The overall student services manager has to work with the many different services to improve the WBIS for both staff and students. In this context, the web developer and manager worked together to explore what methods could be used to improve the current WBIS already in place.

The web developer had to develop WBIS for student services. These web-based student services had to ultimately provide continuously better support for students each year, which is not only dynamic but also problematic in an emergent organisation. For example, the student services section has increasingly changing regulations. For instance, the University wants to provide continuously better support to the students who are involved with the development of a Student Services WBIS, wherein many different services are collectively incorporated. How Brunel University student services section creates WBIS whilst, at the same time, managing organisational change, with fast paced deadlines and the delivery of media features is of great importance in solving the web developer problem.

CHAPTER 5: Data Analysis

5.1 The Data Analysis of an Interpretivist

This data analysis section is from an interpretive perspective. The data analysis process involved using comparisons to develop associations from the data. This enabled the interpretivist to increase his understanding within the context of the research problem (Moses and Knutsen, 2007). Baskerville & Pries-Heje (2001) used an interpretivist approach to develop the ten factors of internet speed. This was generated through the use of comparisons to develop associations. For example, in this data analysis section, the web developer analysed and compared the demand for web-based aesthetics with internet speed in both the student services and the student research handbook projects. The action researcher identified a direct association between web-based aesthetics and internet speed. By employing the strategy of using comparisons to develop association the web developer was able to develop associations within this research, which enabled him to better understand how a web developer develops WBIS in emergent organisations.

To understand how the web developer develops WBIS, this research sets out to design an analytical development tool. This analytical tool aids both the organisation and the web developer when the critical factors of internet speed and web-based aesthetics affect the WBIS development process.

The data analysis chapter begins with the idea of what constitutes satisfactory data analysis. Satisfactory data analysis is viewed by the action researcher from the qualitative perspective. Then the interpretivist approach to the data analysis is explained. The background to the data analysis is presented with the development of 357 nodes. The action researcher's 'code' the sources of information to gather material by topic. For example, the node is used to gather all the content relating to the concept of web-based aesthetics. The container for references to this material is called a 'node'. Following this development of nodes, the student services and student

research handbook AR cycles are analysed sequentially and non-sequentially. The action researcher introduced mixed combinations to identify underlying patterns and associations from both the student services and student research handbook. Additional sources of data are then introduced to gather further understanding and knowledge in answering the research questions. The underlying purpose of this action research investigation is to address the research questions as set out in Chapter 1. The action researcher will be looking for answers to these questions. Lyn Richards (2009) identified criteria to successfully answer these research questions. These criteria are discussed next.

5.2 What Constitutes Satisfactory Data Analysis?

Richards (2009) identifies the following criteria that constitute satisfactory data analysis for AR. These are:

1. That it should meet the goals of the project, answering the research question
2. That it should offer analysis, not just description
3. That it should offer at least a new local theory or explanation

The action researcher agrees with the criteria set out by Richards (2009) i.e. that the data analysis should meet the goals of the project by answering the research question. The fitness for purpose of a data analysis technique is a key criterion to explain and understand the AR investigation. The action researcher also agrees with the second point, which is that the analysis should not be purely descriptive. For example, if it was purely descriptive it wouldn't address the main aim of this investigation which is to resolve a practical problem in WBIS development. Further, the action researcher concurs with the third point which is that the AR offers an explanation of factors which affect WBIS development viz. web-based aesthetics, internet speed, emergent organisation & web developer's level of ability.

Richards (2009) identified three additional perspectives. She stated that these additional perspectives should be accomplished for good qualitative AR data analysis. These are:

1. That it should offer something more than what the participants in the research have reported
2. That it should account for the data
3. That it should be usable i.e. the researcher should be able to do something with the outcome

The action researcher views these three additional perspectives as good indicators in an AR investigation. The last criterion that 'it should be usable' is essential to the intended purpose of this research.

5.2.1 The Interpretivist Data Analysis Process

The action researcher used an interpretivist strategy to investigate the AR data and to draw out patterns and themes. Patterns are themes of recurring events. After discovering patterns from the data, the action researcher then used these patterns to create associations through the generation of categories. Associations are the correlation between the different patterns and themes. These associations are formed by the comparison of the two AR projects i.e. student services and student research handbook. The action researcher used comparisons to map regularities with the aim of discovering general outcomes from the data (Moses & Knutsen, 2007, pp.53).

The interpretivist perspective on Brunel's management and development problems helps to provide resolutions from the AR data. The AR data helped the action researcher to understand the problem in context and provide a resolution to the problem. The action researcher developed clusters of categories from the AR data as possible resolutions.

The action researcher discovered that there were WBIS development problems within the student services department. The student services' manager had a management problem. This management problem concerned the requirements collation for the different student services departments. For example, the data analysis revealed that there were recurring themes of problems involving collaboration within the different departments of the student services section. The problem of collaboration occurred because of varying requirements by the different student services departments.

The action researcher used Nvivo8 to code the data and to generate categories. The action researcher interpreted the data by selecting the appropriate sections and classifying them into to various categories. The process involved selecting parts of the text and giving it a category name or selecting the text and adding the text to a category already created. The action researcher carried out this process for all data sets viz. student services, student research handbook, additional action student services, K's Questions and Dr M Interview (see acronyms for details).

The action researcher wants to understand the question viz. how an emergent organisation develops WBIS, with increased demand on the web developer for web-based aesthetics at internet speed. This can be understood by looking for patterns from the different cycles of each individual project (i.e. of the SS and SRH cycles).

The first stage of data analysis is coding the data, using Nvivo8, into individual nodes. From this process 357 different nodes were developed (see appendix 8.4 - 8.14). From the two AR projects (student services and student research handbook) eight main AR cycles were utilised as the basis for unravelling the flows and patterns. Firstly, the student services project is labelled as the code SS and each cycle in this SS section is labelled from SS1 to SS4 respectively. Secondly, the same process was applied to the student research handbook cycles, labelled from SRH1 to SRH4 respectively. The abbreviations are used to assist the action researcher to easily compare and contrast the different AR cycles belonging to the two projects (i.e. SS and SRH) and to elicit out

deeper understanding from them. Explanation of the four student services and four student research handbook cycles can be viewed in chapter 3.

Categories identified in Table 9 aid the action researcher to find recurring themes and patterns. These patterns inform the action researcher through better understanding and knowledge of the web developer's problem. Table 9 represents the results of the student services cycles. Categories for these cycles are displayed in the left column. The next two sections in this table contain both sequential and non-sequential categories. Sequential combination is succeeding or following in order and vice versa for non-sequential. The sequential and non sequential SS cycles were compared. This data analysis process is designed to draw out associations from the action research data.

Table 9: Student Services (SS) Cycles – Sequential and Non Sequential

Categories	Sequential				Non-Sequential		
	SS1 & SS2	SS2 & SS3	SS3 & SS4		SS1 & SS3	SS1 & SS4	SS2 & SS4
Accommodating Organisational Change	-	-	✓		-	-	-
Appropriateness and Suitability	-	-	-		-	-	-
Categorisation	✓	✓	✓		-	-	-
Coding Problem	-	-	-		-	-	-
Develop Analytical Tool	-	-	-		-	-	-
Different Methodologies	-	-	-		✓	-	-
Emergent Aspects	-	-	✓		-	✓	✓
Emergent Information Requirements	-	-	-		-	-	-
Emergent Methodologies	-	-	-		-	-	-
Emergent Organisation	-	-	✓		-	-	-
Inadequate Methodologies	-	-	-		✓	✓	✓
Information Collation	-	✓	-		-	-	-
Internet Speed Development	-	-	✓		-	-	-
Layout and Design	✓	-	-		-	-	-
Meeting Tight Deadlines	-	-	-		-	-	-
Methodology Issue	-	-	✓		✓	-	✓
Methodology needs emergent Characteristics	-	-	✓		-	-	-
Mixed Methodologies	-	-	-		-	✓	✓

Reduce Time-to-Market	-	-	-		-	-	-
Specific Methodology	-	-	-		-	-	-
Time Constraint	-	-	✓		✓	-	-
Time Consuming	-	-	-		✓	-	-
Time Delay	-	-	-			-	-
Time-to-Market	-	-	-		✓	-	-
Usability	✓	-	-		-	-	-
Web Developers Level of Knowledge	-	-	✓		-	-	-
Web-based Aesthetics	-	✓	-		-	-	-
Not Stated	-	-	-		-	-	-

Table 9 identified three associations from the sequential and non sequential AR cycles. These associations are emergent aspects, methodology issue and time constraint. All three associations identified are supported by literature. Truex, Baskerville & Klien (1999) identified that methodologies would be difficult to implement from start to finish in an emergent organisation. This concurs with our findings that methodology issue is one of the factors affecting WBIS development. Further, Truex, Baskerville & Klien (1999) research concurs with our results that there are also problems of emergent aspects and time constraint affecting the WBIS development process.

The emergent aspects factor appeared first in cycles SS3 & SS4 (sequential) and SS1 & SS4, SS2 & SS4 (non sequential). Secondly, methodology issue appears in cycles SS3 & SS4 (sequential) and SS1 & SS3, SS2 & SS4 (non sequential). Finally, time constraint appeared in cycles SS3 & SS4 (sequential) and SS1 & SS3 (non sequential). These associations identify the factors encountered in the AR investigation and give rise to the new understanding that emergent aspects, methodology issue and time constraint are problems for the web developer when developing WBIS.

By reflecting on the data contained in Table 9, the action researcher starts with the sequential SS combinations in Table 10. The grey boxes in Table 10 are not taken into consideration for this analysis. Only the yellow shaded sequential combination boxes are being discussed. Table 10 represents the sequential combinations of the all the student services (SS) cycles being examined. These SS cycles are: SS1 & SS2 (Figure 7), SS2 & SS3 (Figure 8) and SS3 & SS4 (Figure 9). In the data analysis section the action researcher examined these cycles (SS1-SS4) in pairs to ascertain whether there are any discerning themes and patterns that can be derived from them.

Table 10: Sequential Combination of the Student Services (SS) Cycles

	SS1	SS2	SS3	SS4
SS1				
SS2	SS1 & SS2 (Figure 7)			
SS3		SS2 & SS3 (Figure 8)		
SS4			SS3 & SS4 (Figure 9)	

Figure 7 represents patterns and associations from cycles SS1 & SS2. The first cycle (SS1) demonstrates the initial ideas and thoughts of the web developer. The second cycle (SS2) gives more specific requirements for the web developer to incorporate in the WBIS development process. This is to ascertain what patterns or recurring themes are needed to better understand how the web developer develops WBIS. The modelling of these cycles displays patterns. Patterns are factors affecting both AR cycles. These patterns assisted the action researcher to clearly identify patterns and themes.

How to read Nvivo8 diagrams. The diagrams start off in the top left hand corner. Here both action research cycles are illustrated in rectangle boxes (e.g. SS1 & SS2 action research cycles). Following on from this the WBIS development process is mapped out through the action researcher linking the nodes (e.g. prototyping, internet speed development and emergent

methodologies). This process is mapped out from left to right. The same WBIS mapping process is utilised throughout all data sources' figures.

Figure 7: Student Services AR Cycles 1 and 2 (SS1 & SS2)

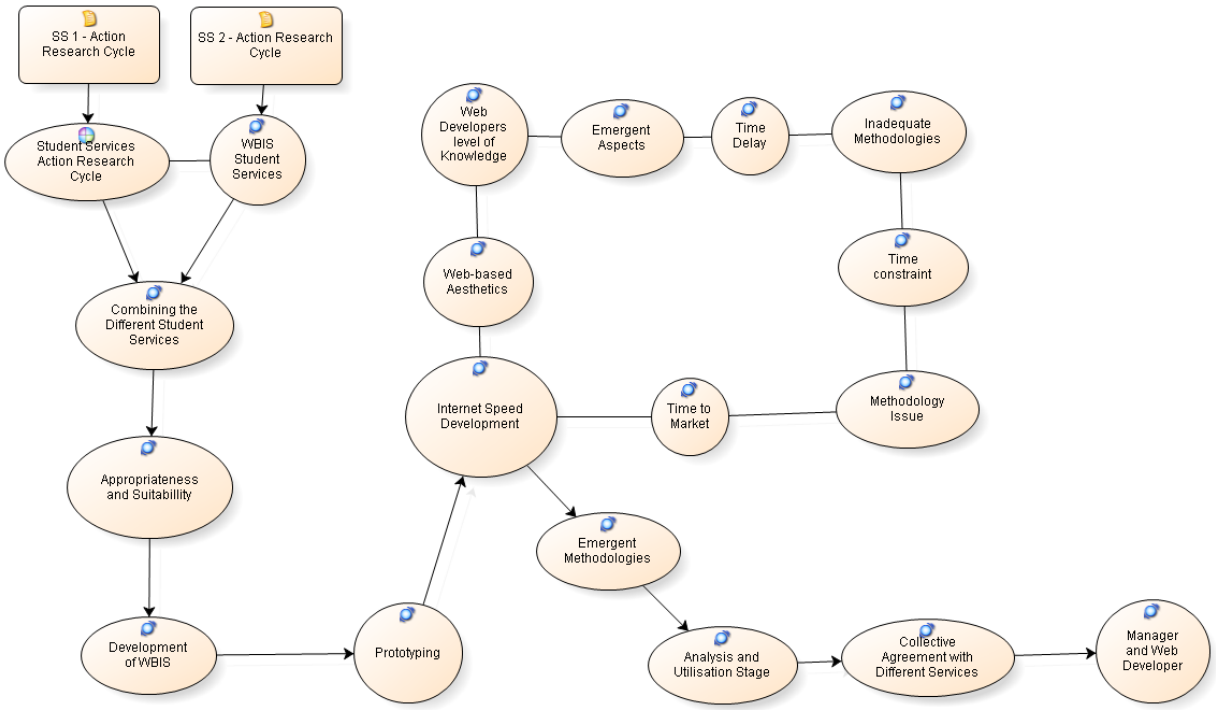
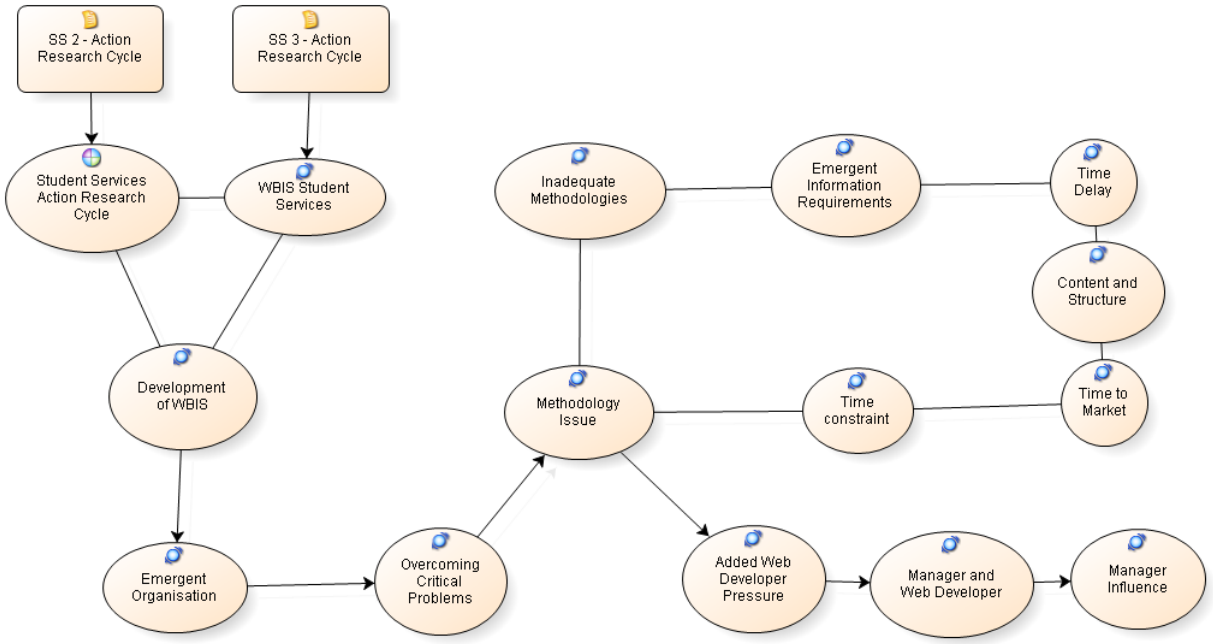


Figure 7 (SS1 & SS2) supports the main question posed, which is that there is a problem with the development of WBIS in an emergent organisation. Some of the problems identified by the web developer with this sequential combination are: the web developer's level of knowledge, emergent aspects, time delay, inadequate methodologies, time constraint, methodology issue, time-to-market, internet speed development and web-based aesthetics. These results demonstrate that these associations are real problems faced by the web developer in an emergent organisation.

The action researcher then looked at the next sequential pattern Figure 8 (SS2 & SS3). The first cycle (SS2) represents the disagreements between the manager and web developer for design requirements. The second cycle (SS3) identifies the current development stage and methodology used in the WBIS project. The action researcher found that the discovered categories in Figure 8 showed similar results as in the AR cycles SS1 & SS2 (Figure 7). These categories identified are: time delay, inadequate methodologies, time constraint, methodology issue and time-to-market. Therefore, the results in Figure 8 (SS2 & SS3) support the results found in Figure 7.

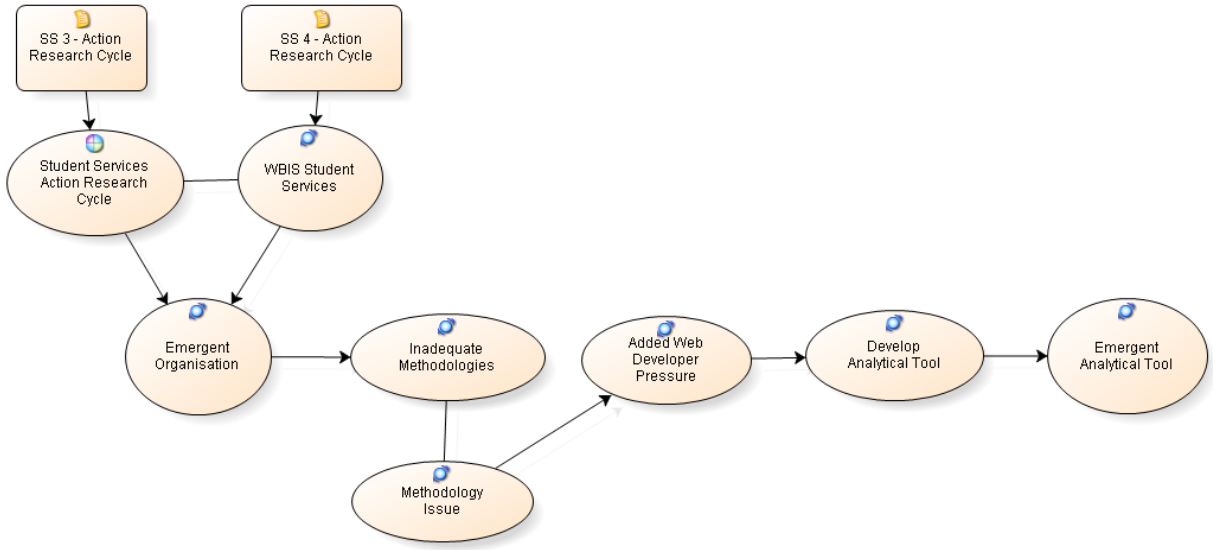
Figure 8: Student Services AR Cycles 2 and 3 (SS2 & SS3)



The action researcher then looked at the next sequential pattern Figure 9 (SS3 & SS4). The first cycle (SS3) identifies the current development stage and methodology within the WBIS project. The second cycle (SS4) represents the initial development of an analytical development tool (Kadar Matrix) needed for the WBIS project. The action researcher found that the categories found in Figure 7 showed similar results as those found in Figures 8 and 9. These categories

identified are: Inadequate Methodologies and Methodology Issue. Therefore the outcome results in Figure 9 (SS3 & SS4) support the analysis found in Figures 7 and 8.

Figure 9: Student Services AR Cycles 3 and 4 (SS3 & SS4)



The data analysis from Figures 7, 8 and 9 gave the action researcher improved understanding of the problems the web developer faced when developing WBIS in an emergent organisation. This understanding of the problem faced by SS in WBIS development enabled the web developer to try out suitable methodologies.

Further, the action researcher found that Figure 9, not only supports the derived themes & categories in Figures 7 and 8, but also identifies new categories. This leads the action researcher to develop a new analytical development tool to develop WBIS in emergent organisations to assist the web developer and manager. These new categories can be seen from the last two nodes (i.e. develop analytical tool and emergent analytical tool) as shown in Figure 9. This analytical development tool is needed to better inform the manager whether the methodologies can be

implemented systematically from start to finish in conditions of internet speed, web-based aesthetics, emergent organisation and web developer's knowledge.

The researcher identified the web developer problems and generated associations from the categories in the sequential cycles. These problems were: the web developer's level of knowledge, emergent aspects, time delay, inadequate methodologies, time constraint, methodology issue, time-to-market, internet speed development and web-based aesthetics. Following on from the sequential combinations (Table 10), the action researcher examined non-sequential combinations of the SS cycles.

Table 11 shows the non-sequential combinations being examined. These are: SS1 & SS3 (Figure 10), SS1 & SS4 (Figure 11) and SS2 & SS4 (Figure 12). Non-sequential combination is not succeeding or following in order. The grey boxes in Table 11 are not taken into consideration for this analysis. Only the yellow shaded non-sequential combination boxes are being discussed.

Table 11: Non-Sequential Combination of the Student Services (SS) Cycles

	SS1	SS2	SS3	SS4
SS1				
SS2				
SS3	SS1 & SS3 (Figure 10)			
SS4	SS1 & SS4 (Figure 11)	SS2 & SS4 (Figure 12)		

The non-sequential cycles (Figures 10, 11 and 12) are used to highlight prevalent problems that might not be taken into consideration in sequential cycles. It also lends itself to support or not support the understanding gained from the sequential cycles.

To better understand the problems faced by the web developer the action researcher is using the three interrelated constructs of the theory of deferred action. These three constructs are: planned action, emergence and deferred action. The first dimension, planned action, states that organisations plan. In the case of student services department the plans are to develop the WBIS before the start of the next academic year. This involves the web developer and manager deciding what is the appropriate methodology for developing the WBIS. The second dimension emergence, explains the changing nature of organisations and its effect on the use of Information Technology (IT). The pressure on time to market impacted on the successful implementation of WBIS methodologies (emergence). The third dimension deferred action is the resolution to emergence in a planning context. Deferred action is taken by actors to overcome emergence in organisations context (Patel 2009b). Patel's (2007) three dimensional analysis enabled the action researcher to explain the data. The web developer had to accommodate emergence by combining WBIS methodologies (deferred action). This enabled the web developer to meet the projects deadline which is the start of the next academic year.

The non-sequential data analysis draws some interesting patterns when compared with the sequential data. These patterns are: emergent aspects, methodology issue and time constraint. Table 12 provides extracts of these three categories through ToDA and are supported with extracts from the student services AR data. Table 12 has two headings per column. The top heading refers to the related construct of the theory of deferred action. Therefore the extracts are examples of: planned action, emergence or deferred action. Sometimes examples can be a combination of more than one construct (i.e. planned action & emergence). The second heading per column (in bold) refers to the category name (i.e. emergent aspects, methodology issue and time constraint). Further Table 12 shows that in all cases deferred action was carried out.

Table 12: Three Interrelated Constructs Categorised Under ToDA

Deferred Action	Deferred Action	Deferred Action
Emergent Aspects	**Methodology Issue**	**Time Constraint**
Apprehensive about the student services WBIS development process, the action researcher developed an analytical development tool to overcome emergent information requirements	RMM is focused on web application and its use within this context is not tested and designed for this higher education environment.	The action researcher found organizing the WBIS development process a time consuming process that involved arranging meetings and mapping the process for each department.

The combined figures of SS1 & SS3 (Figure 10), SS1 & SS4 (Figure 11) and SS2 & SS4 (Figure 12) generated patterns. These patterns agree with the understanding drawn from the initial SS cycles discussed earlier in Figures 7, 8 & 9. However, new categories viz. inadequate methodologies, different methodology and mixed methodologies are also found in the patterns generated in these cycles. Table 13 mentions the above categories and is supported with extracts from the student services AR data. Again Table 13 has two headings per column. The top heading refers to the related construct of the theory of deferred action. The extracts are examples of: planned action, emergence or deferred action. The second heading per column (in bold) refers to the category name (i.e. inadequate methodologies, different methodology and mixed methodologies).

Table 13: Patterns found that confirm deferred action constructs

Emergence	Planned Action	Emergence & Deferred Action
Inadequate Methodologies	**Different Methodology**	**Mixed Methodologies**
The methodologies available need emergent characteristics to cope with the changing nature of the environment in which they are used. Current methodologies are not able to address the problems of WBIS development in an emergent higher education organisation.	An agreement was made to pursue two different methodologies (prototyping and time-boxing) for the initial development.	The student services with continuously tight deadline may use any acceptable methodology or method to deliver the emergent requirements within the set time frame. There is a need to incorporate some or all of these methodologies and also to add new development ideas to them to be able to deal with the problem of emergence.

Figure 10 represents non sequential student services action research cycle. When compared with the sequential action research cycles two new categories emerged. These categories are methodology issue and time constraint.

Figure 10: Student Services AR Cycles 1 and 3 (SS1 & SS3)

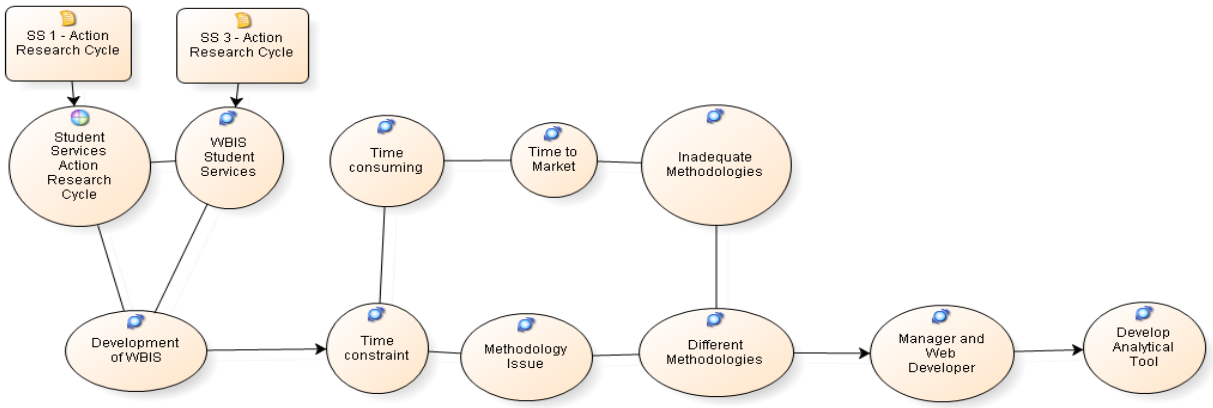


Figure 11 represents non sequential student services action research cycle. When compared with the sequential action research cycles one new category emerged. This category is methodology issue.

Figure 11: Student Services AR Cycles 1 and 4 (SS1 & SS4)

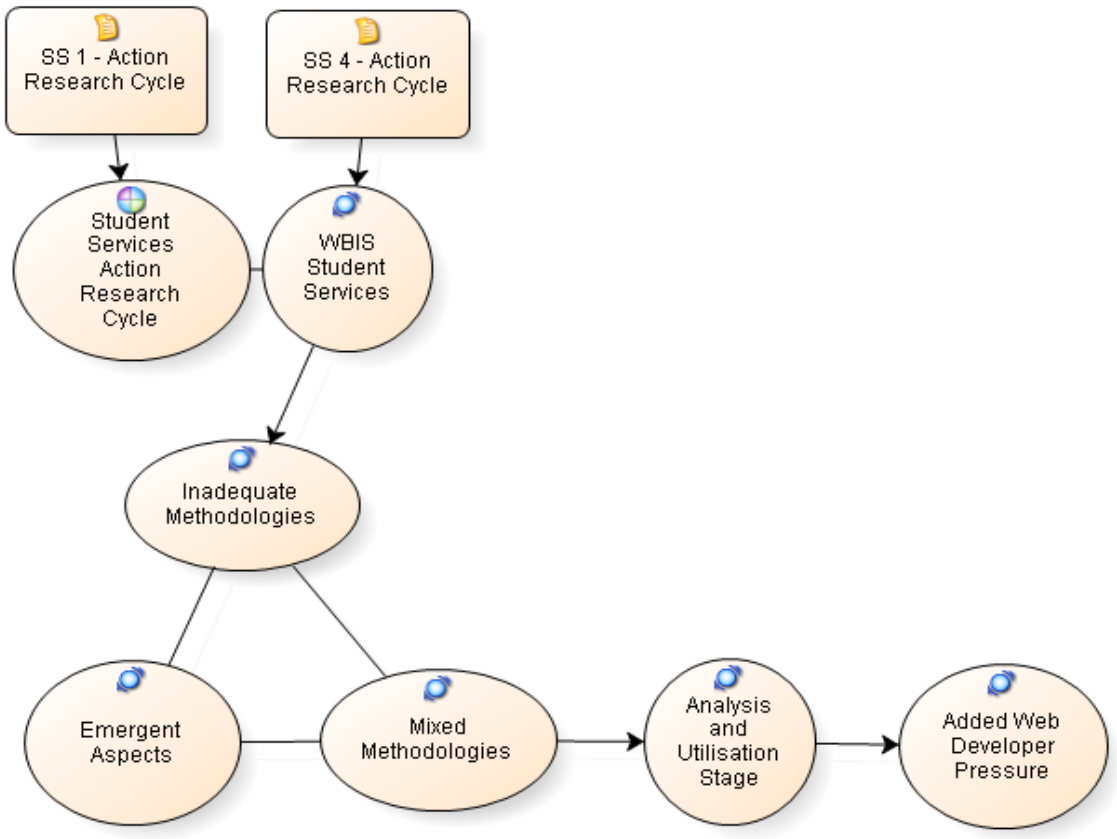
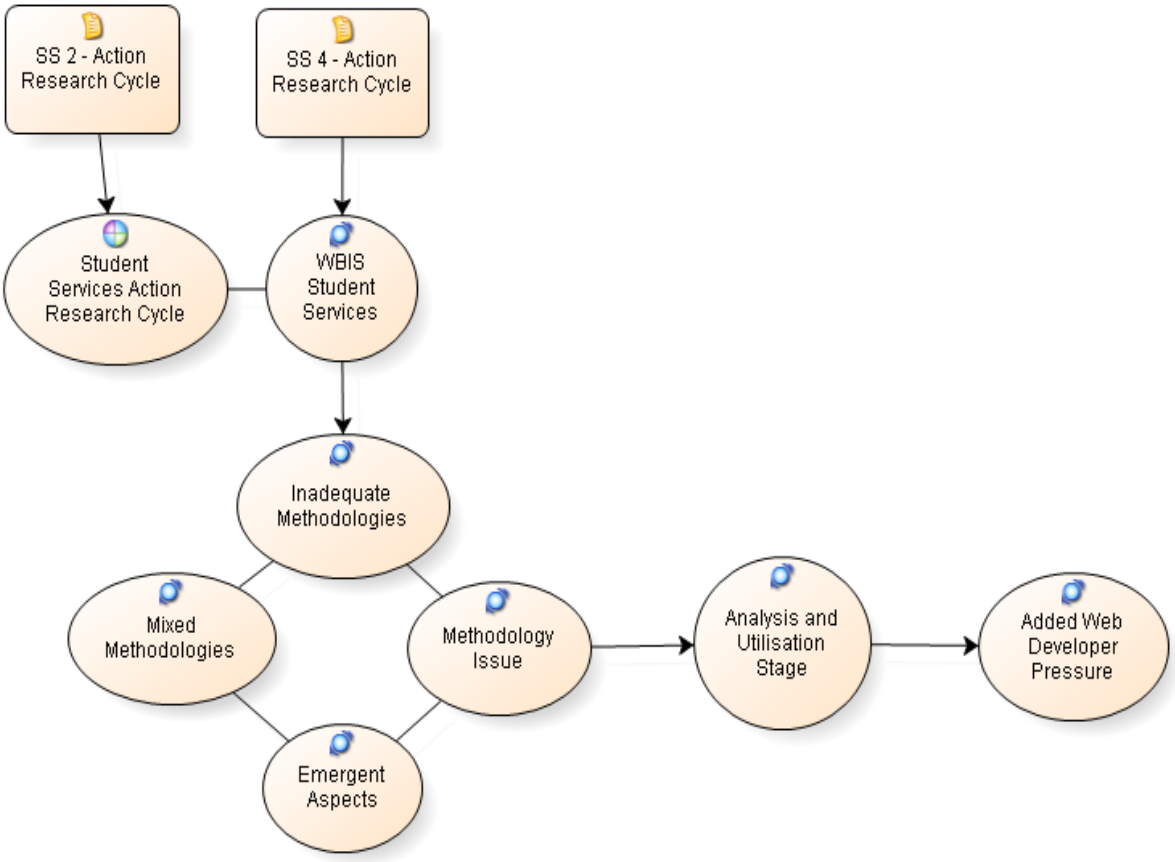


Figure 12 represents non sequential student services action research cycle. When compared with the sequential action research cycles two new categories emerged. These categories are emergent aspects and methodology issue.

Figure 12: Student Services AR Cycles 2 and 4 (SS2 & SS4)



5.3 The Interpretivist Understanding of the Student Research Handbook AR Cycles

Table 14 shows the analysis of sequential combinations. These are: SRH1 & SRH2 (Figure 13), SRH 2 & SRH 3 (Figure 14) and SRH 3 & SRH 4 (Figure 15). The first iteration of the SRH cycle demonstrates similarly the overcoming of critical problems in the development process. More importantly it adds value by revealing new categories such as: usability, layout and design, categorisation and information collation which were not present in the student services cycles' analysis. For example, each of the above mentioned constructs is categorised within ToDA and supported with extracts from the student services AR data (See Table 14). Again Table 14 has two headings per column. The top heading refers to the related construct of the theory of deferred action. The second heading per column (in bold) refers to the category name (i.e. usability, layout & design, categorisation and information collation).

Table 14: New Categories in Student Research Handbook through ToDA

Planned Action	Planned Action & Emergence	Emergence	Emergence
Usability	**Layout and Design**	**Categorisation**	**Information Collation**
Observing the users interactions with the current student research handbook is planned through a card sorting study. Ensuring the font size is legible through the student research handbook.	Satisfaction with the design of the current student research handbook is low. Links within the pages of the handbook are not properly laid out and hard to find. The handbook is inadequate for retrieval of information.	A key issue is, of course, exactly how the information is categorized within the redesigned handbook. The research handbook provides drop-down menus from category heading to provide quicker access to key content.	Retrieving information on the basis of the current headers / information categorization scheme is problematic. Integrating all of these aspects isn't possible within the time constraint.

Table 15 details the sequential combinations of the student research handbook cycles. The grey boxes in this table are not taken into consideration for this analysis. The grey shaded boxes are not considered because they consist of non sequential combinations. Only the yellow shaded sequential combination boxes are being discussed.

Table 15: Sequential Combination of the Student Research Handbook Cycles

	SRH1	SRH2	SRH3	SRH4
SRH1				
SRH2	SRH1 & SRH2 (Figure 13)			
SRH3		SRH2 & SRH3 (Figure 14)		
SRH4			SRH3 & SRH4 (Figure 15)	

Table 16 represents the results of the student research handbook cycles. The tick (✓) in this table indicates the categories identified by the AR data. Categories are displayed in the left column followed by the sequential and non-sequential columns. This is a depiction of the comparison of sequential and non-sequential student research handbook cycles. Sequential combination is succeeding or following in order and vice versa for non-sequential. This data analysis process is designed to draw out associations from the action research data. This is important because the web developer wants to examine the data using sequential and non sequential combinations to add rigour and credibility to the results.

Table 16: Student Research Handbook Sequential and Non-Sequential Combination

	Sequential				**Non-Sequential**		
	SRH2 & SRH1	SRH3 & SRH2	SRH4 & SRH3		SRH3 & SRH1	SRH4 & SRH1	SRH4 & SRH2
Accommodating Organisational Change	-	-	✓		-	✓	-
Adaptability and Flexibility to Change	-	-	-		-	✓	-
Appropriateness and Suitability	-	-	-		-	-	-
Categorisation	✓	✓	✓		-	✓	✓
Coding Problem	-	-	-		-	-	-
Design Testing	-	-	-		✓	-	-
Develop Analytical Tool	-	-	-		-	-	-
Different Methodologies	-	-	-		-	-	-
Emergent Aspects	-	-	✓		-	-	-
Emergent Information Requirements	-	-	-		-	-	✓
Emergent Methodologies	-	-	-		-	-	-
Emergent Organisation	-	-	✓		-	-	-
Experienced Web Developer	-	-	-		✓	-	-
Inadequate Methodologies	-	-	-		-	-	-
Information Collation	-	✓	-		-	-	-
Internet Speed Development	-	-	✓		-	✓	-
Layout and Design	✓				-	-	-
Meeting Tight Deadlines	-	-	-		-	-	-
Methodology Issue	-	-	✓		-	-	-
Methodology needs emergent Characteristics	-	-	✓		-	-	-
Mixed Methodologies	-	-	-		-	-	-
Reduce Time-to-Market	-	-	-		-	-	-

Specific Methodology	-	-	-		-	-	-
Time Constraint	-	-	✓		-	-	-
Time Consuming	-	-	-		-	-	-
Time Delay	-	-	-		-	-	-
Time-to-Market	-	-	-		-	-	-
Usability	✓	-	-		-	-	-
Web Developers Level of Knowledge	-	-	✓		✓	-	-
Web-based Aesthetics	-	✓	-		-	-	-
Not Stated	-	-	-		-	-	-

Having established patterns and associations in the student services cycles, the action researcher focused on the student research handbook cycles. SRH 1 & SRH 2 cycles (Figure 13) map out the complete process. This helps to establish greater understanding of the new problems encountered by the web developer for the student research handbook. The new problems faced were: usability, layout and design, categorisation and information collation.

The modelling of these student research handbook cycles displayed some associations and recurrences within these cycles. These recurring patterns (e.g. accommodating organisational change, categorisation, internet speed development and web developer's level of knowledge) assisted the action researcher to clearly identify meaningful relationships when comparing categories that are closely related. Figure 13 represents the patterns and associations from cycles SRH1 & SRH2.

Figure 13: Student Research Handbook AR Cycles 1 and 2 (SRH 1 & SRH 2)

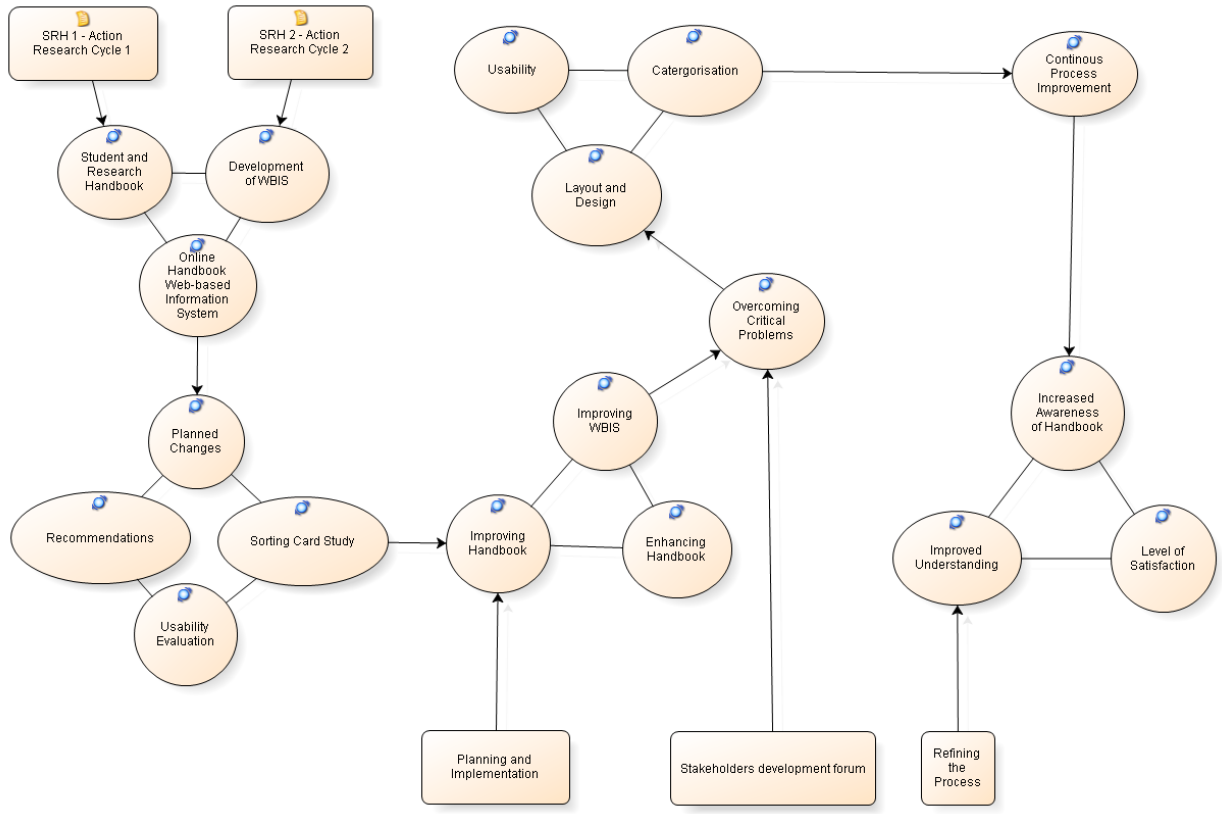
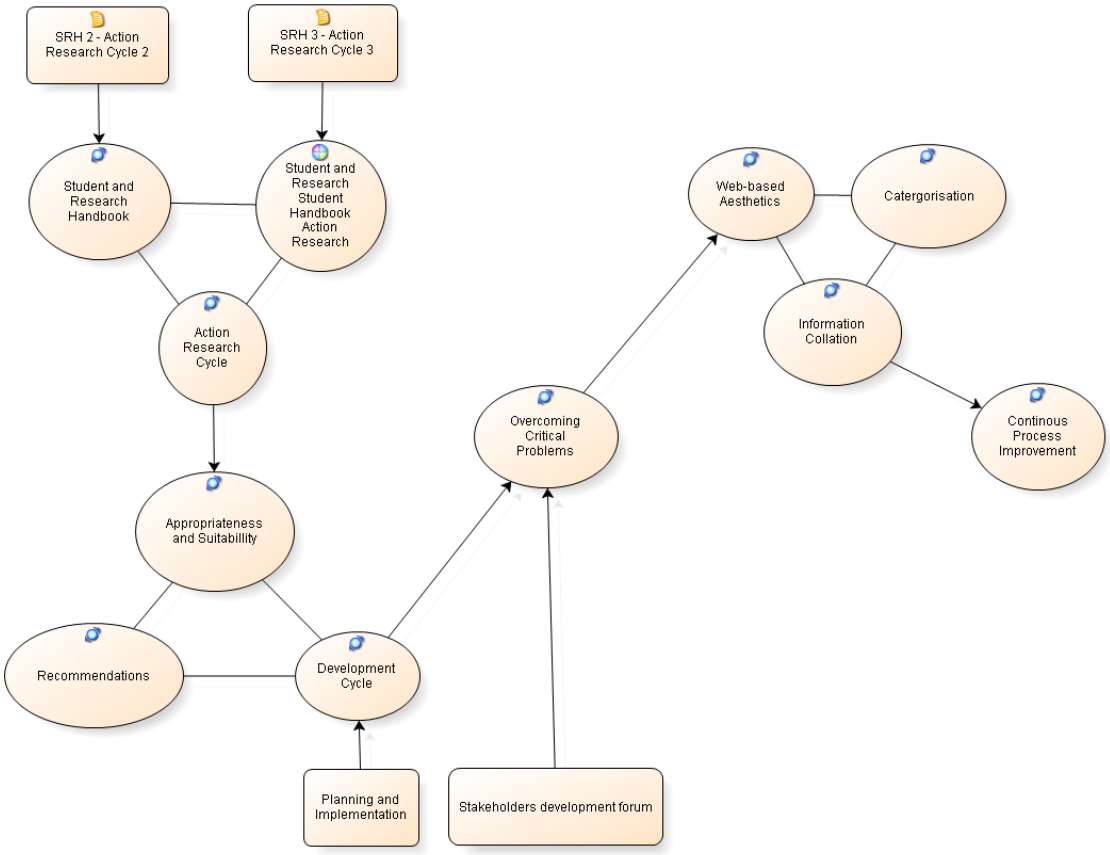


Figure 13 illustrates how the organisation is actively concerned with improving and enhancing the overall design of the student research handbook, whilst at the same time improving the WBIS development process. The reason for this is that the web developer is concerned with WBIS improvement relating to the following categories: layout and design, categorisation and usability. Similarly, these categories of association are found in the AR data. The cycles SRH1 and SRH2 align themselves with the analysis of the student services cycles in that it answers the main question posed (i.e. how does a web developer working in an emergent organisation develop web-based information systems, with increased demand on the web developer, for web-based aesthetics at internet speed?). The results indicate to the action researcher that these three

categories impact on how the web developer develops WBIS in emergent organisations. Therefore the results gained from the action research cycles answer the research question.

The action researcher looked at the next pattern derived from SRH 2 & SRH 3 (Figure 14) and compared this with the patterns derived from SRH 1 & SRH 2 (Figure 13). The reason for comparing and contrasting these cycles is to either affirm or disprove whether the problems faced by the web developer are the same or different for different stages of the development process. The following diagram (Figure 14) represents patterns and associations from cycles SRH 2 & SRH 3.

Figure 14: Student Research Handbook AR Cycles 2 and 3 (SRH 2 & SRH 3)



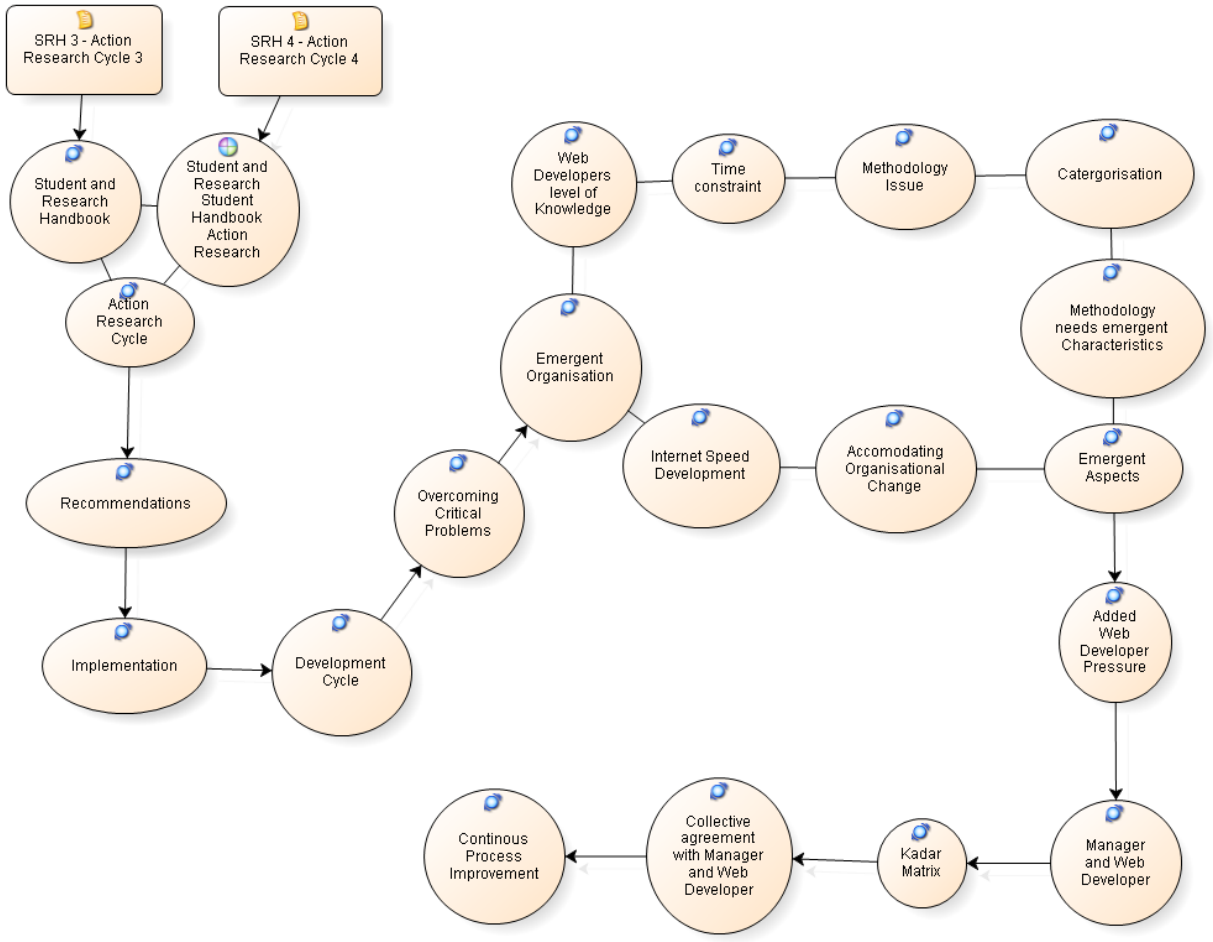
Here the researcher finds that the outcome from the data in Figure 14 (SRH 2 & SRH 3) illustrates that one category (i.e. categorization), matches with that of Figure 13 (SRH 1 and SRH 2). This means that the AR data confirms the aspect of categorisation (Table 16) as being a predominant factor in the student research handbook WBIS development process. Following on from this, two new categories emerged viz. information collation and web-based aesthetics. Information collation has been previously mentioned in Table 14. However, web-based aesthetics has not been previously mentioned in the student services data but became evident in the student research handbook data. This aspect of web-based aesthetics is presented next in Table 17.

Table 17: Web-based Aesthetics through ToDA

Emergence & Deferred Action
Web-based Aesthetics
Improvements were made to the look and feel of the current student research handbook. This was to provide users with more appealing search facilities. The action researcher found that users found the use of the current search facility inadequate. This is from the graduate school report, given to the web developer (see appendix 8.3) The identification of applicable methodologies in an emergent organisation is needed to cope with the critical factor of web-based aesthetics.

These categories information collation and web-based aesthetics, although different in labelling, in terms of patterns and association, support the analysis as found in Figure 14. Both these categories are present in Figure 14. The following diagram Figure 15 represents patterns and associations from student research handbook cycles SRH 3 & SRH 4.

Figure 15: Student Research Handbook AR Cycle 3 and 4 (SRH 3 & SRH 4)



Here the action researcher found that the outcome from the data in Figure 15 (SRH 3 & SRH 4) illustrates that one category (i.e. categorisation), matches with that of Figure 14 (SRH 2 and SRH 3). Here again the AR data confirms that categorisation is a predominant factor in the SRH WBIS development process.

In Figure 15, the action researcher identified similarity with the first two student research handbook cycles (Figures 13 and 14). The similarity among these three cycles is categorisation. However, four new categories are present viz. emergent organisation, web developer's level of

knowledge; methodology needs emergent characteristics and accommodating organisational change. These four new categories are explained with reference to the deferred model of reality with extracts from the student research handbook AR data in Table 18. Again Table 18 has two headings per column. The top heading refers to the related construct of the theory of deferred action. The second heading per column (in bold) refers to the category name (i.e. emergent organisation, web developer's level of knowledge, methodology needs emergent characteristics and accommodating organisational change).

Table 18: Four New elements through ToDA

Emergence & Planned Action	Planned Action, Emergence & Deferred Action	Deferred Action & Emergence	Planned Action & Emergence
Emergent Organisation	**Web Developer's Level of Knowledge**	**Methodology Needs Emergent Characteristics**	**Accommodating Organisational Change**
Actively incorporating a wholesale methodology proved impossible in this type of emergent environment. Reviewing appropriate methodologies in the literature base could prove beneficial in solving the organisations development problem.	The web developer interprets the stages to which the student research handbook project could be completed. The web developer estimates the time taken to carry out the different requirements. The web developer started to engage in parallel development because of the pressure of time to market.	The first cycle established the need for an analytical tool for WBIS in emergent organisations. This tool, the Kadar Matrix, was then applied in the second cycle. The Kadar matrix provided a tool to analytical identify the applicability of the availability of methodologies to the emergent organisation. The critical factors of internet speed and web-based aesthetics made the available methodologies inadequate.	Reviewing appropriate methodologies in the literature could prove beneficial in solving the organisation's development problem. There is no logical order to which recommendations to changes within the organisation should follow. Therefore the manager requirements are important for accommodating the demands of the organisation.

Following the analysis of the sequential interrelations within each of the student research handbook cycles, the action researcher examined the non-sequential student research handbook combination cycles. Table 19 represents the non-sequential combinations of the student research handbook cycles. The grey boxes in this table are not taken into consideration for this analysis. Only the yellow shaded sequential combination boxes are being discussed. This format is consistent through all tables showing yellow and grey boxes. The sequential combinations identified are: SRH 1 & SRH3 (Figure 16), SRH 1 & SRH 4 (Figure 17) and SRH 2 & SRH 4 (Figure 18).

Table 19: Non-Sequential Combination of the Student Research Handbook Cycles

	SRH1	SRH2	SRH3	SRH4
SRH1				
SRH2				
SRH3	SRH1 & SRH3 (Figure 16)			
SRH4	SRH1 & SRH4 (Figure 17)	SRH2 &SRH4 (Figure 18)		

The non-sequentially part of the data analysis follows on from the sequential student research handbook cycle analysis. The non-sequential cycles are used to highlight prevalent problems that might not be taken into consideration in the sequential student research handbook analysis. By analysing the non-sequential student research handbook AR data added rigor in the resulting understanding.

Again, the non-sequential analysis draws some interesting patterns when compared with sequential data. These patterns generated four interrelated constructs viz. accommodating organisational change, categorisation, internet speed development and web developer's level of

knowledge. These four constructs have been previously discussed in Table 18. Firstly, accommodating organisational change appeared in cycles SRH3 & SRH4 (sequential) and SRH1 & SRH4 (non sequential). Secondly, categorisation appeared in cycles SRH1 & SRH2, SRH2 & SRH3 and SRH3 & SRH4 (sequential) and SRH1 & SRH4, SRH2 & SRH4 (non sequential). Thirdly, internet speed development appears in cycle SRH3 & SRH4 (sequential) and SRH1 & SRH4 (non sequential). Finally, web developer's level of knowledge appeared in cycle SRH3 & SRH4 (sequential) and SRH1 & SRH3 (non-sequential). The web developer's level of knowledge and accommodating organisational change has already been mentioned previously in Table 18. To aid the reader this information is mentioned again in Table 20. Again Table 20 has two headings per column. The top heading refers to the related construct of the theory of deferred action. The second heading per column (in bold) refers to the category name (i.e. accommodating organisational change, categorisation, internet speed development, web developer's level of knowledge).

Table 20: Four interrelated cycles: SRH Sequential and Non-Sequential through ToDA

Planned Action & Emergence	Planned Action & Emergence	Emergence & Deferred Action	Planned Action, Emergence & Deferred Action
Accommodating Organisational Change	**Categorisation**	**Internet Speed Development**	**Web Developer's Level of Knowledge**
Reviewing appropriate methodologies in the literature could prove beneficial in solving the organisation's development problem. There is no logical order to which recommendations to changes within the organisation should follow. Therefore the manager requirements are important for accommodating the demands of the organisation.	A key issue is how the information is categorized within the redesigned WBIS student research handbook Retrieving information on the basis of the current headers / information categorization scheme is problematic	The gap in the development process usual results in too many additional adjustments which cannot be incorporated at the development process stage. The time to market places on this project was very strong as the time span for implementation was only one month.	The web developer interprets the stages to which the student research handbook project could be completed. The web developer estimates the time taken to carry out the different requirements. The web developer started to engage in parallel development because of the pressure of time to market.

Figure 16 represents non sequential student research handbook action research cycle. This non sequential action research cycle (SRH 1 & SRH 3) identified three categories. These three categories are design testing, experienced web developer and web developer's level of knowledge.

Figure 16: Student Research Handbook AR Cycle 1 and 3 (SRH1 & SRH3)

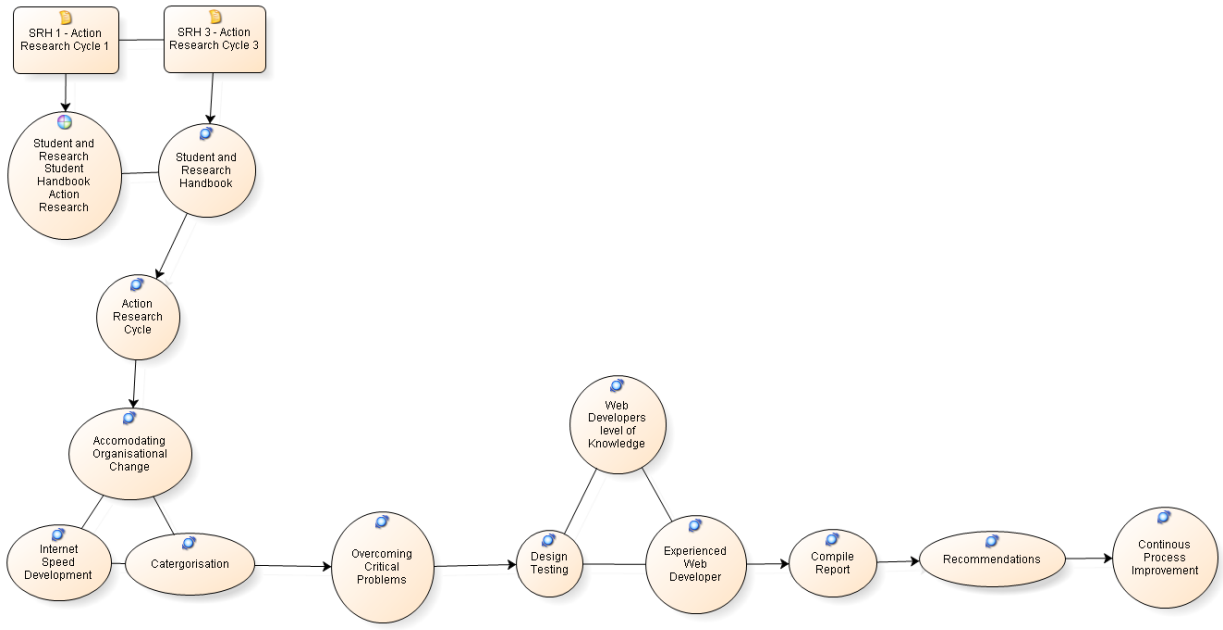


Figure 17 represents non sequential student research handbook action research cycle. This non-sequential action research cycle (SRH 1 & SRH 4) identified four categories. These four categories are accommodating organisational change, adaptability and flexibility to change, categorisation and internet speed development.

Figure 17: Student Research Handbook AR Cycle 1 and 4 (SRH1 & SRH4)

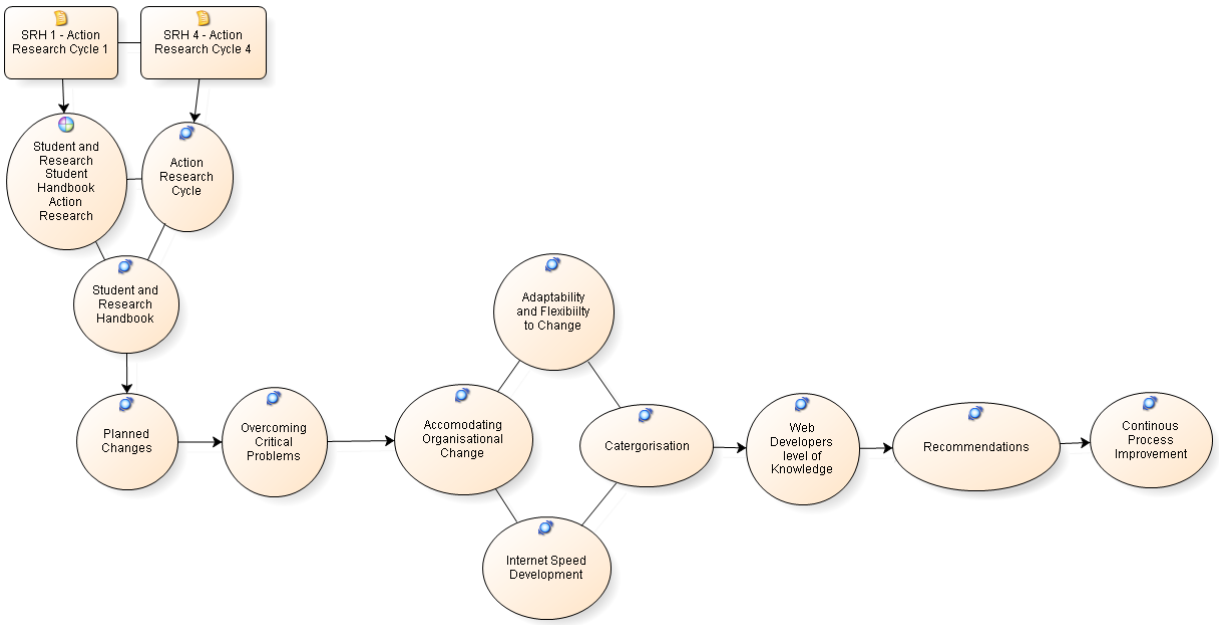
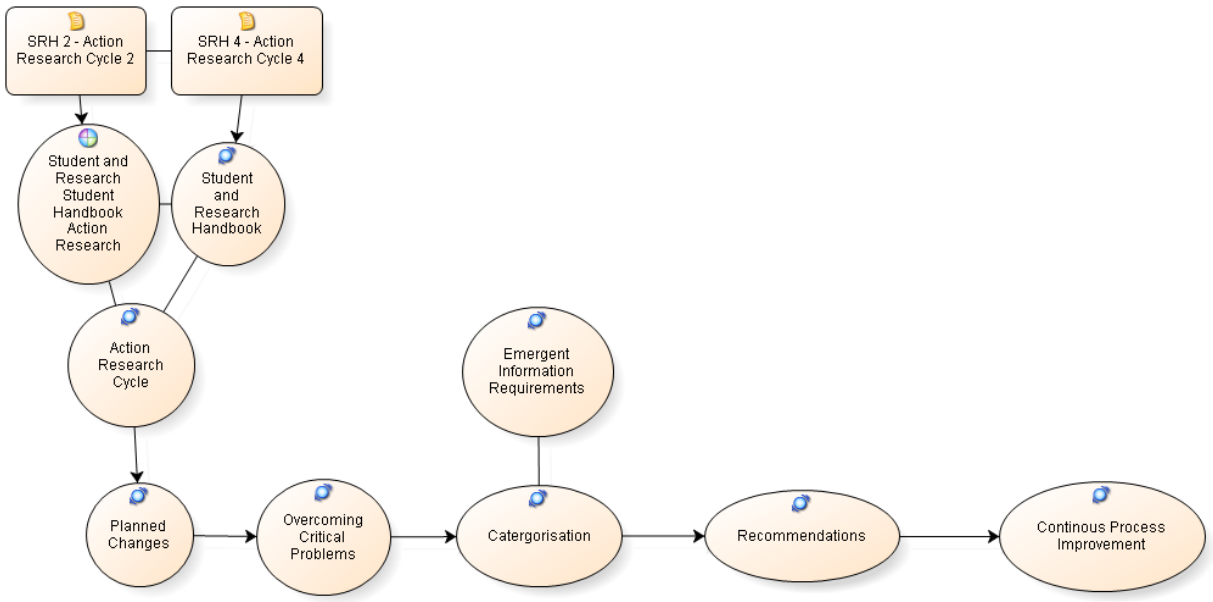


Figure 18 represents non-sequential student research handbook action research cycle. This non-sequential action research cycle (SRH 2 & SRH 4) identified two categories. These two categories are categorisation and emergent information requirements.

Figure 18: Student Research Handbook AR Cycle 2 and 4 (SRH2 & SRH4)



All three Figures i.e. SRH1 & SRH3 (Figure 16), SRH1 & SRH4 (Figure 17) and SRH2 & SRH4 (Figure 18) are analysed together for comparison. The three non-sequential student research handbook Figures (16, 17 & 18) identified recurring patterns namely: accommodating organisational change, internet speed development, web developer level of knowledge and categorisation. These four patterns in the non sequential cycles concur with the patterns exhibited in the sequential student research handbook cycles. Therefore, the four patterns emphasised these as problems faced by the web developer. These patterns are also aligned with the three constructs of the theory of deferred action. However, new patterns emerged in the non-sequential student research handbook cycles. These patterns are: design testing, experienced web developer,

adaptability and flexibility to change and emergent information requirements are found in the patterns generated in these cycles. Table 21 explains these new patterns and is supported with extracts from the student research action research data. Further, Table 21 has two headings per column. The top heading refers to the related construct of the theory of deferred action. The second heading per column (in bold) refers to the category name (i.e. design testing, experienced web developer, adaptability and flexibility to change and emergent information requirements).

Table 21: Four constructs from SRH Sequential and Non-Sequential cycles through ToDA

Planned Action	Planned Action	Planned Action & Emergence	Emergence
Design Testing	**Experienced Web Developer**	**Adaptability and Flexibility to Change**	**Emergent Information Requirements**
In-depth usability evaluations were conducted with a sample of postgraduate research students, using typical scenarios from the initial design phase. The Kadar Matrix is tested again in the development cycle to aid both manager and web developer through the design testing process	The Brunel graduate school compiled a report which was passed to the experienced web developer to implement the development of the WBIS. The initial stage was to match up the requirements with the applicability of the different methodologies available to the web developer	Any redesign needs to consider the context of the handbook in relation to other material on the web and in particular any planned changes for the related student research handbook. There is no logical order to which recommendations to changes should be followed	The student research handbook required the implementation of the changes estimated by the web developer that would take the least amount of time. The web developer examined those tasks which would require a shorter time period. This created a problem because the web developer couldn't plan what tasks would come next.

5.4 Mixed Combination of Student Services & Student Research Handbook

This section of the data analysis helped to substantiate the results in the previous sequential and non-sequential student services and student research handbook cycles. Researchers argue that this process helps to view the data from many different perspectives (Bazeley, 2007 and Richards, 2009). Table 22 shows all mixed combinations of student services and student research handbook cycles that were examined. The yellow boxes in this table are all taken into consideration for this analysis.

Table 22: All Combinations of SS and SRH Cycles

	SRH1	SRH2	SRH3	SRH4
SS1	SS1 & SRH1 Figure 20	SS1 & SRH2 Figure 24	SS1 & SRH3 Figure 28	SS1 & SRH4 Figure 32
SS2	SS2 & SRH1 Figure 21	SS2 & SRH2 Figure 25	SS2 & SRH3 Figure 29	SS2 & SRH4 Figure 33
SS3	SS3 & SRH1 Figure 22	SS3 & SRH2 Figure 26	SS3 & SRH3 Figure 30	SS3 & SRH4 Figure 34
SS4	SS4 & SRH1 Figure 23	SS4 & SRH2 Figure 27	SS4 & SRH3 Figure 31	SS4 & SRH4 Figure 35

Table 22 combines the student services and student research handbook cycles to draw conclusions to the web developer's understanding of the WBIS development problem.

The data in Figure 19 identifies that Emergent Aspects, Methodology Issue and Time Constraint are in the top three frequencies when combining and analysing the student services and student research handbook cycles action research data. The researcher has already established these constructs from the student services and student research handbook cycles. This adds more rigour to our understanding that these results have an impact on the WBIS development process.

Figure 19: Combined SS & SRH Frequency

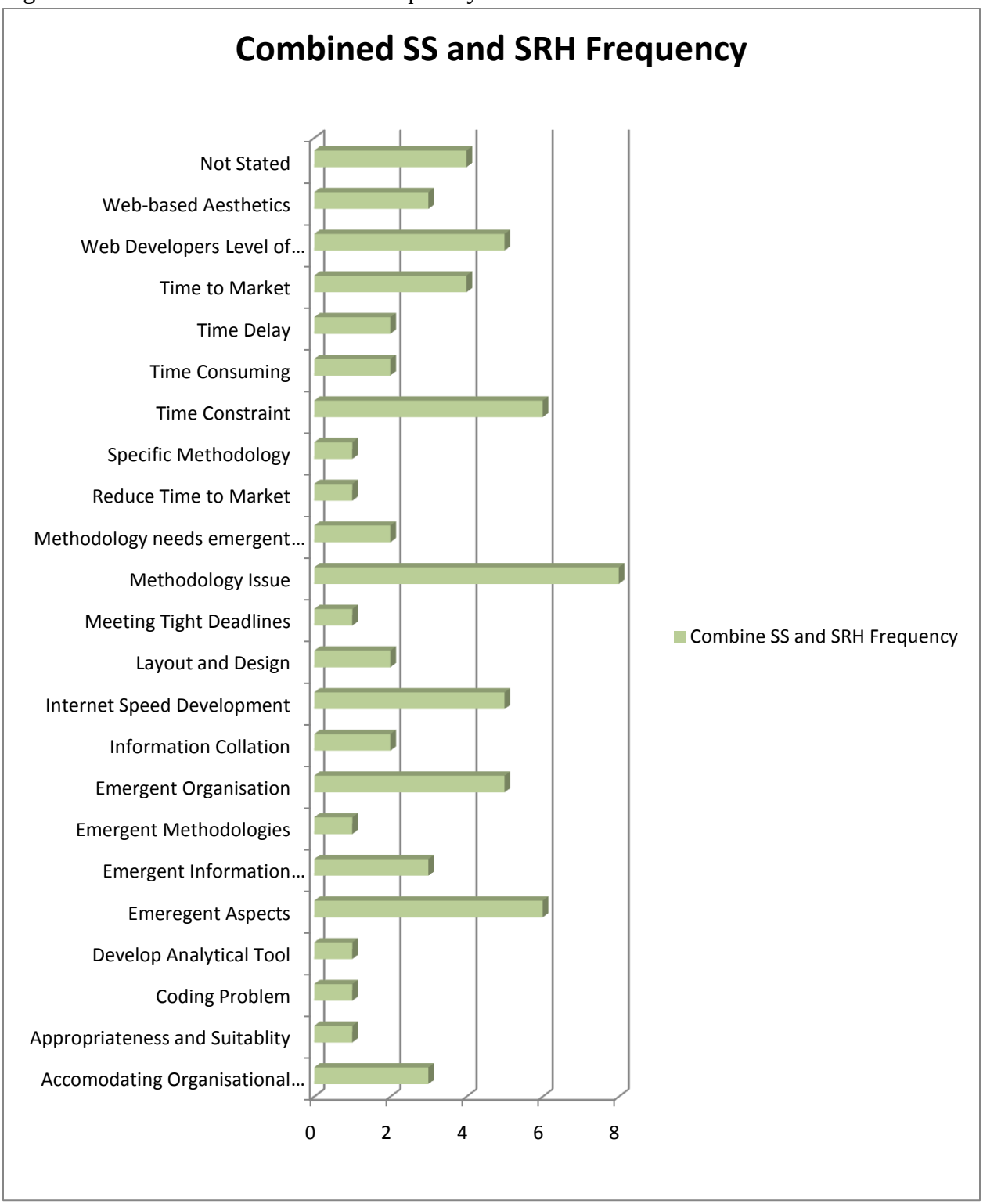


Figure 19 emphasises the problems of student research handbook cycles which are: accommodating organisational change, categorisation, internet speed development and web developer's level of knowledge. Further, it identifies that accommodating organisational change, internet speed development and web developer's level of knowledge in the student research handbook cycle which is prevalent to the top problems encountered within the combination cycles. One of these constructs that isn't mentioned in the combination cycles is categorisation. For this reason, the action researcher will not take this factor of categorisation into consideration when making recommendations for web developers in an emergent higher education organisation.

Figure 20 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS1 & SRH1) identified two categories. These two categories are accommodating organisational change and internet speed development.

Figure 20: SS AR Cycle 1 & SRH AR Cycle 1 (SS1 & SRH1)

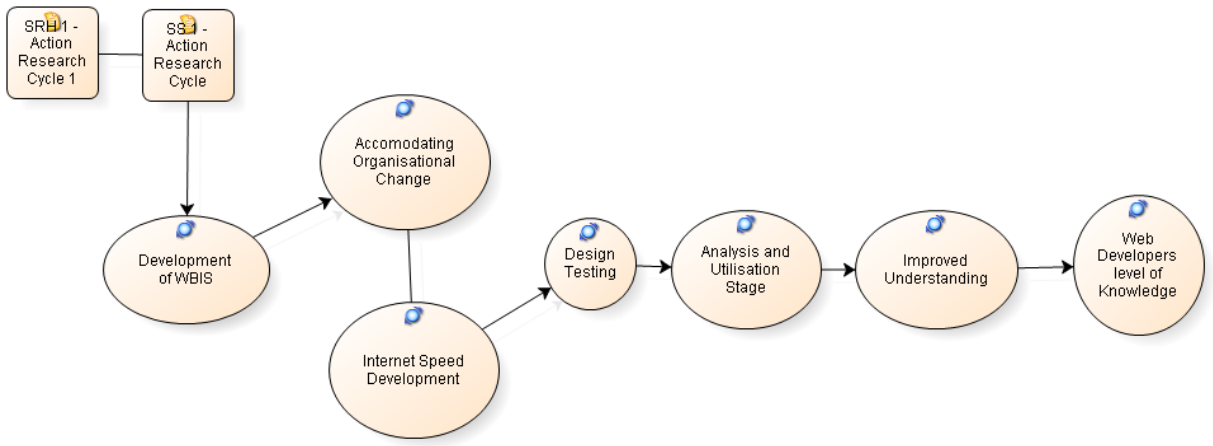


Figure 21 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS2 & SRH1) identified two categories. These two categories are layout and design and web developer level of knowledge.

Figure 21: SS AR Cycle 2 & SRH AR Cycle 1 (SS2 & SRH1)

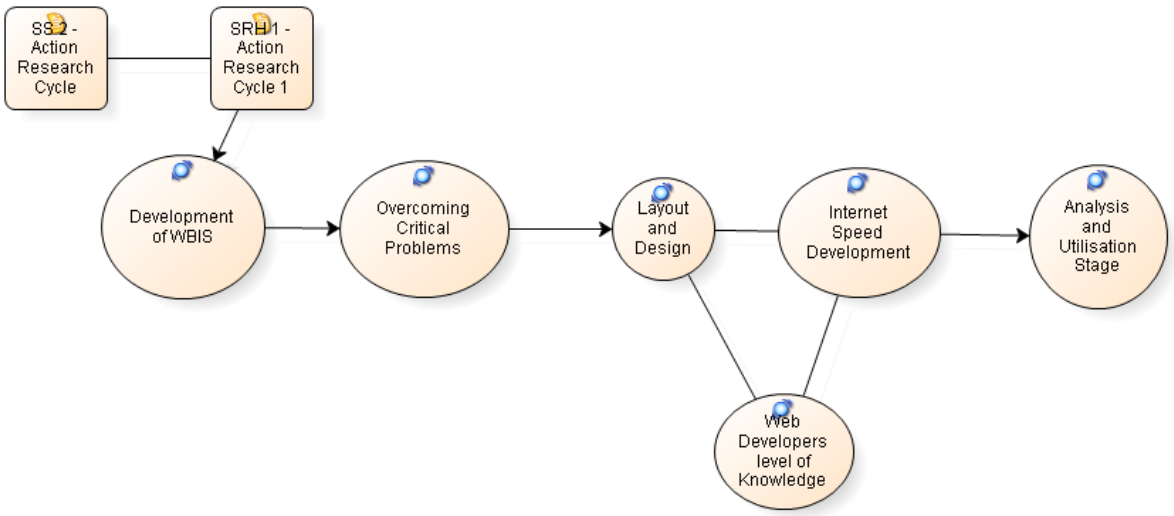


Figure 22 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS3 & SRH1) showed no relationship.

Figure 22: SS AR Cycle 3 & SRH AR Cycle 1 (SS3 & SRH1)

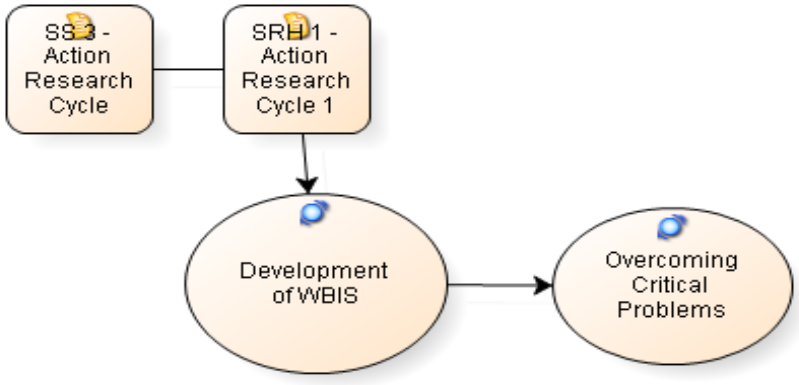


Figure 23 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS4 & SRH1) shows no relationship.

Figure 23: SS AR Cycle 4 & SRH AR Cycle 1 (SS4 & SRH1)

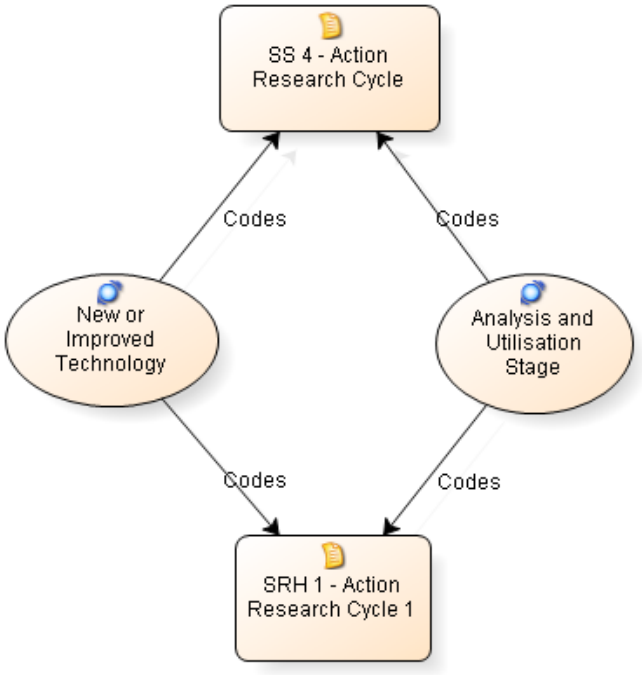


Figure 24 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS1 & SRH2) identified three categories. These three categories are appropriateness & suitability, information collation and web-based aesthetic.

Figure 24: SS AR Cycle 1 & SRH AR Cycle 2 (SS1 & SRH2)

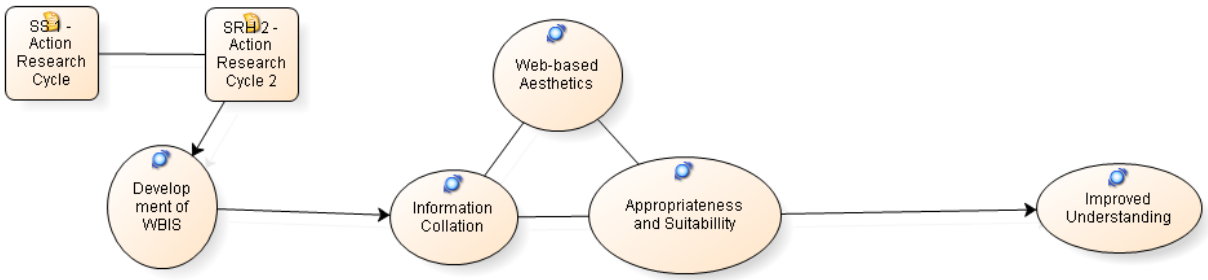


Figure 25 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS2 & SRH2) identified three categories. These three categories are coding problem, emergent information requirements and layout and design.

Figure 25: SS AR Cycle 2 & SRH AR Cycle 2 (SS2 & SRH2)

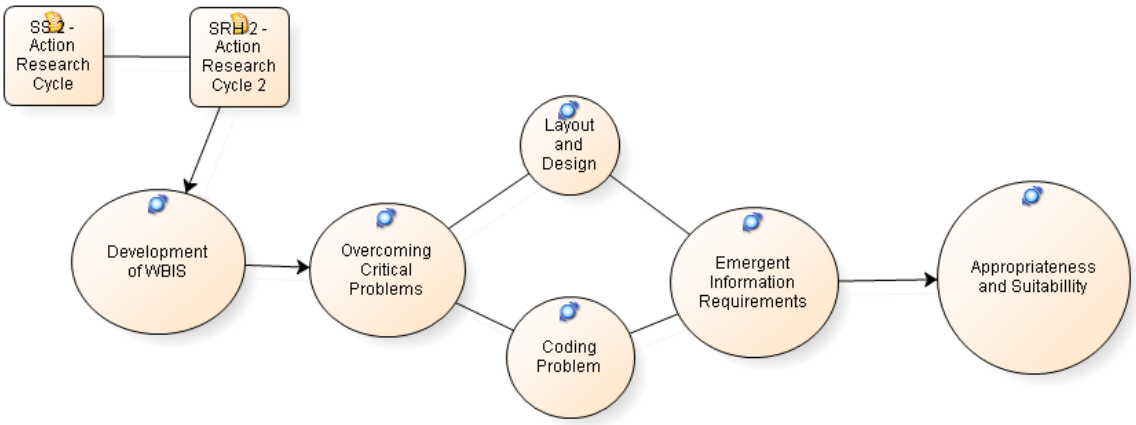


Figure 26 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS3 & SRH2) shows no relationship.

Figure 26: SS AR Cycle 3 & SRH AR Cycle 2 (SS3 & SRH2)

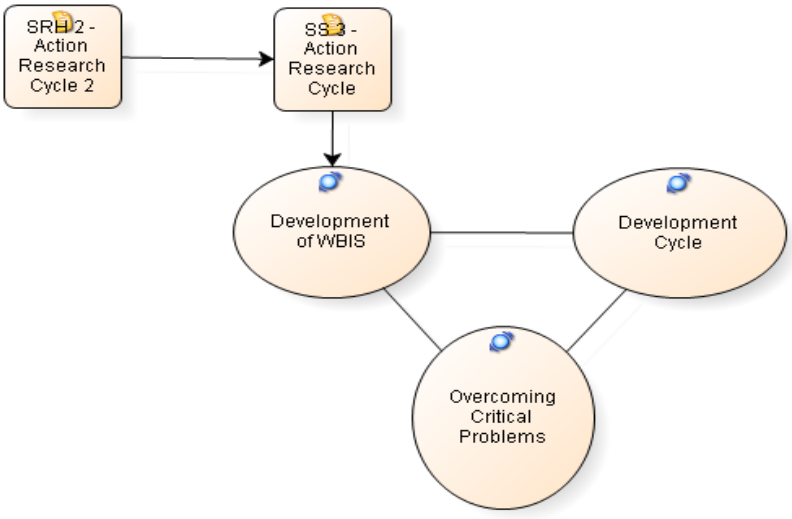


Figure 27 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS4 & SRH2) shows no relationship.

Figure 27 SS AR Cycle 4 & SRH AR Cycle 2 (SS4 & SRH2)

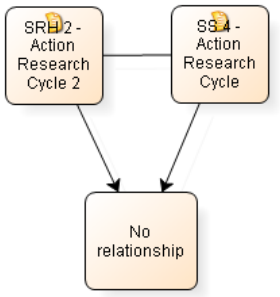


Figure 28 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS1 & SRH3) identified eleven categories. These eleven categories are accommodating organisational change, develop analytical tool, emergent aspects, emergent methodology, information collation, internet speed & development, methodology issue, time constraint, time to market, web developer's level of knowledge and web-based aesthetics.

Figure 28: SS AR Cycle 1 & SRH AR Cycle 3 (SS1 & SRH3)

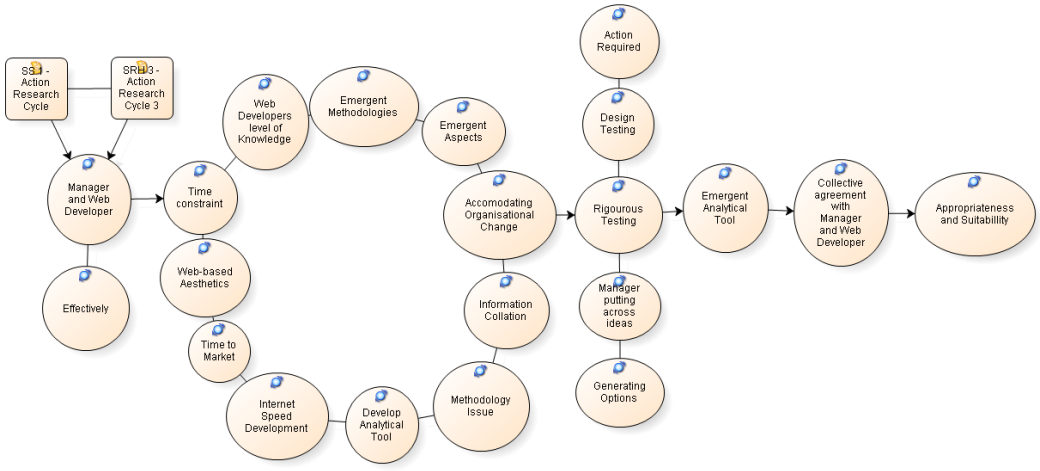


Figure 29 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS2 & SRH3) identified seven categories. These seven categories are emergent aspects, emergent organisation, internet speed development, methodology issue, time constraint, web developer level of knowledge and web-based aesthetics.

Figure 29: SS AR Cycle 2 & SRH AR Cycle 3 (SS2 & SRH3)

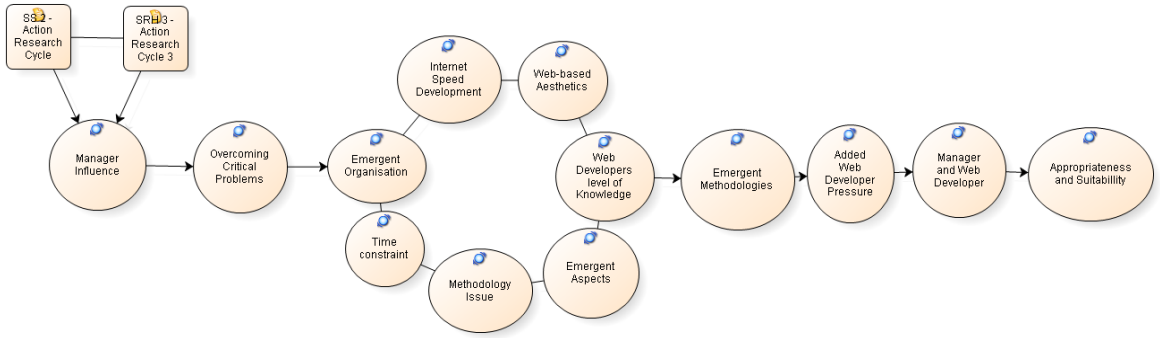


Figure 30 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS3 & SRH3) identified four categories. These four categories are emergent organisation, methodology issue, methodology needs emergent characteristics and time constraint.

Figure 30: SS AR Cycle 3 & SRH AR Cycle 3 (SS3 & SRH3)

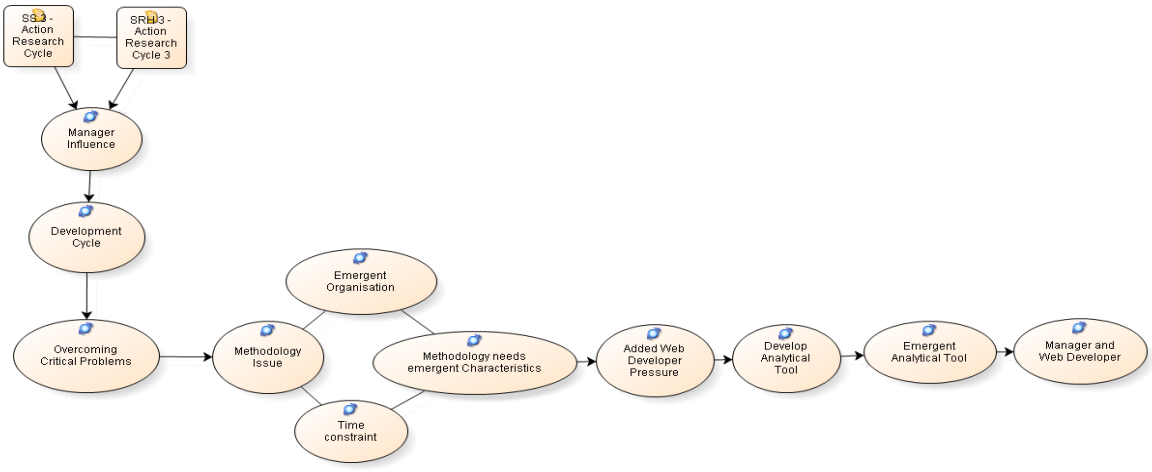


Figure 31 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS4 & SRH3) identified two categories. These two categories are emergent aspects and methodology issue.

Figure 31: SS AR Cycle 4 & SRH AR Cycle 3 (SS4 & SRH3)

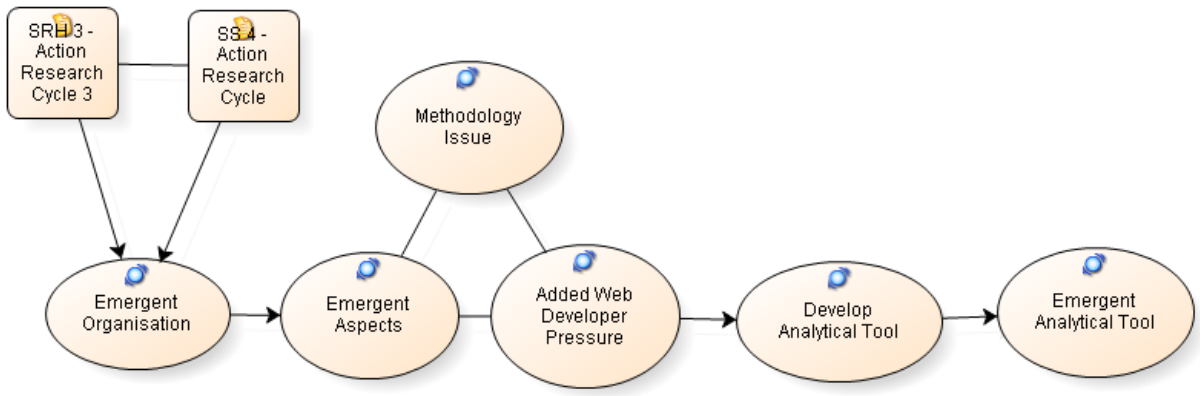


Figure 32 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS1 & SRH4) identified nine categories. These nine categories are accommodating organisational change, emergent aspects, internet speed development, methodology issue, time constraint, time consuming, time delay, time to market and web developer's level of knowledge.

Figure 32: SS AR Cycle 1 & SRH AR Cycle 4 (SS1 & SRH4)

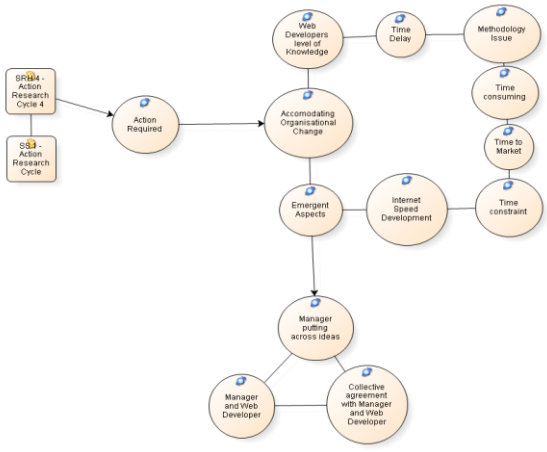


Figure 33 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS2 & SRH4) identified twelve categories. These twelve categories are emergent aspects, emergent information requirements, emergent organisation, internet speed development, meeting tight deadlines, methodology issue, reduce time to market, specific methodology, time constraint, time delay, time to market, web developer's level of knowledge.

Figure 33: SS AR Cycle 2 & SRH AR Cycle 4 (SS2 & SRH4)

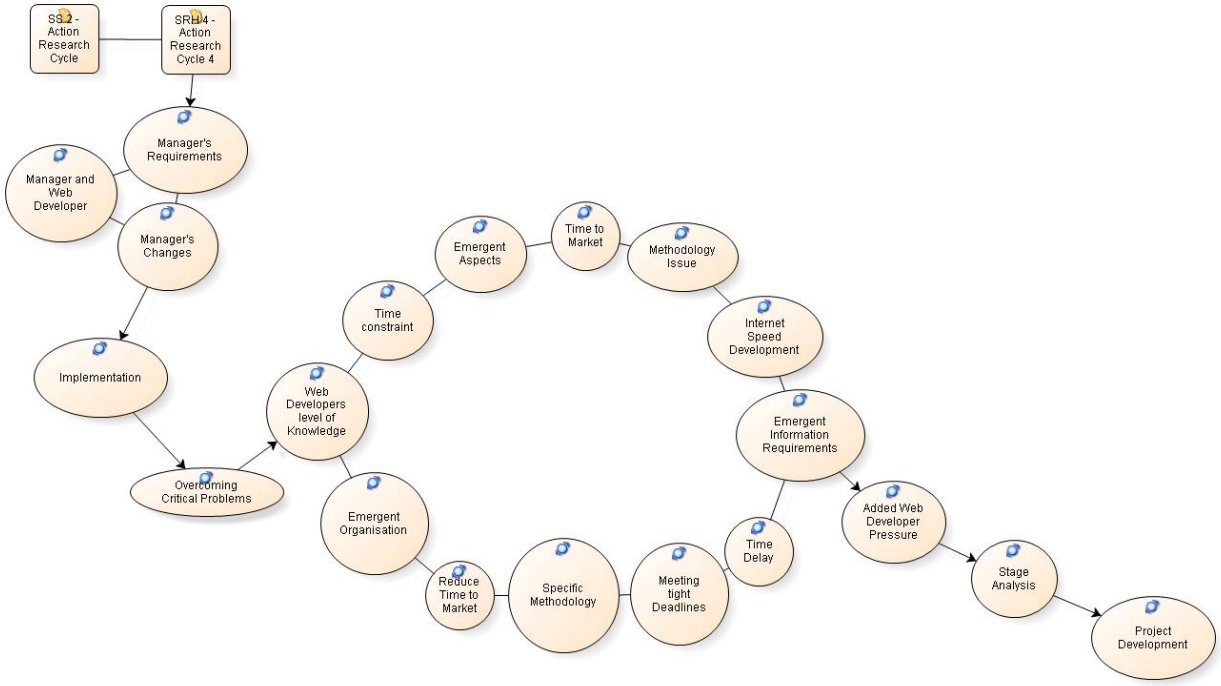


Figure 34 represents student services and student research handbook action research cycle. This mixed combination action research cycle (SS3 & SRH4) identified seven categories. These seven categories are emergent information requirements, emergent organisation, methodology issue, methodology needs emergent characteristics, time constraint, time consuming and time to market.

Figure 34: SS AR Cycle 3 & SRH AR Cycle 4 (SS3 & SRH4)

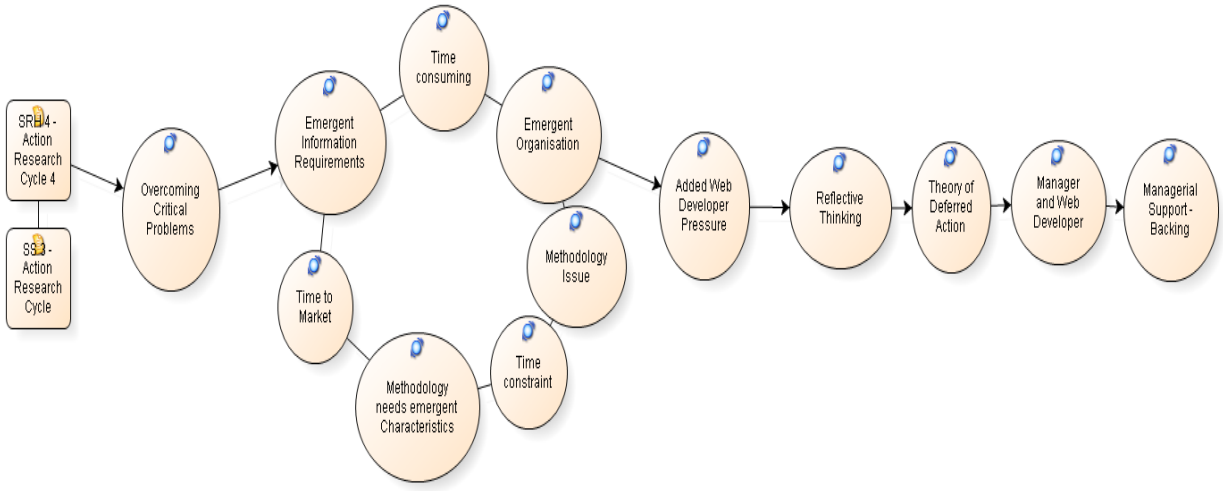


Figure 35 represents the student services and student research handbook action research cycle. This mixed combination action research cycle (SS4 & SRH4) identified three categories. These three categories are emergent aspects, emergent organisation and methodology issue.

Figure 35: SS AR Cycle 4 & SRH AR Cycle 4 (SS4 & SRH4)

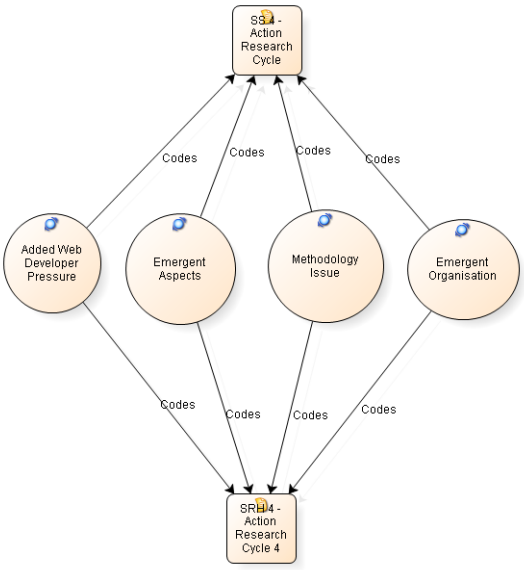


Table 23 represents the results of the student services and student research handbook cycles mixed combinations. The tick (✓) in this table indicates the categories identified by the AR data. Categories are displayed in the left column followed by the sequential and non-sequential columns. This data analysis process is designed to draw out associations from the action research data.

Table 23: Mixed Combinations: Student Services and Student Research Handbook Cycles

	SS1 & SRH 1	**SS2 & SRH 1**	**SS3 & SRH 1**	**SS4 & SRH 1**	**SS1 & SRH 2**	**SS2 & SRH 2**	**SS3 & SRH 2**	**SS4 & SRH 2**	**SS1 & SRH 3**	**SS2 & SRH 3**	**SS3 & SRH 3**	**SS4 & SRH 3**	**SS1 & SRH 4**	**SS2 & SRH 4**	**SS3 & SRH 4**	**SS4 & SRH 4**
Accommodating Organisational Change	✓	-	-	-	-	-	-	-	✓	-	-	-	✓	-	-	-
Appropriateness and Suitability	-	-	-	-	✓	-	-	-	-	-	-	-	-	-	-	-
Coding Problem	-	-	-	-	-	✓	-	-	-	-	-	-	-	-	-	-
Develop Analytical Tool	-	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	-
Emergent Aspects	-	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓	-	✓
Emergent Information Requirements	-	-	-	-	-	✓	-	-	-	-	-	-	-	✓	✓	-
Emergent Methodologies	-	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	-
Emergent	-	-	-	-	-	-	-	-	-	✓	✓	-	-	✓	✓	✓

Organisation																
Information Collation	-	-	-	-	✓	-	-	-	✓	-	-	-	-	-	-	-
Internet Speed Development	✓	-	-	-	-	-	-	-	✓	✓	-	-	✓	✓	-	-
Layout and Design	-	✓	-	-	-	✓	-	-	-	-	-	-	-	-	-	-
Meeting Tight Deadlines	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	-	-
Methodology Issue	-	-	-	-	-	-	-	-	✓	✓	✓	✓	✓	✓	✓	✓
Methodology needs emergent Characteristics	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	✓	-
Reduce Time-to-Market	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	-	-
Specific Methodology	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	-	-
Time Constraint	-	-	-	-	-	-	-	-	✓	✓	✓	-	✓	✓	✓	-
Time Consuming	-	-	-	-	-	-	-	-	-	-	-	-	✓	-	✓	-
Time Delay	-	-	-	-	-	-	-	-	-	-	-	-	✓	✓	-	-
Time-to-Market	-	-	-	-	-	-	-	-	✓	-	-	-	✓	✓	✓	-
Web Developers Level of Knowledge	-	✓	-	-	-	-	-	-	✓	✓	-	-	✓	✓	-	-

Web-based Aesthetics	-	-	-	-	✓	-	-	-	✓	✓	-	-	-	-	-	-
Not Stated	-	-	✓	✓	-	-	✓	✓	-	-	-	-	-	-	-	-

5.5 Summary of Mixed Combinations

The data analysis results drawn from Figures 20 to 35 and Table 23 support the previous results which show that emergent aspects, methodology issue and time constraint are predominant factors in WBIS development in emergent organisations. This concurs with the results previously found in the student services and student research handbook sequential and non sequential cycles as discussed earlier. These results added more rigour to the interpretations drawn from the sequential and non-sequential results.

5.6 Additional Sources of AR Data

This section brings together the student services (SS) and student research handbook (SRH) AR data with three additional AR data sources. These three additional sources are: additional action student services (AASS), K's Questions (K's Q) and Dr M Interview (Dr M's Int). The purpose of analysing these additional sources of AR data is to further bring understanding and rigor to the findings that have already been established in analysing the first two main sources of AR data (SS and SRH). These findings helped the web developer to improve the WBIS development process in practice.

The data analysis from the three combined additional sources draws conclusions that are beneficial to both manager and web developer. The web developer already established that emergent aspects, methodology issue, time constraint, accommodating organisational change, internet speed development and web developer's level of knowledge appears in the following three categories viz. student services (sequential and non-sequential), student research handbook (sequential and non-sequential) and mixed combinations of both student services & student research handbook.

Table 24 charts the process in analysing the forthcoming sections by examining all the five sources of action research data. This table shows combinations of the additional sources of information gathered together with student services and student research handbook cycles. The grey boxes in this table are not taken into consideration for this analysis. Only the yellow shaded combination boxes are being discussed.

Table 24: Additional Sources of Information Gathered

	Student Services (1-4)	**Student Handbook (1-4)**	**Additional Action Student Services**	**K's Questions**	**Dr M's Interview**
Student Services (1-4)					
Student Handbook (1-4)	SRH1-4 & SS1-4 Figure 37				
Additional Action Student Services	AASS & SS1-4 Figure 38	AASS & SRH1-4 Figure 41			
K's Questions	K's Q & SS1-4 Figure 39	K's Q & SRH1-4 Figure 42	K's Q & AASS Figure 44		
Dr M's Interview	Dr M's Int & SS1-4 Figure 40	Dr M's Int & SRH1-4 Figure 43	Dr M's Int & AASS Figure 45	Dr M's & K's Q Figure 46	

The web developer found further evidence (see Figure 36) to substantiate previous findings in the sequential and non-sequential cycles and in the mixed combination cycles and again in the overall AR data sources. Bazeley (2007) and Richards (2009) emphasised this point of looking at the data from different angles. This data analysis technique was utilised by the action researcher and has proven to be beneficial in this investigation. It enabled the action researcher to develop better understanding of the categories affecting the web developer in an emergent organisation.

Figure 36, identified the frequency of recurring factors from all the data sources. The data analysis drawn from this is the frequency of all the data sources, further strengthens the argument that web-based aesthetics, time constraint and emergent aspects are the three most prevalent factors emanating from all data sources. The less prevalent factors in the frequency of all sources are considered by the action researcher. However, they are not significant enough to adversely affect the web developer when developing WBIS in an emergent organisation.

Figure 36: Frequency of All Sources

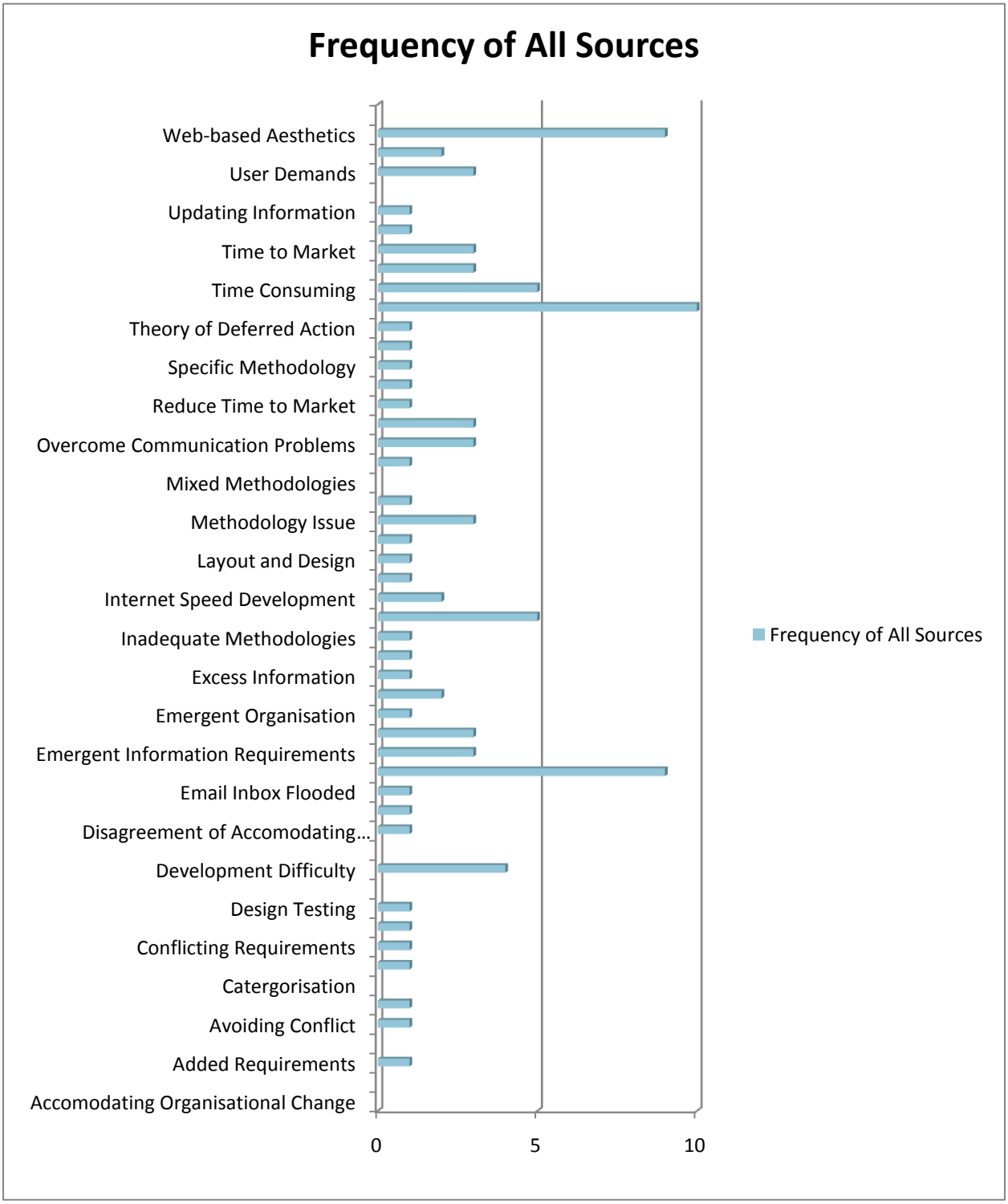


Figure 37 represents the student services cycles 1-4 and the student research handbook action research cycles 1-4. This action research cycle combination (SRH1-4 & SS1-4) identified twenty two categories. These twenty two categories are coding problem, design testing, emergent aspects, emergent information requirements, emergent methodologies, emergent organisation, information collation, internet speed development, layout and design, meeting tight deadlines, methodology issue, methodology needs emergent characteristics, need for improved technology, reduce time to market, specific methodology, theory of deferred action, time constraint, time consuming, time delay, time to market, web developers level of knowledge and web-based aesthetics.

Figure 37: SRH AR Cycles 1 to 4 and SS AR Cycles 1 to 4 (SRH1-4 & SS1-4)

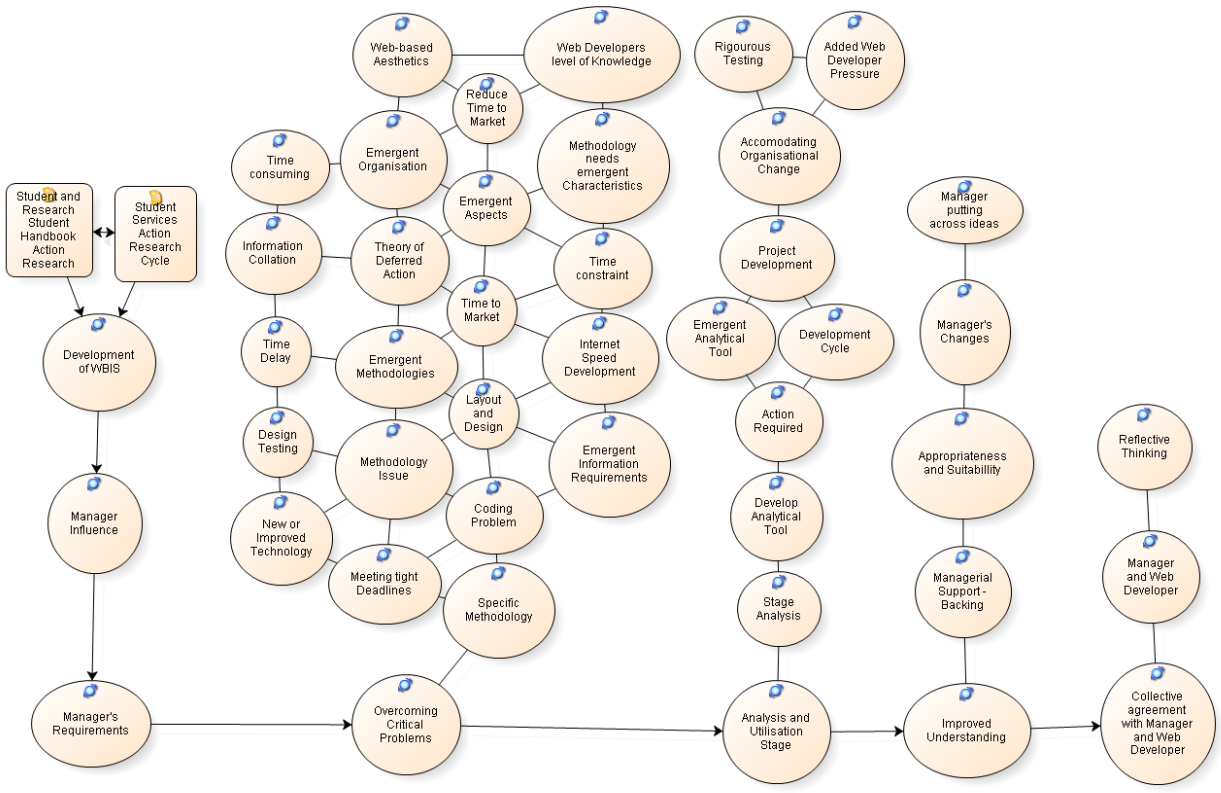


Figure 38 represents the additional action student services and student services action research cycles 1-4. This action research cycle combination (AASS & SS1-4) identified fifteen categories. These fifteen categories are browser compatibility, compare and contrast layout, development difficulty, emergent aspects, emergent methodologies, enhancing web-based aesthetic, inadequate methodologies, information collation, internet speed development, methodology issue, overcome communication problems, time constraint, time consuming, time delay and web-based aesthetics.

Figure 38: AASS and SS AR Cycles 1 to 4 (AASS & SS1-4)

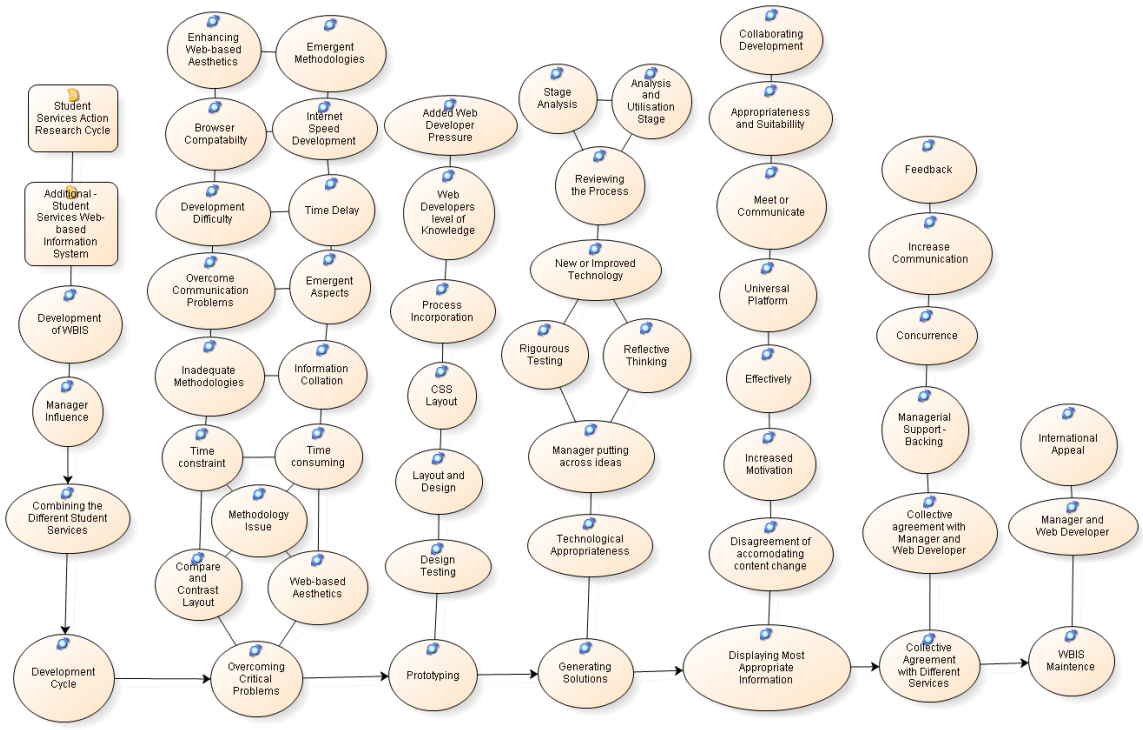


Figure 39 represents K's Q and student services action research cycles 1-4. This action research cycle combination (K's Q & SS1-4) identified five categories. These five categories are development difficulty, emergent aspects, time constraint, time consuming and web-based aesthetics.

Figure 39: K's Questions and SS AR Cycles 1 to 4 (K's Q & SS1-4)

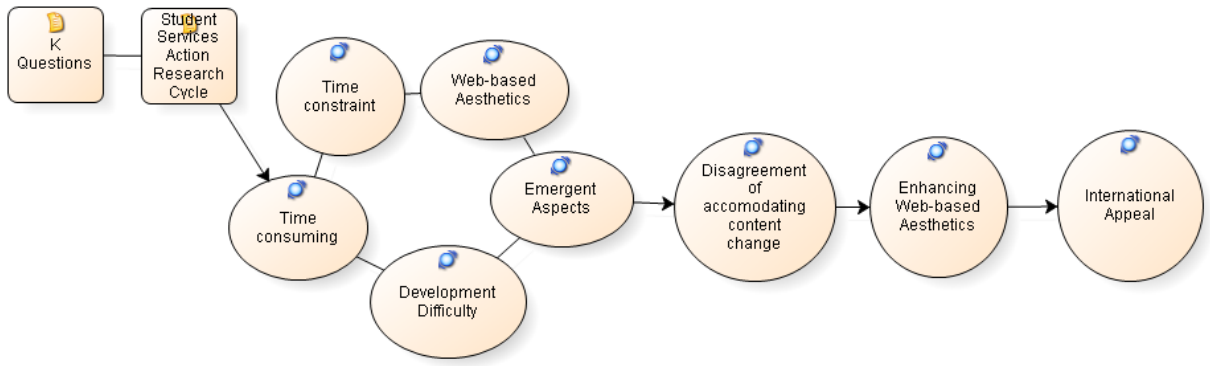


Figure 40 represents Dr M's Int and student services action research cycles 1-4. This action research cycle combination (Dr M's Int & SS1-4) identified seven categories. These seven categories are emergent aspects, emergent information requirements, information collation, overcome communication problems, time constraint, time to market and web-based aesthetics.

Figure 40: Dr M's Interview and SS AR Cycles 1 to 4 (Dr M's Int & SS1-4)

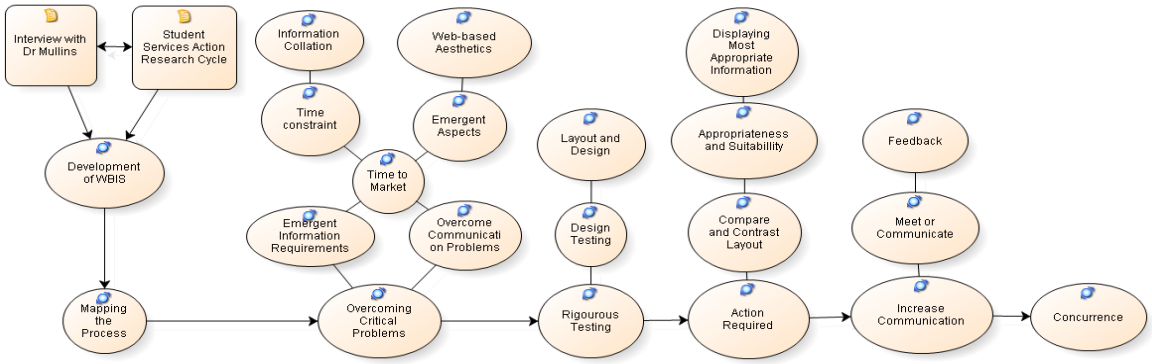


Figure 41 represents additional action student services and student research handbook action research cycles 1-4. This action research cycle combination (AASS & SRH1-4) identified eleven categories. These eleven categories are conflicting requirements, emergent methodologies, experienced web developer, methodology issue, showing manager changes, technological tools required, time constraint, time delay, unforeseen problems, user demands and web developer's level of knowledge.

Figure 41: AASS and SRH AR Cycles 1 to 4 (AASS & SRH1-4)

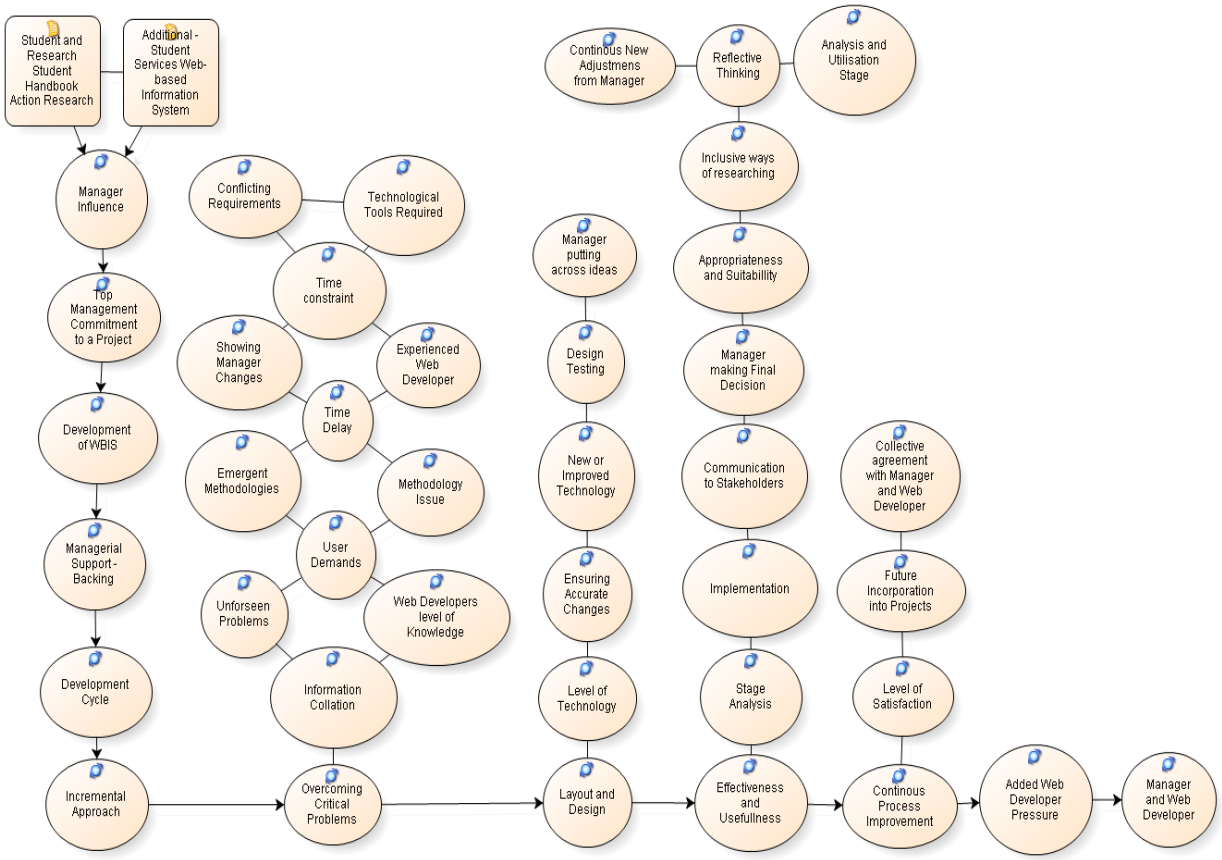


Figure 42 represents K's Q and student research handbook action research cycles 1-4. This action research cycle combination (K's Q & SRH1-4) identified four categories. These four categories are emergent aspects, time constraint, time consuming and web-based aesthetics.

Figure 42: K's Questions and SRH AR Cycles 1 to 4 (K's Q & SRH1-4)

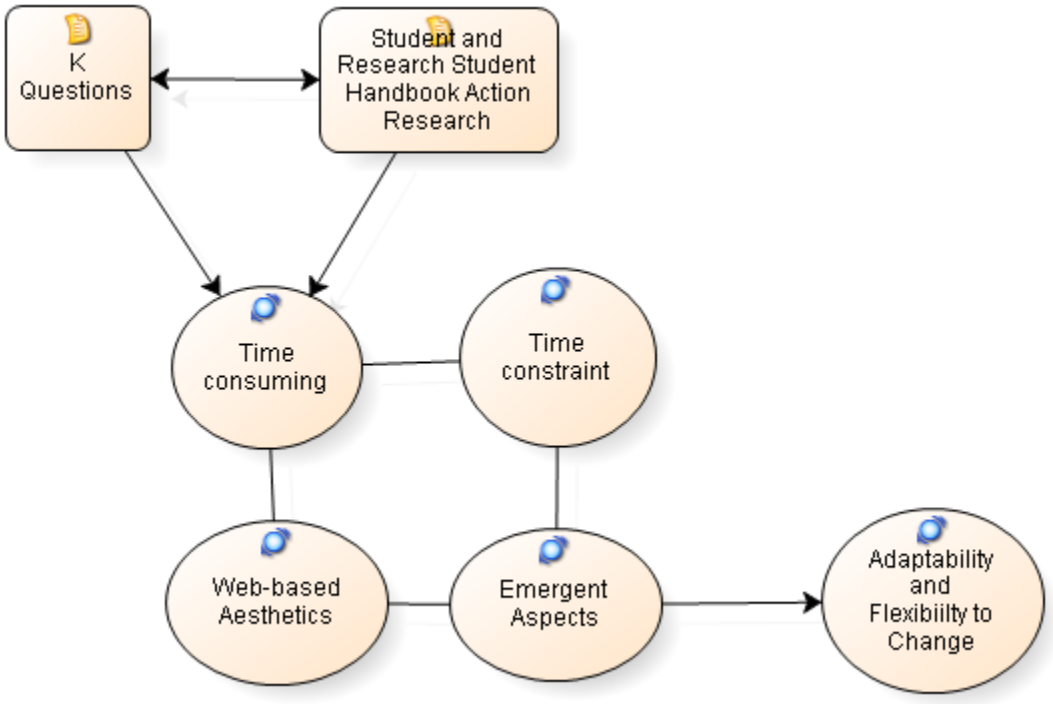


Figure 43 represents Dr M's Int and student research handbook action research cycles 1-4. This action research cycle combination (Dr M's Int & SRH1-4) identified ten categories. These ten categories are added requirements, emergent aspects, emergent information requirements, information collation, key issues, time constraint, time to market, updating information, user demands and web-based aesthetics.

Figure 43: Dr M's Interview and SRH AR Cycles 1 to 4 (Dr M's Int & SRH1-4)

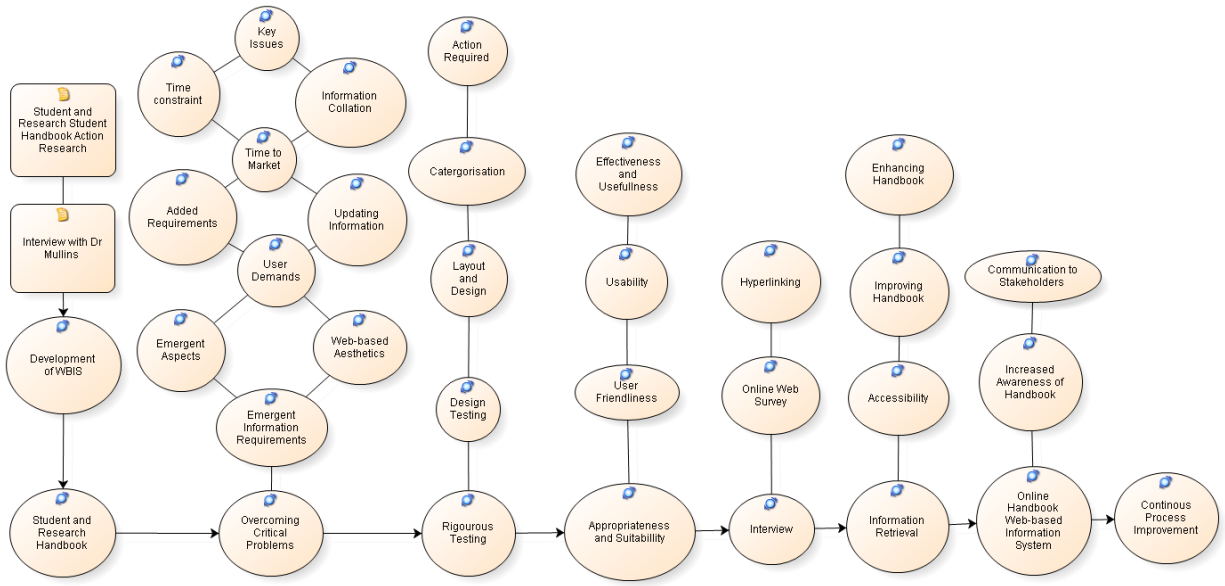


Figure 44 represents K's Q and additional action student services action research. This action research cycle combination (K's Q & AASS) identified ten categories. These ten categories are development difficulty, disagreement of accommodating content change, editing and uploading problems, email inbox flooded, emergent aspects, enhancing web-based aesthetics, paper based system, time constraint, time consuming and web-based aesthetics.

Figure 44: K's Questions and AASS (K's Q & AASS)

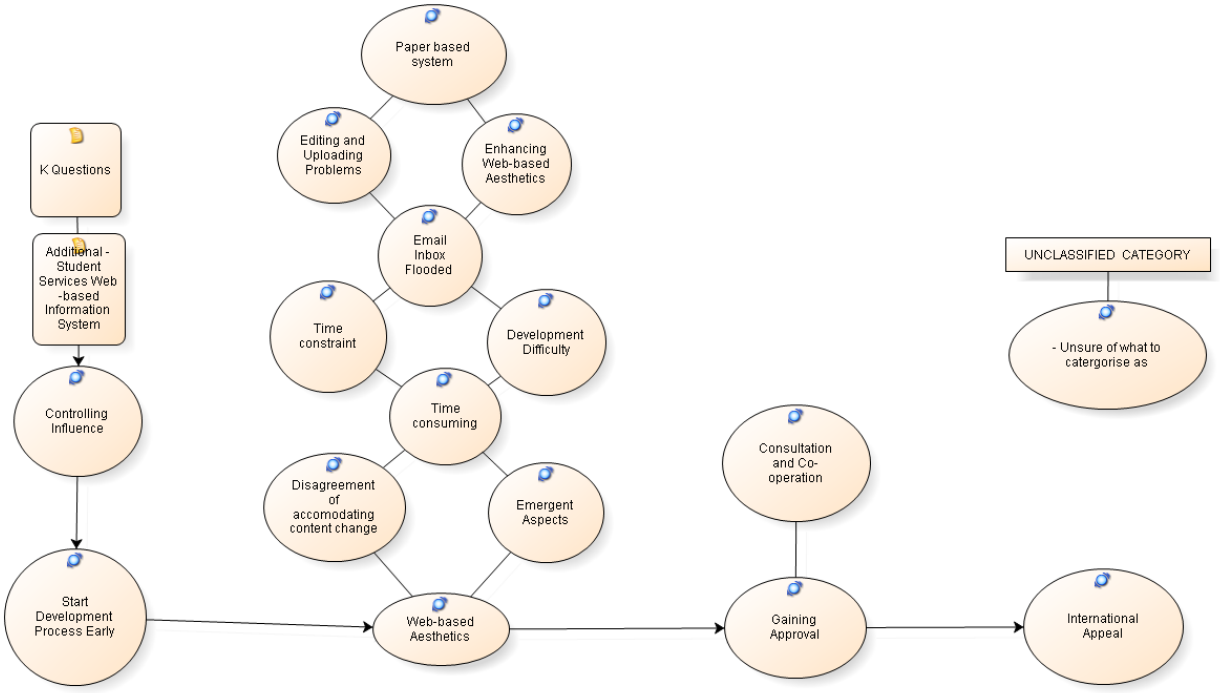


Figure 45 represents Dr M's Int and additional action student services. This action research cycle combination (Dr M's Int & AASS) identified ten categories. These ten categories are avoiding conflict, development difficulty, emergent aspects, excess information, information collation, overcome communication problems, paper based system, time constraint, user demands and web-based aesthetics.

Figure 45: Dr M's Interview and AASS (Dr M's Int & AASS)

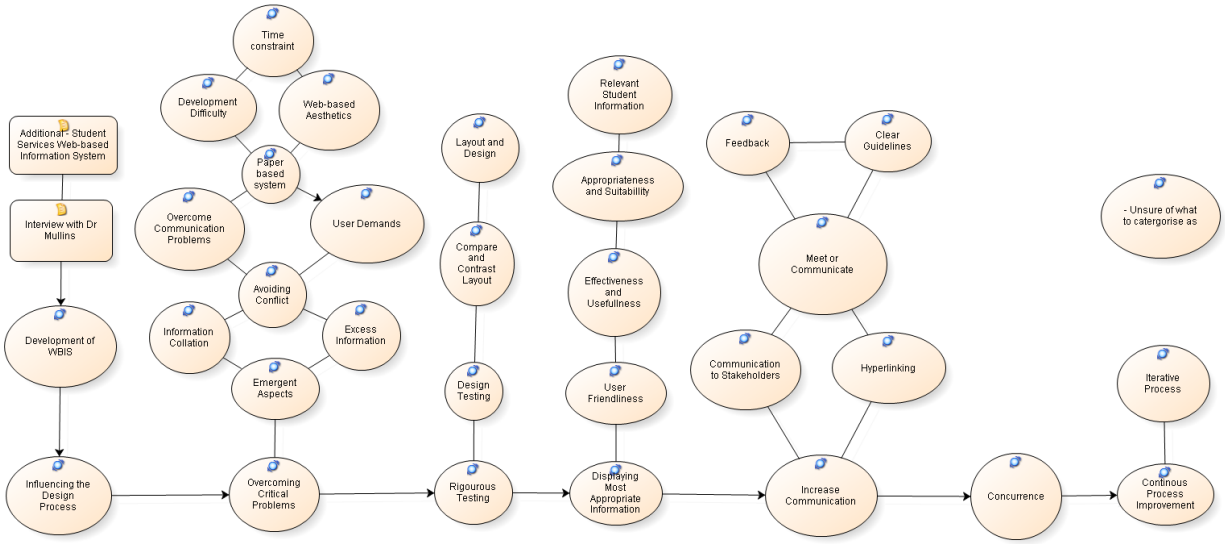


Figure 46 represents Dr M's Int and K's Q. This action research cycle combination (Dr M's Int & K's Q) identified four categories. These four categories are emergent aspects, paper based system, time constraint and web-based aesthetics. The action researcher found that some text in the action research data set could not be ascertained. This was assigned to 'unsure of what to categorise as' under the category called unclassified category in figure 46.

Figure 46: Dr M's Interview and K's Questions (Dr M's Int & K's Q)

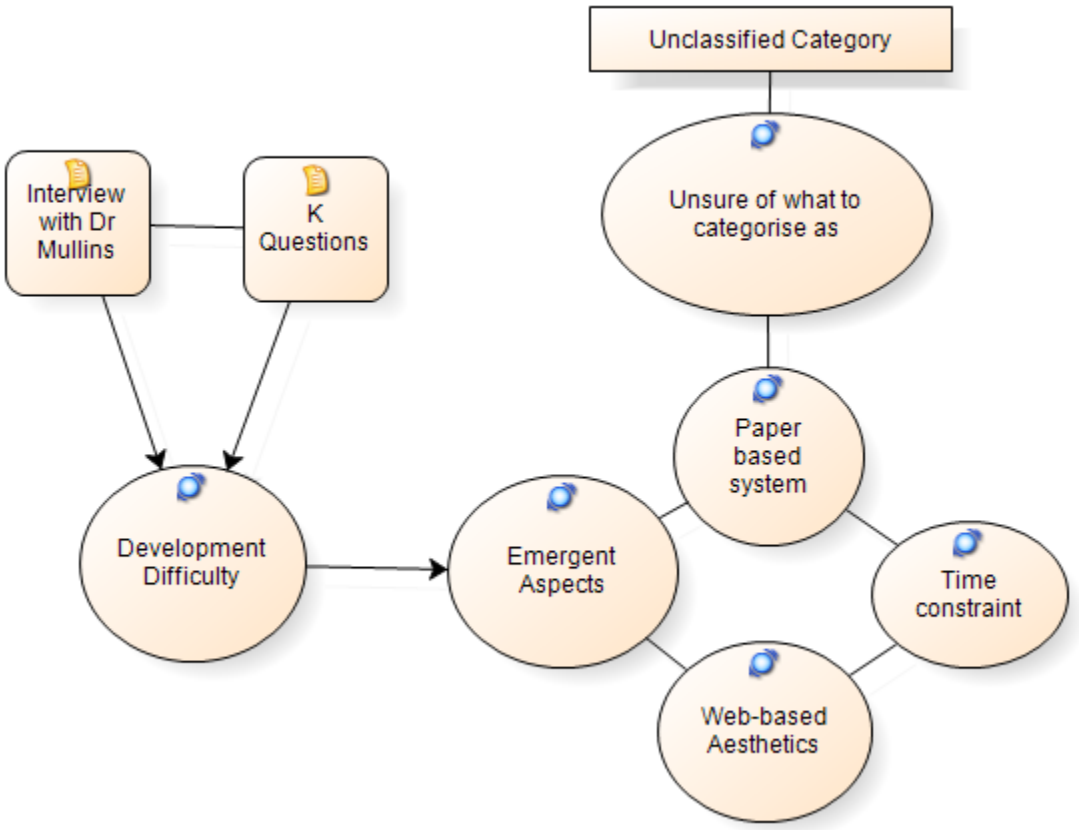


Table 25 represents the AR data from all sources of data. The tick (✓) in this table indicates the factors identified by the AR data. Categories are displayed in the left column followed by the different sources of data in the respective columns. This table enabled the comparison of all the different data sources. This enabled the action researcher to draw out associations from the

action research data. The data analysis drawn from Figures 37-47 and Table 25 further strengthens the argument that: web-based Aesthetics, time constraint and emergent aspects are the three most prevalent factors to transpire from all data sources.

The data analysis of all the data sources reveals various factors affecting the WBIS development process in the student services and student research handbook contexts. These factors confirm the deferred model of reality. In particular web-based aesthetics, time constraint and emergent aspects indicate emergence which are aligned to the theory of deferred action.

Table 25: All Sources of Data

	SRH1-4 & SS1-4	AASS & SS1-4	K's Q & SS1-4	Dr M's Int & SS1-4	AASS & SRH1-4	K's Q & SRH1-4	Dr M's Int & SRH1-4	K's Q & AASS	Dr M's Int & AASS	Dr M's Int & K's Q
Accommodating Organisational Change	-	-	-	-	-	-	-	-	-	-
Adaptability and Flexibility to Change	-	-	-	-	-	-	-	-	-	-
Added Requirements	-	-	-	-	-	-	✓	-	-	-
Appropriateness and Suitability	-	-	-	-	-	-	-	-	-	-
Avoiding Conflict	-	-	-	-	-	-	-	-	✓	-
Browser Compatibility	-	✓	-	-	-	-	-	-	-	-
Categorisation	-	-	-	-	-	-	-	-	-	-
Coding Problem	✓	-	-	-	-	-	-	-	-	-
Conflicting Requirements	-	-	-	-	✓	-	-	-	-	-
Compare and Contrast Layout	-	✓	-	-	-	-	-	-	-	-
Design Testing	✓	-	-	-	-	-	-	-	-	-
Develop Analytical Tool	-	-	-	-	-	-	-	-	-	-
Development Difficulty	-	✓	✓	-	-	-	-	✓	✓	-
Different Methodologies	-	-	-	-	-	-	-	-	-	-

Disagreement of Accommodating Content Change	-	-	-	-	-	-	-	✓	-	-
Editing and Uploading Problems	-	-	-	-	-	-	-	✓	-	-
Email Inbox Flooded	-	-	-	-	-	-	-	✓	-	-
Emergent Aspects	✓	✓	✓	✓	-	✓	✓	✓	✓	✓
Emergent Information Requirements	✓	-	-	✓	-	-	✓	-	-	-
Emergent Methodologies	✓	✓			✓	-	-	-	-	-
Emergent Organisation	✓	-	-	-	-	-	-	-	-	-
Enhancing Web-based Aesthetics	-	✓	-	-	-	-	-	✓	-	-
Excess Information	-	-	-	-	-	-	-	-	✓	-
Experienced Web Developer	-	-	-	-	✓	-	-	-	-	-
Inadequate Methodologies	-	✓	-	-	-	-	-	-	-	-
Information Collation	✓	✓	-	✓	-	-	✓	-	✓	-
Internet Speed Development	✓	✓	-	-	-	-	-	-	-	-
Key Issues	-	-	-	-	-	-	✓	-	-	-
Layout and Design	✓	-	-	-	-	-	-	-	-	-
Meeting Tight Deadlines	✓	-	-	-	-	-	-	-	-	-
Methodology Issue	✓	✓	-	-	✓	-	-	-	-	-
Methodology needs emergent Characteristics	✓	-	-	-	-	-	-	-	-	-
Mixed Methodologies	-	-	-	-	-	-	-	-	-	-

Need or Improved Technology	✓	-	-	-	-	-	-	-	-	-
Overcome Communication Problems	-	✓	-	✓	-	-	-	-	✓	-
Paper based System	-	-	-	-	-	-	-	✓	✓	✓
Reduce Time-to-Market	✓	-	-	-	-	-	-	-	-	-
Showing Manager Changes	-	-	-	-	✓	-	-	-	-	-
Specific Methodology	✓	-	-	-	-	-	-	-	-	-
Technological Tools Required	-	-	-	-	✓	-	-	-	-	-
Theory of Deferred Action	✓	-	-	-	-	-	-	-	-	-
Time Constraint	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time Consuming	✓	✓	✓	-	-	✓	-	✓	-	-
Time Delay	✓	✓	-	-	✓	-	-	-	-	-
Time-to-Market	✓	-	-	✓	-	-	✓	-	-	-
Unforeseen Problems	-	-	-	-	✓	-	-	-	-	-
Updating Information	-	-	-	-	-	-	✓	-	-	-
Usability	-	-	-	-	-	-	-	-	-	-
User Demands	-	-	-	-	✓	-	✓	-	✓	-
Web Developers Level of Knowledge	✓	-	-	-	✓	-	-	-	-	-
Web-based Aesthetics	✓	✓	✓	✓		✓	✓	✓	✓	✓
Not Stated	-	-	-	-	-	-	-	-	-	-

5.7 Concluding Remarks

The data analysis brought all the different data sources together for data analysis. Nvivo8 software package was utilised for this purpose. The amalgamation of the data from the five sources is accommodated with relative ease by the Nvivo8 software package. This assisted the action researcher in setting up the raw AR data, from all sources, into nodes and categories. Then from this the action researcher used Nvivo8 to facilitate the design and layout of the data sources to generate meaningful diagrammatical flow patterns. The action researcher then identified patterns and associations in the final analysis.

The data analysis draws understanding that web-based aesthetics, time constraint, and emergent aspects are the three most prevalent factors affecting the WBIS development process. Reflecting on these findings helped the action researcher to understand how to develop WBIS in emergent organisations. These findings were considered with reference to the deferred model of reality to develop an analytical development tool as aid for WBIS development in emergent organisation. This tool helped the web developer to address the WBIS development problem set out in chapter one. However, this analytical development tool is generally applicable to all emergent organisations.

The ToDA informed the action researcher's interpretivist approach. The tables of data support the three constructs of the theory viz. planned action, emergence & deferred action. These are significant features of the WBIS development process and need to be incorporated in it. The categories generated by the AR data support these design process constructs. This helped the action researcher to understand the phenomenon by labelling the AR data as either: planned action, emergence or deferred action. This was evidence throughout the data analysis section.

Further, some of the major recurring problems that have been identified in the data analysis modelling are: methodological issue, emergent aspects, web-based aesthetics and time constraint. By analysing the data and by cross referencing the patterns, the action researcher identified

meaningful outcomes from the data sources. The analysis aided the action researcher to gain a better perspective on how a web developer addressed the WBIS development problem to overcome emergent development problems.

The understanding gained by interpreting the data is that the web developer needed tools to help defer the design process throughout the WBIS development process. The categories of problems revealed by the data confirmed the deferred model of reality as applicable to WBIS development. This lead the action researcher to base the development of the analytical development tool on the deferred model of reality as discussed in the next chapter.

CHAPTER 6: Development of the Kadar Matrix

6.1 Introduction

This chapter provides an explanation of how the Kadar Matrix was developed as an analytical tool to help the web developer. The development of the tool not only answered a call in literature as mentioned in chapter 2. This development analytical tool also addressed the problems experienced by the web developer in practice. Further, the development of the tool is consistent with the action research (AR) methodology which seeks to intervene actively in the main problem being studied. This AR methodology enabled the development of the Kadar Matrix, the analytical development tool, the AR data and the theoretically informed deferred model of reality. The Kadar Matrix is based on the AR Data and the deferred model of reality. The development of the tool is explained in this chapter and the scope for further improvements to the analytical development tool is discussed.

The development of the Kadar Matrix is based on the AR data, supported by literature, and informed by the theory of deferred action. The action research data found that the web developer needed an analytical development tool to aid the web developer and manager to accommodate emergence within the organisation. The AR cycle in Table 26 demonstrates that the web developer needs an analytical development tool to develop WBIS. These results support previous researchers views that web developers require new analytical development tools to accommodate emergence (Baskerville, Pries-heje & Ramesh, 2007). The three core constructs of the theory of deferred action emergence, planned action and deferred action are supported by the action research data and inform the development of the Kadar Matrix.

The AR data in Table 24 identified the need for an analytical development tool to assist the manager and web developer to develop WBIS in an emergent organisation. The AR data confirmed that the manager found it difficult to select appropriate features of WBIS student services. The AR data gave the web developer greater understanding of the decision making

process to inform the manager of what can and cannot be developed. For this reason the action researcher developed an analytical development tool.

The action research data reveals an emergent organisation as predicted by ToDA. The WBIS development problem faced by the manager is one of WBIS development in an emergent organisation. The problem is situated within an emergent organisation. Therefore, the development of an appropriate analytical tool is developed with ToDA. ToDA is a theory that explains the emergence phenomenon for information systems.

Table 26: Action Research Cycle

(Diagnosing) **Problem in Development**	**(Planning Action)** **Action in Development**	**(Taking Action)** **Solution in Development**
The project consisted of developing a student services web-based information system that encompasses rich information on the different services provided. The manager proposed the problem of how to select appropriate features within the WBIS.	Many of the requirements had to be agreed with the different Student Services sections. This involved organising and arranging meetings with the different services managers. It is a time consuming process that involved meeting the different departments and mapping down what was needed.	The student services manager met with the different services to discuss ideas on how they would like the WBIS to be designed. The manager mapped out what features the different student services requested. The web developer discussed what methods could accommodate the different features in development. Based on the web developer ability to develop WBIS, an agreement was made to pursue two different methods of initial development. The manager would have liked to know what features could be incorporated before meeting with the different service managers. The

		web developer felt one couldn't rule out the use of a feature until it is tested within its environment.
Experiencing, Reflecting, Interpreting and Tacking Action	**Experiencing, Reflecting, Interpreting, and Tacking Action**	**Experiencing, Reflecting, Interpreting and Tacking Action**
The action researcher felt excited by the opportunity to develop a WBIS for a wide audience. Despite initial doubts the action researcher's reflection on what methodologies can be successfully applied to the project led to confidence that the problem could be resolved. The action researcher reviewed the relevant methodologies. Having looked at the methods for development, an appropriate method was selected.	The thought of the manager having to get collective agreement with the different services made the web developer feel more focused and content with implementing the development process. Knowing the entire role of what the web developer had to implement from start to finish and having started initiated communication and progress updates daily, enabled him to provide clear direction.	Due to the different web based aesthetics requirements (e.g. high resolution images with multimedia features viz. text, audio, still images, animation, video and interactivity) and level of internet speed the manager isn't able to get a collective agreement with the different student services (e.g. new students start in September therefore a working prototype needs to be ready by August). The web developer's role had to incorporate aiding the decision on what could and could not be developed. Apprehensive about this process the action researcher had to develop a web developer tool to overcome this problem. Reflecting on the problem, the web developer thought that there was a need for an analytical development tool that could aid this emergent development process.
Evaluating the Action and Assessing the Learning Points		
Agreement: The web developer's experience and knowledge of methodologies will have an impact on the manager's ability to		

incorporate the features required for WBIS development. Generate a development tool for emergent WBIS development that can be used when encountering the demand for features to incorporate in the development process. Disagreement: In the testing and applicability of the design requirements, there is necessity for the tests to be carried out within its actual environment.
Experiencing, **Reflecting, Interpreting, Tacking Action**
With the fast paced web-based development process and the dominance of "time to market" (Baskerville and Pries-Heje, 2002), the demand to meet deadlines is equally essential when compared with the need to develop the features. Having this type of pressure placed on the web developer inhibits the developer's ability to prepare and plan out the development process according to a specified method. Both web developer and manager felt it was necessary to develop a better way of understanding the current state of the development process and what the web developer could contribute to it. Using a theory that models emergence process may enable the web developer to develop an appropriate tool.

The AR data analysis identified three prominent factors viz. web-based aesthetics, time constraint and emergent aspects. These factors are incorporated into the development of the analytical development tool for the web developer. Additionally, the other recurring patterns, themes and associations viz. methodological issue, emergent aspects, web-based aesthetics and time constraint are also taken into consideration.

6.2 Data Analysis & Development of Kadar Matrix

Walsham (1995) asserts that the result of data analysis in interpretive research is the interpretation given to the data by the action researcher. This technique is applied to develop the Kadar Matrix. The action researcher agrees with the Walsham (1995) stance.

The action researcher viewed the prime focus of data analysis as the content of the data. By content is meant the themes and issues that arise from the AR data. The action researcher takes

the Maxwell (1996) stance which states that data analysis strategies have to be consistent or comparable to the questions being asked. Maxwell (1996) argued that interview questions sought the views, opinions, meanings, and understandings that web developers attach to their actions. He claims that it is appropriate to identify the themes and issues which emerge from the AR data. This type of content analysis entails identifying categories in the data. Its application here is to identify themes or categories that are relevant to WBIS development and usage. The identified themes or categories which support the formulation of the analytical development tool are inherent in the AR data collection process and which were pursued further in the interviews. These concepts were developed while data was interpreted throughout the research investigation.

6.3 Initial Interpretation of the Data

The initial interpretation of the data generated themes in relation to the emergent nature of the organisation. This emergent nature was problematic for the web developer to develop WBIS and affected his ability in the organisation. For example, the web developer experienced an unstructured WBIS development process which was based solely on the manager's requirements. The manager had to involve the different student services perspectives collectively throughout the student services WBIS development process. This involvement with the different perspectives placed the manager under increased pressure to accommodate their different requirements. This resulted in more pressure being added to the web developer's role. The web developer had to look at what WBIS methodologies could accommodate these continuously changing requirements and report back to the manager.

The data affirms factors reported in the literature. These factors are internet speed and web-based aesthetics. They have major influence on the WBIS development process. The demand for web-based aesthetics and internet speed is increasing at a rapid pace in the organisation, and the action researcher found that the use of a WBIS methodology is logically flawed and non-existent in this emergent environment, although, the development process eventually reaches its business objectives. The methodologically based development process reaching its business objectives is

presently misunderstood as the inadequacy of planning. It is believed that better planning would not cause similar problems. However, the data analysis revealed the alternate emergent organisation perspective. The data analysis generated more detailed interpretation from the data and gave the action researcher greater understanding to propose and develop the Kadar Matrix to support the WBIS development process in the emergent organisation.

6.4 Kadar Matrix as the application of the Deferred Model of Reality

The action researcher applied ToDA to develop the Kadar Matrix. The Kadar Matrix itself is the first WBIS development tool for developing WBIS in emergent organisations. ToDA has been applied to develop the Kadar Matrix for web IS developers. The theory of deferred action enabled the web developer to accommodate emergence in the WBIS development process. Patel (2006) theory of deferred action explains emergence as it affects information systems in an emergent organisation. ToDA is a 'theory for action and design'. Patel (2006) proposes three design dimensions of ToDA. These are: planned action, emergence, and deferred action. The correlations of these three design dimensions will determine what type of system design is feasible through ToDA. ToDA postulates that systems can be predetermined and specified through planned action. However, when emergent aspects are introduced into specified systems then it is difficult to implement planned action. In an emergent environment organisations are dynamic and specification is not concrete i.e. in a constant state of change.

The principle of deferring design decisions is the basis for thinking of the WBIS development process as deferred. For example, the web developer deferred the design decisions for implementing the list of requirements regarding the student research handbook WBIS. This deferred design decision was needed by the web developer to research and select a WBIS methodology (or a combination to accommodate the project) from start to finish.

The Kadar Matrix is founded on the principle of deferred design decisions. For example, the Kadar Matrix was used to illustrate that applying a single WBIS methodology couldn't be

implemented from start to finish. For this reason, the web developer was required to defer the design decisions to incorporate the use of two different WBIS methodologies. Incorporating these two different methodologies aided the web developer in implementing the WBIS development process in the emergent organisation.

It was necessary to defer design decisions because of the nature of the emergent organisation. The research data showed much evidence that Brunel University is an emergent organisation. The emergent organisation exhibited continuously changing structures, processes and procedures. For example, the management structure changed midway through the development of the student services WBIS. This resulted in the web developer having a shorter time period to complete the project. The process for querying changes to the student services WBIS has shifted directly to the web developer as opposed to previously going through both the manager & the web developer. The procedures for uploading web-based content to the external web-based platform had changed. New procedures were put in place to monitor the content through Brunel marketing departments, whereas no permission was needed by the web developer previously.

Deferred action is the central construct that underpins the Kadar Matrix. The notion of 'deferred action' is used to facilitate the understanding of the AR categories. The AR categories underpin the development of the Kadar Matrix. This Kadar Matrix permits the web developer to defer the development design action until the appropriate design context emerges. Deferred action is used as a core construct for developing tools used by web developers to cope with emergence to WBIS development process. The Kadar Matrix is a mechanism to enable the reflective designers to carry out deferred design.

The Kadar Matrix builds on the synthesis of planned action, emergence and deferred action provided in the ToDA. This synthesis is the unique contribution of the theory to understand social action in emergent organisations. It is incorporated into the Kadar Matrix. Patel and Hackney (2008) used a similar synthesis i.e. a four dimensional analysis that include deferred action. These dimensions are planned action, emergence, deferred action and diffused

management (See page 222 at bottom of table 27). The dimensions are based on ToDA to enable systems analysis of emergence and its modelling for systems design. This was to establish what structural and functional design within IS can be deferred. Similarly, the Hyper-T-modeller was proposed to model deferment in systems (Patel, 2001). The Hyper-Tmodeller CASE tool enables better interpretative and situated system requirements gathering, through visual modelling by users and professional system developers. Patel (2001) states that it is designed to address the requirements communication gap between system analysts, designers and eventual users. However, this tool was designed but never used in practice. The action researcher is aware of this earlier work applied to the ISD process through deferred action. Patel's work (2006) sought a form of continuous system development for the IS in emergent organisations. This previous work demonstrates that this type of synthesis can be applied to emergent organisations. The present research goes further by applying the synthesis to the web-based context.

The Kadar Matrix is grounded in the gDRASS (Patel, 2006) matrix generalised taxonomy of deferred action. The gDRASS matrix models emergent organisations and possible system design types (Figure 47). These synthesised interrelations postulate design principles and the development of appropriate design techniques. Hence, it can be used to describe, analyse, and explain systems design and design domains. The gDRASS matrix interrelated constructs are; formalism, deferred action, emergence (emergent organisation) and diffusion management as detailed in Table 27.

Table 27: gDRASS Constructs (Patel, 2006)

gDRASS Constructs	**Definition**
Formalism	Prescribes precise rules for creating structural forms to achieve set objectives.
Deferred Action	Is concerned with enabling actual action as interrelation design with formal design.
Emergence (Emergent Organisation)	Is unknowable and unpredictable social action. (Social Action that is organised but subject to emergence)

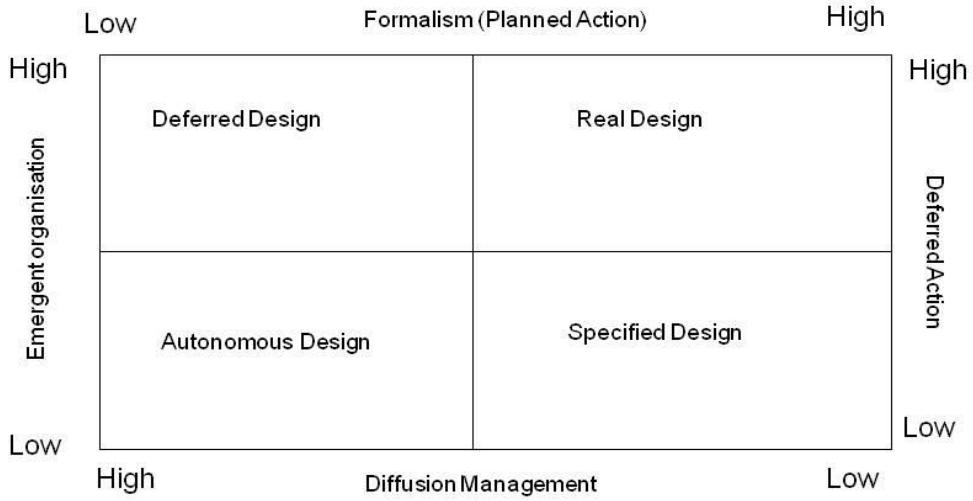
Diffusion Management	The joint responsibility of reflective and action designers to manage organisation and systems structure and operations.

The interrelated constructs of the gDRASS propose four types of design: deferred design, real design, autonomous design and specified design as detailed in Table 28. The constructs of the gDRASS matrix create interrelationships of the four different design dimensions. This gDRASS analytical tool (Figure 47) enables the developer to model types of design in actuality. By invoking deferred action as the basis for the development of a WBIS analytical development tool for emergent organisation, this research aims to adapt the constructs of the gDRASS matrix to apply them in the WBIS development process for emergent organisation. The gDRASS matrix was used to map the experience of the web developer and the AR data. Figure 47, shows that the espoused WBIS development process at student services is specified design. However, the action research data reveals that the actual WBIS development process is deferred design (Table 28). Therefore the action research data supports construing the WBIS development process as a deferred design process.

Table 28: gDRASS Design Types (Patel, 2006)

Types of Design	**Definition**
Deferred Design	Design by action designers within formal design to cope with unknowable emergence.
Autonomous Design	When design capability is afforded to intelligent machines by reflective designers that become autonomous of humans.
Real Design	Design of structures and operations by rational design for enactment in emergent actuality and responsive to it in real time.
Specified Design	Conducted by reflective designers from specification obtained from users

Figure 47: Adopted from Patel (2006) gDRASS Matrix Design Types

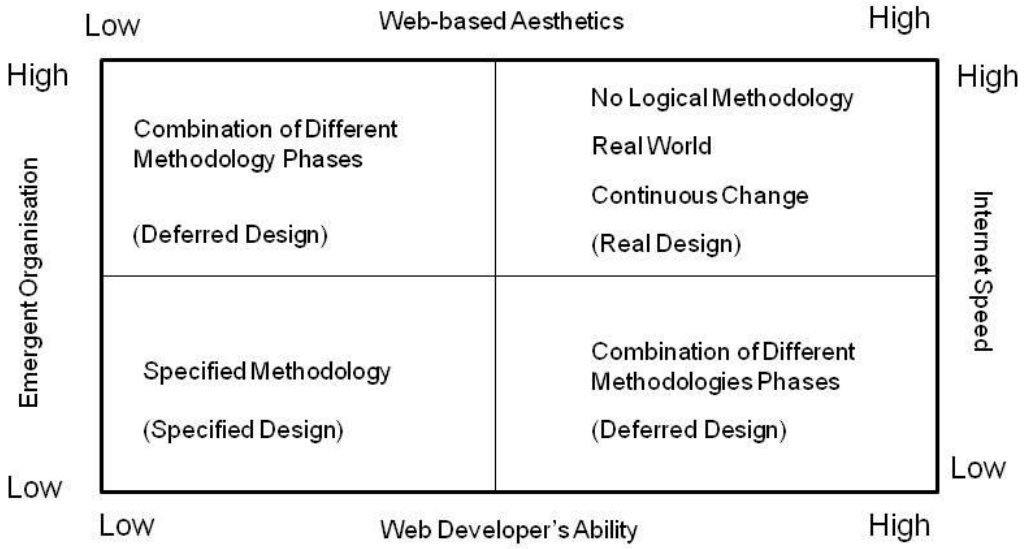


The system design types are listed in Table 28. The action researcher is focused on two design types i.e. specified design and deferred design. The Kadar Matrix is a type of deferred design. The constructs underpinning the Kadar Matrix (Figure 48) are adapted from the gDRASS matrix. Specified design in the gDRASS matrix (Figure 47) correlates to low emergence, low deferred action, high level of planned action and low level of diffusion management. This correlates to the specified methodology quadrant located in the bottom left corner of the Kadar Matrix. In this bottom left quadrant there is low emergence, low web developer ability, low level of internet speed and a low level of web-based aesthetics.

Deferred design takes place in the top left quadrant of the Kadar Matrix. In this quadrant there is high level of emergence and internet speed, with low-medium levels of web-based aesthetics and web developer's ability. The modelling of real design, takes place where all four of these constructs are at a high level (top right quadrant). The bottom right quadrant displays a design

element not categorised as a form of design from the gDRASS matrix, though its inclusion demonstrates a web-based development type in the context of an emergent organisation.

Figure 48: Kadar Matrix - Adaptation of gDRASS Matrix



The AR data reveals that the web developer was consistently being positioned in the deferred design quadrant (top left – Table 29). The data showed high level of continuous change, low level of enactment of prescribed rules (formalism), high level of the action-researcher participation in organisation and systems structure (diffusion management) and high level of deferred action (where planned action meets actual action).

The Kadar Matrix is developed on the basis of the four main constructs revealed by the AR data. These constructs are emergent organisation, web-based aesthetics, internet speed and web developer's ability. These constructs are the core problems faced by the web developer. The constructs are interrelated because they all simultaneously affect the web developer throughout the WBIS development process. The taxonomy of the Kadar Matrix constructs in Figure 48 is described in the following four sub sections.

6.4.1 Emergent Organisation as defined in the Kadar Matrix

The first dimension is the emergent organisation dimension. The emergent organisation construct reported in the literature, revealed by the AR data and theoretically proposed by ToDA. Describing an organisation as emergent means that every feature of social organisations-culture, meaning, social relationships, decision processes, etcetera are continuously evolving, following no predefined pattern. Truex, Baskerville & Klien (1999) state that the organisation may exhibit temporal regularities, but recognisable only in hindsight, because organisations are always in process of change; they are never fully formed. Brunel University student services exhibits emergent organisation characteristics. Therefore, the emergent organisation factor is a feature of the WBIS development process. See Table 29 for the correlation of emergent organisation with the other three dimensions (web-based aesthetics, internet speed and web developer's ability). The notion of emergent organisation was described in more detail in the literature review (chapter two).

6.4.2 Web-based Aesthetics as defined in the Kadar Matrix

The second dimension is the web-based aesthetics dimension. Today's dynamic organisations demand increasingly more multimedia features and tailored WBIS (Kautz, Madsen & Norbjerg, 2007). This increased demand for new web-based multimedia features placed the web developer under extreme pressure to include these multimedia features (i.e. video, audio and graphics).

These features can render web development methodologies inadequate (Lang, 2002). For example, this need for more multimedia features was found to be prevalent in the AR data for both student services and student research handbook WBIS development in Brunel.

The web-based aesthetics construct is reported in the literature and supported by AR data. Barry & Lang (2001b) state that the web-based aesthetics has a significant design role for the web developer within a WBIS development environment. The web developer's level of involvement in the development process will be determined by organisations demand for more multimedia features.

Critically web developers and graphic designers have different perceptions and values. These perceptions and values create the importance of developing a common resolution of the cross-cultural paradigms i.e. developing a common understanding in relation to different job roles in the WBIS development process. The different perceptions and values arise because web developers are recruited from different areas such as marketing, graphics design and video or film production to meet the new types of demands of web-based aesthetics (Kautz, Madsen & Norbjerg, 2007). Further, Vidgen (2002) contends that web developers have to accommodate the development of WBIS in various domains e.g. health, law and higher education. For example, by understanding the perceptions and values of the web developer in a higher education context contributed to better understanding of cross-cultural difficulties. See Table 29 for the correlation of web-based aesthetics with the other three dimensions (emergent organisation, internet speed and web developer's ability).

6.4.3 Internet Speed as defined in the Kadar Matrix

The third dimension is the internet speed dimension. The construct of internet speed is reported in the literature and supported by AR data. The notion of 'internet speed' was developed alongside the birth of the WWW and the dot com explosion in the 1990s. This new paradigm gave new focus and meaning to the aspects of time-to-market, customer focus and the ability to

respond to changing business needs (Baskerville & Pries-Heje 2002). Further explanation is given in the literature review in Chapter 2.23.2. See Table 29 for the correlation of internet speed with the other three dimensions (emergent organisation, web-based aesthetics and web developer's ability).

6.4.4 Web Developer's Ability as defined in the Kadar Matrix

The fourth dimension is the web developer's ability dimension. The web developer's ability construct is derived from the AR data. The web developer's ability is dependent on his experience and knowledge of WBIS methodologies. Therefore this construct is important in understanding how WBIS methodologies can be implemented to meet the objectives of the University. In this action research project, the web developer is experienced in several different WBIS methodologies. This enabled the web developer to utilise different WBIS methodologies to overcome the development problems encountered. See Table 29 for the correlation of web developer's ability with the other three dimensions (emergent organisation, internet speed and web-based aesthetics).

6.5 Explanation of Kadar Matrix Quadrant Types

The Kadar Matrix enabled the web developer to defer design decisions until the context became clear (see examples as outlined in section 6.6). The Kadar Matrix utilises the design types of deferred design, real design and specified design from ToDA. The design types in Table 29 are themselves correlated. The Kadar Matrix quadrants are derived from the action research data. This is evident from the student services AR project which revealed possible types of coherent WBIS methods. Table 29 demonstrates and explains the interrelationships between the constructs and are listed below.

Table 29: Kadar Matrix Quadrant Types

Kadar Matrix Quadrants	
Combination of Different Methodology Phases (Deferred Design) (Top Left Quadrant)	**No Logical Methodology / Real World / Continuous Change (Real Design)** (Top Right Quadrant)
High level of continuous change within the organisation Web developer knowledge and ability to implement ~~a~~ few methodologies Time-to-market is critical (high) i.e. there is an increase demand to deliver the WBIS within a short development cycle. Demand for web-based aesthetics is low - medium	High level of continuous change within the organisation Web developer knowledge and ability to implement ~~a~~ few different methodologies Time-to-market is critical (high) i.e. there is an increase demand to deliver the WBIS within a short development cycle. Demand for web-based aesthetics is high
Specified Methodology (Specified Design) (Bottom Left Quadrant)	**Combination of Different Methodologies Phases (Deferred Design)** (Bottom Right Quadrant)
Low level of continuous change within the organisation Web developer knowledge limited to one or two methodologies Time-to-market is low, resulting less pressure to develop WBIS on time Demand for web-based aesthetics is low	Low level of continuous change within the organisation Web developer knowledge and ability to implement many different methodologies Time-to-market is low – medium, less pressure to develop within a short development cycle Demand for web-based Aesthetics is medium – high

6.6 The use of Kadar Matrix in Practice

This section describes the Kadar Matrix use in practice with data. There are four quadrants to this matrix and each of these quadrants is discussed. These four quadrants are combination of different methodology phases which are: no logical methodology, specific methodology and combination of different methodologies. These quadrants are aligned to the theory of deferred action. Each quadrant displays a design type i.e. deferred design, real design and specified design. Each of these four quadrants represents a quadrant in the Kadar Matrix. The Kadar Matrix is underpinned by the gDRASS, where specified design of the gDRASS matrix is the specified methodology of the Kadar Matrix. The deferred design of the gDRASS matrix is the combination of different methodologies of the Kadar Matrix. The four quadrants of the Kadar Matrix are presented next.

6.6.1 Combination of Different Methodology Phases (Deferred Design)

The top left quadrant of the Kadar Matrix is the combination of different methodology phases. For example the AR data identified that the time to utilise Ikonic documentation process methodology would result in the project being delayed longer in order to accommodate student services WBIS development process. Therefore, it was decided between the manager & web developer to initially utilise Ikonic process with timeboxing. Timeboxing is a time management technique common in planning projects, where the schedule is divided into a number of separate time periods. This enabled the web developer to stay on schedule within an environment of high levels of internet speed. This top left quadrant represent the deferred design process type of ToDA.

6.6.2 No Logical Methodology / Real World / Continuous Change (Real Design)

The top right quadrant of the Kadar Matrix is when no logical methodology exists. For example, the AR data identified that none of the available methodologies were suitable in the student research handbook WBIS development process. The manager urged the web developer to choose at least one methodology. This resulted in a disagreement between the web developer and the manager. The reason for this disagreement was that the web developer identified that none of the nine methodologies in the literature review could accommodate the design requirements. This top right quadrant represents the real design process type of ToDA.

6.6.3 Specified Methodology (Specified Design)

The bottom left quadrant of the Kadar Matrix is when a specified methodology can be implemented. For example, the AR data identified that even when the organisation tried to plan for the development of the WBIS student research handbook the organisation was continuously changing. Therefore, the matrix highlighted that none of the available methodologies could be implemented. However, if the organisation exhibited low levels of emergence then existing methodologies could be used. This bottom left quadrant represents the specified design process type of ToDA.

6.6.4 Combination of Different Methodologies Phases (Deferred Design)

The bottom right quadrant of the Kadar Matrix is when combination of different methodologies can be implemented. For example, the AR data identified that due to the high level of web-based aesthetics, good time management is needed for the development of the student research handbook WBIS. The web developer used a combination of two methodologies to implement the development of the WBIS student research handbook. These methodologies are prototyping and timeboxing. These methodologies were selected because they were deemed by the web

developer to deliver the project within an emphasis placed on time-to-market. This bottom right quadrant represents the deferred design process type of ToDA.

6.7 Summary of Data Generation and Kadar Matrix Development

This chapter described the development of the Kadar Matrix based on the published literature, AR data and the theory of deferred action. The literature based factors of internet speed & web-based aesthetics were reaffirmed by the AR data. The factors of emergent organisation and web developer's ability were prevalent in the AR data. The AR data aligned well with the theory of deferred action. This enabled the action researcher to use the AR data through ToDA, as the basis for developing the WBIS analytical development tool i.e. Kadar Matrix.

The Kadar Matrix helped the web developer to defer design decisions in the WBIS development process until the context become clear. With this knowledge, the web developer advised the manager on matters pertaining to WBIS development in emergent organisations.

CHAPTER 7: Conclusions, Contributions and Further Research

7.1 Introduction

Richards (2009, p191) states that conclusions chapter is not simple to write. The misleading phrase 'writing it up' can portray one-off conclusion to a project. She argues that the concluding chapter should convey the rough with the smooth in the researcher's reflections. She contends that the action researcher's reflection should not hide the difficult bits as contained in the data or the smoothing out of the rough aspects in the research. The action researcher intends to follow the recommendations as set out by Richards (2009, p191).

This chapter provides discussion and conclusions relating to the web developer's work in some of the issues he encountered and how he resolved them, in particular how the results of the AR data revealed the problems associated to the implementation of web-based methodology systematically from start to finish because of emergence.

The contribution, limitations and future direction of the research is discussed. Richards (2009, p206) states that the action researcher needs to show that he has done justice to the data and that the analysis of that data makes sense. In the present research, the analysis of the data enabled the action researcher to review the building blocks upon which the research has been established. These building blocks derived from the relevant literature include concepts, viz. emergent organisations, web-based aesthetics and internet speed. Understanding these concepts gave the action researcher added insights of how a web developer develops WBIS within an emergent higher education organisation.

7.2 Assessing the Aim and Objectives against the Research Outcomes

The aim and objectives in the introductory chapter allowed the action researcher to assess the research outcome with the action plan of the thesis. He used an action research methodology to

accomplish the aims and objectives. This methodology allowed him to investigate the social aspects placed on the web developer throughout the project. This research approach allowed him to integrate the social aspects into both theory and practice.

The main objective of this research is to develop a web-based analytical development tool that aids both organisation and practitioner when critical factors, internet speed and web-based aesthetics, affect the WBIS development process in emergent organisations. By undertaking an AR methodology, this enabled the action researcher to answer the main research question: "How does an emergent organisation develop WBIS, with increased demand on the web developer for web-based aesthetics at internet speed?" The main research question was followed by two sub questions which are: "How much influence does the web developer have within the organisation?" and "How can the web developer improve the process to cope with internet speed?" Conducting this investigation using the AR research design, the researcher ascertained, after completing the research, that the questions posed were not only appropriate for this investigation, but also helped the researcher to achieve the stated aim and objective of the investigation, through the development of the Kadar Matrix (an analytical development tool) detailed previously in Chapter 6.

In Chapter 2 the action researcher found that a single development methodology may not fit every situation in an emergent WBIS development process. The AR data in this investigation supports Howcroft and Carroll (2000) claim that a single web-based development methodology is inadequate for developing WBIS within an emergent organisation. The themes generated from the AR data show that methodological issues arise as the major concern from the data analysis (see Chapter 5). The literature review in Chapter 2 aided the researcher in selecting an appropriate theory to inform the research. This investigation used ToDA, as informing practice, to improve the rational development of WBIS for emergent organisations. This investigation not only gathered data that affirms ToDA's central tenet but also enabled the action researcher to understand the phenomenon more accurately. This is in accordance with Hambrick (2007) stating that: the selection of theory should help to "organise our thoughts, generate coherent

explanations and improve our predictions". This was achieved through the lens of the deferred model of reality conceptualised in the theory.

Chapter 3 explains the action researcher's epistemological and ontological position. This position is from an interpretivist perspective that social action, as in organisations, is emergent. The action researcher assessed the concurrence between the purpose and method to select a qualitative approach, the action research method. This qualitative approach is determined logically by the research question and the purpose of the investigation. The action researcher placed himself solely on the qualitative side of the divide. This position is backed by Bryman (2007). Although Mingers (2001) suggests researchers should use mixed methods, the action researcher asserts that applying mixed methods created a conflict with the researcher's epistemological and ontological perspective.

Chapter 4 described the historical growth of Brunel University from its first inception in 1966. Since then, the university has distributed its communication via a paper based system until the internet became available in the late 1990s. The University had a management problem in terms of communicating between employees within the organisation and also communicating general & specific information to students. The University is now transitioning towards developing more web-based information systems. For example, the paper based student handbooks are now available online and the production of paper based handbooks has stopped. The organisation is assumed to be emergent, with its structure, processes, and procedures changing continuously.

Richards (2009, p206) advocates that the researcher should bring all the different data sources together for the purpose of data analysis. This is done in Chapter 5. Further, the action researcher utilised Nvivo8 software package for data analysis. The action researcher has attended a course on how to utilise the Nvivo8 software package to analyse the data and found the Nvivo8 package beneficial. The benefits of using this package include not only a user friendly layout, but also accessible and comprehensible design aspect. These aspects enabled the action researcher to easily navigate the software, as the layout and design is based on Microsoft Outlook 2007. The

action researcher is IT literate and has previous knowledge and experience in using Microsoft Outlook 2007 software package.

The action researcher used Nvivo8 to assist in the amalgamation of the five different sources of data. These five different sources are student services, student research handbook, K's Questions, Dr M's Interview and Additional Action Student Services AR data. The action researcher found that by using the Nvivo8 software package the analysis was carried out with relative ease to classify the data into nodes and categories. From these nodes and categories, meaningful diagrammatical flow patterns are recognised and analysed. By analysing and cross referencing the data drawn from all data sources, the action researcher found meaningful agreements. These correlated with existing problems encountered in emergent organisations. Some of these recurring problems identified are: Methodological Issue, Emergent Aspects, Web-based Aesthetics and Time Constraint.

The action researcher followed the Walsham (1995) argument which states that the result of data analysis in interpretive research is the interpretation given to the data by the action researcher. Therefore this technique is applied to develop the Kadar Matrix. The action researcher described the development of the analytical development tool, the Kadar Matrix, in Chapter 6. The action researcher developed the Kadar Matrix informed by the theory of deferred action and through action research data. This research setting is based on the critical factors of internet speed and web-based aesthetics. Furthermore, the action research data was used in conjunction with the theory of deferred action gDRASS matrix to develop the Kadar Matrix. This adaptation of the gDRASS and action research data enabled the web developer to advise the manager more accurately about meeting volatile demands on the WBIS development process. The development and implementation of the Kadar Matrix in practice proved to be a vital tool in deferring the design process.

The action researcher identified WBIS development problems in the literature. The investigation captured AR data in practice to reaffirm the problems reported in the literature. Identifying the

problems in practice enabled the action researcher to test a solution with the aid of the theoretical lens – the theory of deferred action. This involved synthesising the AR data and using the gDRASS matrix to align the synthesis into relevant categories. This formed the basis for the development of the web developer's analytical development tool i.e. the Kadar Matrix. The Kadar Matrix helped the web developer to defer the decision process which facilitated and enhanced the intervention throughout the development process. Gaining this perspective and knowledge helped the web developer to advise the manager more accurately about meeting volatile demands on WBIS development within emergent organisations.

7.3 Answering the Research Questions

The action researcher constantly asked: Is the analysis of the AR data addressing the research questions posed? He bore in mind what the outcome may mean, how the patterns and associations generated could answer the research questions. Further, he established how to use the mechanical processes, such as Nvivo8 software package. This was achieved by undertaking an Nvivo8 course. These processes supported the interpretative method used to answer the research questions (Richards, 2009).

The main research question was:

How does an emergent organisation develop WBIS, with increased demand on the web developer for web-based aesthetics at internet speed?

WBIS development in an emergent organisation needs better analytical development tools to help the web developer accommodate emergence. Emergence is central to the successful implementation of web-based aesthetics for WBIS development. Emergence has an impact on the ability of the web developer to develop WBIS at internet speed. The web developer's knowledge of available WBIS methodologies can affect the web developer's ability to accommodate emergences. The problem of emergence led the web developer's to develop

WBIS with increased demand on the web developer for web-based aesthetics at internet speed. The Kadar Matrix was used as an analytical development tool to overcome this problem.

The action research investigation discovered that Brunel University was an emergent organisation and therefore subject to a continuously changing environment. This aligned with the Truex, Baskerville & Klien (1999) view that organisations are subject to continuously changing structures, processes and procedures. For example, the changing environment within Brunel University has forced the University to change its management structure. The change of management structure is as a result of continuous demand by students and staff to provide WBIS information and communication in real time. This has placed added pressure on the web developer to deliver these changes to accommodate the demand for speedy development.

There is agreement among the patterns generated from the student services and student research handbook data. The resultant patterns and associations derived from the data analysis are of significant importance to the future WBIS development. These resulting patterns of the student services data presents a clear picture of the design, development and implementation issues surrounding not only the managers, but all stakeholders as well. These concurring patterns resulted in identifying three significant categories.

There are three categories in agreement which are drawn from the three data sources. The three data sources are student services AR data, student research handbook AR data and additional action student services AR data. The three categories are: methodological issues, time constraint and emergent aspects. All these three aspects helped the action researcher to understand the WBIS process in context. These three aspects gave the action researcher a greater understanding of how a web developer develops WBIS in a changing environment. Further, this enabled the action researcher to utilise the gDRASS matrix (Patel, 2009b) which is adapted for greater understanding of WBIS within an emergent organisational phenomenon.

This section also aims to answer the first sub-question which is:

How much influence does the web developer have within the organisation?

In this investigation the web developer had to overcome the 'uncontrollability threat' which is apparent in many AR projects. The 'uncontrollability threat' involves the action researcher attempting to change the environment that is being studied and within which the researcher does not have full control (Avison, Myers & Nielsen, 1999). The action researcher needed more time to overcome the 'uncontrollability threat' as the execution of the design and also the relationship between the researcher and subjects needed the development of trust. Avison, Baskerville & Myers (2001) correctly point out that "rarely will an organisation cede ultimate authority for organisational action to an external researcher". This is why the action researcher spent three months building trust within the organisation. The action researcher was initially trusted with minor responsibilities but this gradually grew into major responsibility. For example, the action researcher was initially allowed to answer the phone and take messages. After a period of time the action researcher was trusted more and given responsibility for arranging and conducting meetings without the approval of the manager.

Coinciding with the uncontrollability threat, the web developer had to develop WBIS with inadequate development tools. Baskerville, Pries-heje & Ramesh (2007) stated that developing WBIS in today's changing work place is a problem that needs better analytical tools to address the problem of emergence in emergent organisations. To accommodate these aspects, the action researcher found that the manager had the overall controlling power. Bearing this in mind, about the controlling aspects of the manager, there is a specific need to involve a knowledgeable web-based developer. The web developer needs to possesses the necessary skills (or be able to acquire these skills) to deal with the multitude of problems arising within the changing organisation.

One of the necessary skills that needed to be obtained is good communication between the project manager, web developer and stakeholders. The project manager had a good working

relationship with the stakeholders in initiating the project. Moreover, the results indicated that it is the web developer's knowledge and expertise that drives the project from conception to the final outcome. Further, the web developer's influence is subject to the trust given by the manager. The web developer had significant influence in the development of the WBIS student services & student research handbook. The web developer's influence is also evident in the construction of the Kadar Matrix, as the web developer's level of knowledge is vital to the successful implementation of WBIS development process.

This section further aims to answer the second sub-question:

How can the web developer improve the process to cope with internet speed?

There are ten properties (see Chapter 2.13.2) of internet speed (Baskerville & Pries-Heje 2001). The data analysis (see Figure 19) identified that internet speed was a prevalent factor in the development of WBIS.

Internet speed gave new focus to the following aspects: time-to-market, all stakeholders and the ability to accommodate organisational change within a rapidly changing environment (Baskerville & Pries-Heje 2002). For example, the student research handbook WBIS project had only had one month in which to deliver the project. Further, the rapidly changing environment resulted in additional adjustments throughout the WBIS development process.

The analytical development tool the Kadar Matrix, created by the action researcher, was used to assist the web developer in deferring the design decisions relating to internet speed. The pressures of internet speed affected the web developer's ability in making rational design decisions. To overcome the difficulty of internet speed, the Kadar matrix was used to assist the web developer in selecting an appropriate WBIS development methodology.

7.4 Learning Points: Student Services and Student Research Handbook AR Cycles

This section highlights the learning points arising from the AR student services and student research handbook WBIS development projects. In relation to the information contained in Table 10, the researcher has learnt the following from student services and student research handbook AR cycles. There are five learning points on student services cycle one which is discussed below.

Student Service Cycle One: Selecting appropriate features

Firstly, the demand of time-to-market has given the web developer and manager the motivation to develop a better way of understanding the current stage of the development process. Secondly, the methodologies available to the web developer were inadequate in overcoming the characteristics needed to solve the WBIS development problem. Thirdly, methodologies with low levels of emergence are useful in non-emergent higher education organisations. Fourthly, new analytical tools are needed for emergent higher education organisations. Fifthly, the new tools need to be updated continuously as and when new features need to be incorporated.

Student Services Cycle Two: Disagreement in design requirements for Student Services WBIS

There are four learning points in the student services cycle two. The first is using CSS 2.1 supports content positioning, table layout and features for internationalisation, including some properties which are related to user interface. The second is utilising a single platform for the WBIS development which is used to reduce the time taken in the development process. The third aspect is the manager's awareness of the WBIS development methodologies. This created a better understanding between the manager and web developer and therefore speeded up the development process. The fourth aspect relates to an organisation with continuously tight

deadlines and which may use any acceptable methodology or method to deliver the emergent requirements within the set timeframe.

Student Services Cycle Three: Current development stage and methodology

There are three learning points in this student services cycle three. The first one is the use of ToDA to develop the applied Kadar Matrix analytical development tool for emergent organisations. The theory is established as a suitable theory for WBIS development. The second learning point is that by reviewing the different methodologies, it can help the web developer in identifying what phases of the different methodologies might be applicable. The third learning point is that the manager has an agreement with the web developer to investigate appropriate web-based development methodologies.

Student Services Cycle Four: WBIS Development tool using Kadar matrix

There are three learning points in this student services cycle four. The first point is that the web developer has analysed the gDRASS matrix from the theory of deferred action in relation to the student services WBIS and has determined that it is a useful tool for WBIS development. The next point is that the findings of the AR data are used with the gDRASS matrix to develop the Kadar Matrix. The final point is that this analytical development tool provided a solution to inform both web developer and manager on how to develop WBIS rationally in an emergent organisation.

Student Research Handbook Cycle One: Problems with student and research handbook

There are three learning points in this student research handbook cycle one. The first aspect is to improve the student research handbook in the following areas: access, structure & information, interaction and design. The second aspect is learning how to categorise the information better

within the redesigned student research handbook. The last aspect is that the WBIS development process needs to consider the context of the student research handbook in relation to other material on the web.

Student Research Handbook Cycle Two: Analysing problems in current handbook

There are three learning points in this student research handbook cycle two. To begin with there was a need for quicker access to key content within student research handbook. Next to improve the web-based Aesthetics encouraged greater student interaction with the student research handbook. Finally, additional content was incorporated within the WBIS development process.

Student Research Handbook Cycle Three: Recommendations from Web Developer and Manager

There are two learning points in this student research handbook cycle three. The first of the two learning aspect is that the Kadar Matrix provided the web developer with an analytical development tool which identified and analysed the applicability of the methodologies in relation to an emergent organisation. The other aspect is that the Kadar Matrix helped to identify two critical factors which were internet speed and web-based aesthetics.

Student Research Handbook Cycle Four: Implementation and review using Kadar matrix

There were two learning points in this student research handbook cycle four. One aspect is the changing demand which hampers the smooth execution of the WBIS development process (e.g. having to start and stop the project as new add-ons are requested). The other aspect is that ToDA is evaluated by the action researcher as a good theory in aiding the web developer to rationally understand the emergent nature of the organisation within a WBIS context and to design rationally WBIS in emergent organisations.

7.5 Contribution to Knowledge through Theory and Practice

Definitions and interpretations of this research may vary widely. However, what is clear is that it sought to contribute knowledge on how web developers develop WBIS in emergent organisations, particularly for Brunel University student services. This research has produced research results that arguably make a form of contribution to knowledge for both higher educational organisations and WBIS development. These contributions are summarised in Table 30. Further, there are several potential areas of improvement.

Table 30: Contribution of Research Process

Research Process	**Contribution**
Theory	Identified the phenomenon of emergence in the literature and adapted the theory of deferred action (ToDA) to accommodate WBIS development process in emergent organisations by applying the theory to develop the Kadar Matrix.
Practice	Developed an analytical development tool (Kadar Matrix) for web developers, which was applied to student services WBIS and student research handbook WBIS. This analytical development tool can be applied to other higher education emergent organisations to develop WBIS.

7.5.1 The Central Contribution

The central contribution (of the research) to knowledge is the Kadar Matrix analytical development tool. The Kadar Matrix is derived from the results in the AR data and based on the constructs of the theory of deferred action (ToDA). This Matrix is composed of a four dimensional analysis. The analysis consists of four factors which are: web-based aesthetics,

internet speed, emergent organisation and the web developer's level of knowledge. These four aspects have an impact on the web developer throughout the WBIS development process.
The significance of the Kadar Matrix is that it assisted the action researcher in deferring the design decisions until the context of the development process emerged and became clear. The value of using the Matrix is that it enabled the web developer to analyse the effect of emergence in the organisation, in terms of its modelling of WBIS development. This analytical development tool helps to position the web developer in contributing fully throughout the WBIS development process. The Matrix enabled the web developer to accurately plan and advice the manager in accommodating volatile demands of both organisational change and WBIS development.

The Kadar Matrix applied the theory of deferred action by utilising the constructs of the gDRASS matrix to develop the Kadar Matrix for WBIS in emergent organisations. The gDRASS matrix was adapted with AR data for the purpose of developing the Kadar Matrix which is used by web developers in actuality to develop WBIS in emergent organisations.

How does the Kadar Matrix compare with existing techniques (e.g. the WISDM matrix) for WBIS development? Vidgen et al (2002, p.32) state that the WISDM matrix can be used by web developers'. There are four categorises of the WISDM matrix. These are: socio (organisations and people), technical (software model), analysis ('what is required') and finally design ('how' it will be achieved). Their WISDM supports web developers with an even handed solution to both the soft and hard approaches for IS development. Their matrix assumes stable organisations. The Kadar Matrix, however, provides web developers with an analytical development tool that defers the design decision to accommodate continuously changing organisational demands.

The Kadar Matrix has contributed to the practice of developing WBIS in Brunel University. The web developer used the Kadar Matrix to develop two WBIS. These two web-based systems were developed for the student services and the student research handbook sections. For example, the web developer was asked by the manager to select an appropriate web-based methodology that could be implemented from start to finish in the student services WBIS. The Kadar Matrix was

used to identify and inform the manager that (with the constraining factors affecting the WBIS development i.e. internet speed, web-based aesthetics, emergent organisation and web developer ability) combinations of different methodologies were needed to carry out the project. The manager concurs with the web developer that the Kadar Matrix has aided the WBIS development process in the student services department.

The Kadar Matrix weakness is that it has not been used by other practitioners or researchers as compared to the WISDM matrix (Vidgen, 2002, Avison and Fitzgerald 2003a). However, the Kadar Matrix is relatively a new analytical development tool. The action researcher advocates that if other researchers use the Kadar Matrix for WBIS development it can be refined further to enhance its effectiveness in emergent organisations.

ToDA is a verbal theory (Patel, Eldabi and Khan, 2009a) which has conceptions or models of IS. The theory of deferred action, with techniques and tools, has design principles which are utilised by IS developers. The theory of deferred action has been applied to IS but not web-based IS. This research set out to apply the theory to web-based IS. Therefore, this research adds rigor to the theory by applying it to an area in which it was not previously applied i.e. with AR data to verify its usefulness. Further, the action research data verify the theory's assertion that Information Systems is developed in emergent organisations.

This research has contributed to the ToDA by applying its concepts to develop the Kadar Matrix analytical tool for WBIS in emergent organisation. The theory of deferred action also proposes deferred action as a means of understanding emergent organisations and this research has developed the Kadar Matrix as a form of deferred action for web developers. ToDA addresses the problem of how to design IS rationally for emergent organisations. The investigation utilised ToDA for designing WBIS rationally. Its applicability, to inform practice, is evident in Patel et al (2009c) work which states that: "the theory is presented as a theory to inform practice to improve the rational design of information systems for emergent organisation". Further, ToDA explains the effect of emergence on the rational design of IS. This effect on the present research is

conceptualised as internet speed, web-based aesthetics, web developer's ability and emergent organisations. ToDA, as a theory to inform practice, provides guidance in the form of design constructs. These design constructs were used to inform the action researcher in the development of the Kadar Matrix.

After reviewing the current state of the literature, this research is able to suggest the deferred model of reality for WBIS in emergent organisations. This model was then tested and further refined through the process of AR to develop the Kadar Matrix. This research has been able to further progress the theory of deferred action in the web-based IS domain and applied it practically in an emergent higher education context. It also amalgamates some existing areas of research, such as, internet speed as well as producing some relatively new areas to the topic e.g. web-based aesthetics within a WBIS context.

The action researcher applied the three design dimensions of ToDA to understand the WBIS development phenomenon within an emergent organisation. The three dimensions consisted of planned action, emergence and deferred action. These three dimensions were used to interpret the AR data. This enabled the action researcher to understand the phenomenon being encountered in actual context. By understanding the phenomenon through the ToDA, the action researcher was able to more accurately understand the emergent environment and therefore build more appropriate WBIS for student services of Brunel University.

The research contribution is applying to practice and extending the ToDA through its constructs of the gDRASS matrix and adapting these constructs for the purpose of developing the Kadar Matrix analytical development tool for WBIS development for web developers to use in actual emergent organisations. The AR data affirms that the web developer used the Kadar Matrix to defer the design decision in context. By deferring the design decision the web developer is able to more accurately advise the manager on appropriate methodologies required for WBIS development.

The AR testing of the Kadar Matrix enabled the action researcher to contribute to the practice of WBIS development. The Kadar Matrix helped the web developer to resolve practical development problems. These included overcoming the pressures of time-to-market, web-based aesthetics requirements, changing levels of an emergent organisation, together with the level of web developer's knowledge. However, the limitations of the Kadar Matrix in solving the problems in practice relates to the fact that the study is conducted in a higher education organisation and within an environment that is driven by higher educational standards.

7.6 Directions for Further Research and Limitations of Thesis

It can be argued that part and parcel of virtually every doctoral research study, is a part of or a section of future research work that can be undertaken as a direct result of the investigation. Indeed, undertaking this research has proved to be no different. The true nature of research being about choice, can always lead to different scenarios. Also, as more of the AR data was analysed more new and interesting aspects were discovered. This is an inevitable fact of research which, by its very nature, is constantly evolving.

Further AR is currently being undertaken to investigate how the Kadar Matrix can improve the internet speed in terms of time-to-market. This will be done through monitoring (data-gathering) its effect within different WBIS development projects at Brunel University. This will give more credibility to its effectiveness in actuality.

ToDA needs deferred points to help researchers understand exactly when to defer the design process. This would help the action researcher to more accurately develop WBIS through the Kadar Matrix. In the present research, it is the web developer interpretation that determines when and how to defer the design process.

The thesis has to be examined in the light of its limitations. Every research has its own weakness and limitation, as perfect and complete research does not exist (Lin, 2002). The limitations

reported in this study refer to general limitations of theoretical and practical issues, as well as limitations of the research design approach. This study should be interpreted under the following limitations:

The analytical development tool (viz. Kadar Matrix) developed to aid the web developer in overcoming inadequate methodologies in emergent organisations, is limited to being tested in a single environment of a higher education institution. Further testing in other higher educational and organisational contexts may be necessary to give new explanations and add validity to this analytical development tool (Ramrattan & Patel, 2009). Such applications would also test its theoretical base viz. ToDA.

Internet speed and web-based aesthetics are not the only significant factors in WBIS development. Liang (2006) argues that the easy-to-use aspect (based on the need of use from user perspective) is critical for successful implementation in WBIS development. Though, for the purpose of this study internet speed and web-based aesthetics remain the main consideration. It is beyond the scope of this project to incorporate other WBIS development factors.

The web developer's role had to incorporate the use of multimedia and graphic design within a WBIS context. However, the developer's role is significantly different in an IS context. In an IS context the developer does not require multimedia and graphic design skills to implement the development process. Further research is required by researchers in understanding why web developers, in a WBIS environment, need a different skills set to operate in an IS context.

7.7 Reflecting on the Action Research Approach

Apart from the researcher's experience, there are other factors that can inhibit the successful conduct of an AR study by a doctoral researcher. For instance, AR arguably suffers from the Hawthorn effect. The Hawthorn effect is a form of reactivity where subjects modify their behaviour in response to the fact they are being studied. AR is interventionist by nature and the

intervention can have an adverse effect on the result of the study. Although some of the potential conflicts have been introduced and looked at in this research, there may be others that are not obvious within the context of the investigation. Further exploration is needed in terms of accommodating the time available for doctoral action researchers within an AR project.

The action researcher found that the research questions posed in chapter one is an appropriate one to investigate. This is supported by the data which identified the prominent problems faced by the web developer when developing WBIS in emergent organisations. These problems are internet speed and web-based aesthetics. An action research method was used to investigate these problems and this method helped to answer the questions posed. This method enabled the researcher to iteratively adapt to the emergence problem and answer the questions in context. It also provided the techniques needed to develop an analytical development tool for practical use by web developers.

The use of the AR method enabled the collection of appropriate data to answer the research question. The data was interpreted from different perspectives as recommended by Richards (2009). This enabled the action researcher to accurately elicit answers from the data. Firstly the research cycles were examined at a micro level and secondly at a macro level. This logic facilitated the building of small themes and patterns to ascertain whether these are evident at a macro level. This approach gave credence to the themes and patterns generated and therefore, the method to interpret the data is considered appropriate.

The process of conducting AR is one that has been well documented in the literature. However, what is less clear and can be an area for future research is the application of AR within the constraints of doctoral research. PhD researchers who have no prior background knowledge in action research are inexperienced researchers, even though they may have interesting research ideas. However, inexperience in general research terms is not something that current literature on AR takes into account.

The action researcher advocates that future AR should be focused on the confinement which is placed on action researchers during their doctoral research studies. Doctoral AR investigations need to be fully explored and analysed before selecting an action research method which is not suited for doctoral AR students.

7.8 Concluding Remarks

The usefulness of knowledge generated from this investigation has been discussed in this chapter. It has highlighted the improvement in the understanding of how a web developer develops WBIS. It has also ascertained ToDA's ability to explain the WBIS phenomenon within an emergent higher education organisational context. However, the action researcher contends that applying the Kadar Matrix in different contextual environments will further test its usability and may generate a wider appeal to both academics and practitioners.

The AR investigation found that the WBIS development process is problematical because the organisation under investigation here exhibited continuous change in its processes, resources and procedures are evidence of an emergent higher educational organisation. The knowledge and understanding gained from the theory of deferred action assisted the action researcher to better understand emergent organisations.

The use of ToDA's deferred model of reality in the investigation helped the action researcher identify that none of the nine web-based methodologies examined in the literature review could be implemented systematically and successfully from start to finish because of emergent factors. This was evident in both student services and student research handbook WBIS projects. Further, the deferred model contributed to the development of the Kadar Matrix. The three synthesized design dimensions of ToDA are the foundation for the Kadar Matrix. The Kadar Matrix enabled the action researcher to better understand the emergence phenomenon and provide practical knowledge to deal with emergence in the WBIS development process.

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8 Appendices

8.1 Appendix 1: Action Research Sample

8.1.1 Action Research Cycle: Sample A

These templates were based on Coghlan & Brannick (2005) action research method. They were then refined by the action researcher by tailoring them suit the emergent organisation.

(Diagnosing) **8.1.2 Problem in Development**	**(Planning Action)** **8.1.3 Action in Development**	**(Taking Action)** **8.1.4 Solution in Development**
The disagreement of testing the applicability of the design requirement to its actual environment. Required the development of a prototype Student Services without the incorporation of Web-based Aesthetics.	There were 10 active different Student Services that needed to be incorporated. Designing the pages with a consistent layout design seemed a logical format. Though not providing the content, means the structure needed to be in a universal format that would appeal to the different services.	Having reviewed the manager's feedback of wanting one picture per page, with no more than two paragraphs of textual information and relevant contact details. The Web Developer used Dreamweaver to implement the initial design following a CSS format. This enabled the design to be compatible over multiple browsers.
8.1.5 Experiencing, Reflecting, Interpreting and Tacking Action	**Experiencing, Reflecting, Interpreting and Tacking Action**	**Experiencing, Reflecting, Interpreting and Tacking Action**
Having this problem made the action researcher feel apprehensive as to which type of structure would be suitable. Though having an	The 10 different Student Services might need to expand into creating more space for additional services. I have to look at the bigger picture of	Having used primalis before and gathered knowledge of the coding problems of using the in-house built system. I need to be aware of the

agreement with the manager about using CSS enabled the web developer a more narrowed thought of designs.	the development of this project. As developing for what is required now might make it hard for expansion in the future.	layout problems faced when developing for two different information systems. It might be worth recommending to the manager it is worth developing outside of primalis to save me time developing.

8.1.6 Evaluating the Action and Assessing the Learning Points

Agreement:

Using CSS as a cross browser language for developing the infrastructure. Though the release of CSS 2.1, means it might be beneficial to upgrade to the improved language. As it supports media-specific style sheets so that authors may tailor the presentation of their documents to visual browsers, aural devices, printers, braille devices, handheld devices, etc. It also supports content positioning, table layout, features for internationalization and some properties related to user interface.

Disagreement:

When developing for internal and external information systems it causes development problems. Suggestion to the manager to develop for one specific audience will improve the time taken to develop.

Experiencing, **Reflecting, Interpreting, Tacking Action**

The emergent nature of the organisation (Truex, Baskerville & Klien 1999) creates difficulty in implementing a rational structure for development. If the manager was aware of the web-based information system development methodologies then it could create the impetus to develop using a specific methodology. As it is an organisation with continuously fast approaching deadlines it seems acceptable in this context to use any methodology or method to deliver requirements as and when received within the time frame.

8.2 Appendix 2: Semi-Structured Interview

The semi-structured interview is aligned with the research question. This is necessary to add credibility to the AR data. Further, by conducting the semi-structured interview the action researcher was able to add an alternative perspective in analysing the data. The process of

looking at the data analysis from different perspectives is recommended by Richards (2009). This data was analysed along with the action research cycles in chapter 5.

8.2.1 K's Questions Semi-Structured Interview

K's Questions

What is your job role?

I am an administrator within the Student Services department. I help facilitate the everyday tasks that need to be carried out. Using a variety of software packages to produce correspondence and documents, and maintain presentations, spreadsheets and databases.

My other tasks include: devising and maintaining office systems; booking rooms; arranging meetings, taking minutes and keeping notes; invoicing; liaising with members of staff in other departments or external contacts; ordering and maintaining stationery and equipment supplies; organising and storing paperwork, documents and computer-based information.

How do you plan on getting the information you need for the student handbook?

Well the information I need is mainly sent in Microsoft word format and are updates from previous year different sections. This involves asking for any revisions by emailing the heads of the different section along with a link sending them to their page.

Is this method a good way of getting the information needed?

It is a very time consuming process and my email inbox is normally flooded during the time of year where we update the student handbook. It probably is an ok way of carrying out the

changes, though it's been the same system from previous years. I don't feel confident enough to change the process as I might end up making more trouble for myself. Sticking to what I know as a tried and tested method is probably better.

Do you have any techniques on how you organise your work?

I use a, don't laugh, paper based system. Where I write down on a paper the different sections and tick off which ones I've sent off, yet to do and received. This way I see it every morning when I come into work and have a good feeling when I cross each section I've done.

How much influence do you have in changing the design of the student handbook?

I would probably say a strong influence, not sure how you would measure that. If I felt there was a problem with the design, layout, content. I'd firstly email back the section I wanted to make amendments and make recommendations. If I strongly wanted to change the content and the head of the section didn't agree. umm, I would consult with my manager and decide from there where to go. hmm now that I think about it I don't really have that much control, do I.

How does the pressure of time-constraint affect your development of the student handbook?

It is very strong time constraint on my behalf. With students starting back every year in September. My deadline is fixed, though each year I tend to try and start the process earlier and earlier. Though it never seems I have enough time to adjust everything to the way I want it. I suppose it's a progression thing that can always be improved. I can't stop time.

How important is Web-based Aesthetics for the student handbook?

Umm, the look and feel of the student handbook is very important. Though content wise it is more important if I had to choose. We have many students from around the world who access the handbook and we try to do everything we can look wise to make it easy for them to navigate.

How can the web-based development process be improved?

Interesting question, umm if we had a system that the different heads of the different services could access and edit it would very time consuming. I could also foresee emails being sent to me on problems editing and uploading. So a system that did that kind of improvement I am not sure.

With changing structures, processes and resources in the organisation do you find it hard to develop the student handbook?

Yes in short. Though you get used to that style of environment within this department. If you're not able to adapt to change and work parallel, everything would drag on.

Anything else you would like to add to the factors affecting the development process?

Not really, maybe the different level of computer skills is a major factor in how quick I get the amendments back. Wait maybe, if they didn't have to supply us with new pictures, it would save on the size of emails being sent and improve the speed to which the handbook gets updated. Hmm it might improve the process, though I am sure something else will distort the time taken.

Thank you for your time ☺
Mark Ramrattan

8.3 Handbook Report

The handbook report was given to the web developer to carry out the development of the student research handbook WBIS. This report was conducted in coordination with:

Yuanyuan Yin
Research student, School of Engineering and Design, Brunel University

Kate Hone
Director, Brunel Graduate School

8.3.1 Access Executive Summary

The Research Handbook is an online resource for Postgraduate Research (PGR) students, providing information about their studies, Brunel regulations and the services available to them. It is designed to complement the main online Student Handbook. This review of the usability of the handbook was commissioned because Registry and the Graduate School had concerns that some information was difficult to find in the current version of the handbook. Improvements to the Research Handbook are needed to improve the student experience for Research Students and also to reduce the workload of Registry and service departments who deal with queries that could be answered by a better designed handbook.

Research was conducted involving a total of 62 current PGR students with the aim of analysing the problems of the current handbook and providing recommendations for its improvement. The research involved a survey, a usability study (where users were observed interacting with the site and questioned about their experience) and a card sorting study (with the aim of helping to better categorise the information on the site).

The main problems identified with the current handbook were that:

- Satisfaction with the design of the current Research Handbook is low
- It is difficult to access the online Research Handbook from the Brunel web site
- It is difficult to find information on the basis of the current headers / information categorization scheme
- Links within the pages of the handbook are not properly highlighted and are therefore hard to discern
- There is no possibility to search just within the handbook

The key recommendations for implementation in the 2009/10 update of the handbook are as follows:

- Create direct links to the Research Handbook from appropriate locations on the Brunel web site / intranet (including links to and from the University's main Research pages)
- Rename the handbook as the Research Student Handbook
- Remove old versions of the Research Handbook
- Highlight hyperlinks within the Handbook text
- Ensure that font size is legible throughout
- Improve the organisation of the current material by categorising content under the following headings:

    - Introduction / Welcome
    - Admission, registration and fees
    - Policies and Procedures
    - PhD Process and Progression
    - Thesis and Viva

- Support and Services

Longer term the following recommendations are made for the improvement of the Research Handbook:

- ❖ Provide drop-down menus from category headings to provide quicker access to key content
- ❖ Provide a search facility within the Research Handbook
- ❖ Improve look and feel of current handbook
- ❖ Provide additional content on topics such as the PhD process, thesis writing and submitting work to journals

Introduction

The Research Handbook is provided as a resource for all Postgraduate Research (PGR) students at Brunel University. It is available via the Brunel intranet at the following web address:

http://intranet.brunel.ac.uk/research_handbook/

Anecdotal evidence from both students and staff has suggested that it can be difficult to find the information that you are looking for within the online handbook. The potential result is a poor user experience for students and an increase in the workload of Registry, School support and academic staff and other support staff who handle research student enquiries. The Brunel Graduate School therefore commissioned this research to:

1. Explore current situation of the online research handbook website.
2. Discover current problems of the online research handbook website.
3. Create guidelines for improving the current online research handbook website

The focus of this work is the usability of the online handbook. With the rapid growth of information technology, web-based information services, which support the user to find information in a fast and convenient way, have gained increasing importance (Oztekin et al, 2009). With intention of improving the web-based information services, numerous studies have emphasised on an importance of *usability* to the quality of web service. *Usability* has been identified as *'the effectiveness, efficiency, and satisfaction with which specified users can achieve goals in particular environment'* (Hornbaek, 2006). It has been highlighted as one of the most critical elements for web design due to the fact that usability refers to the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use (ISO 9241-11).

The research was conducted in four phases. During the first phase an interview was conducted with the Senior Assistant Registrar (Graduate Studies) to solicit his views on the current handbook and to identify scenarios to use in later testing. During the second phase an online web survey of PGR students was conducted with the intention of exploring 1) degree of awareness of the current handbook, 2) degree of use of the current handbook, 3) level of satisfaction with the current handbook. During the third phase in-depth usability evaluations were conducted with a sample of PGR students, using typical use scenarios gathered from phase 1. Among the great deal of web usability research, usability evaluation has been wildly recognised as one of the major corner-stones of web design (Gerrnberg & Buxton, 2008). Participants were observed interacting with the current handbook and their views on the usability of the handbook were also collected. In the final phase of the research a card sorting study was conducted with a sample of PGR students with the aim of identifying the most intuitive categorisation of information within the handbook. This report now describes each phase in more detail.

8.3.2 Phase 1 – Expert Interview

Aims and Objectives

The aim of this phase was to explore the issues of the current handbook from a Brunel University perspective and to identify scenarios describing typical uses of the Research Handbook for information search.

Methodology

An interview was conducted with Dr Stephen Mullins, the Senior Assistant Registrar (Graduate Studies) at Brunel University. The interview took approximately 30 minutes and was recorded with Dr Mullins' permission. Questions covered any particular problems Dr Mullins had identified within the handbook. Dr Mullins was also asked to provide examples of the types of questions that PGR students came to him with for which the answers could be found in the handbook.

Results

Dr Mullins confirmed the view that it is not always clear where to find key content given the category titles within the handbook. A number of typical scenarios were also identified, representing the kinds of common PGR queries where the answer could be found in the student handbook. Examples include finding out how to change supervisor and finding out the requirements and formats for the final thesis. These were used in Phase 3 of the research described below.

8.3.3 Phase 2 – Survey

Aims and Objectives

The aim of this part of the study was to investigate users' experience and attitudes about the current online research handbook. The questionnaire survey concentrated on three issues: 1) degree of awareness of the current research handbook, 2) degree of use of the current research handbook, and 3) level of satisfaction with the current research handbook.

Methodology

The questionnaire survey was designed with close-ended and open-ended questions (see Appendix A). The former were designed to explore participants' backgrounds and their experience with the Research Handbook. The latter were designed to encourage participants to make suggestions for the Research Handbook design. The questionnaire survey was conducted based on a web-based questionnaire survey system (www.freeonlinesurvey.com) in 07/2009. The biggest advantage of the web-based questionnaire survey system is that the questionnaire can be easily created and distributed. In addition, all the collected data can be exported as an Excel document which can be used straightforwardly for statistical analysis. The disadvantage of the web-based questionnaire survey system is that it is difficult to reach some participants who do not use internet in the design industry. Invitation emails were sent out to all PGR students at Brunel (approximately 1000) invitation and 45 valid responses were received giving a response rate of approximately 4.5%.

Sample Results

43 PGR students submitted valid responses to the survey. The sample represented an acceptable cross section of the PGR population, with representatives from each year of study (1st, 2nd, 3rd

and over) and from 12 different Schools and Specialist Research Centres. A full demographic break down is shown in Appendix B.

Use of the current handbook

80% of respondents were aware of the existence of the Research Handbook. Of these around two thirds had used the online version, and around a third had used a paper version. The handbook had been used for a variety of purposes, including understanding policies and procedures and to get advice on issues related to PhD study. The majority of these students used the handbook around once or twice a year. Fewer than 10% used it every month.

Satisfaction with the current handbook

Around four in five students were either not satisfied with the content of the current handbook or were neutral. Satisfaction with the design of the current handbook was poor, with 35% of students not satisfied and a further 52% neutral. Full details are shown in Appendix B.
Moreover, many suggestions have been collect based on the open-ended question. These suggestions can be categorised in to 7 groups:

- Information in the research handbook should be constantly and immediately updated
- The research handbook should provide more information about thesis writing (process plan, content structure, style, font, spacing, margins)
- The research handbook should offer more information about journal submission process
- More details about PhD study process should be added in the research handbook
- There should be more information about research in Brunel which includes Brunel research ranking in the world, funding for research, etc.
- Popularity of the research handbook should be improved

- The research handbook should be more accessible by providing more links to the research handbook

8.3.4 Phase 3 – Usability Study

Aims and Objectives

A usability study was conducted with the aim of uncovering very specific areas in the current Research Handbook that should be improved.

Methodology

There were three stages in the usability study: introduction, user observation, and interviews. Firstly, the introduction part explained the background and content of this research. During this stage participants were provided with an information sheet and consent form[1]. Secondly, participants were asked to find the Research Handbook from the Brunel Homepage and then do some tasks by using the current online Research Handbook. The tasks were designed based on recommendations from the interview with Dr. Mullins. A total of 17 scenarios were designed with 5 tasks being chosen at random for each participant to complete (see table 1 for scenarios). In the end, a short interview was conducted to investigate participants' experiences and opinions about the Research Handbook. Participants were recruited via an email advertisement sent out to all PGR students. The testing was conducted in a computer laboratory within the Graduate School and took around 1 hour to complete. Participants were each given a nominal sum to cover expenses.

[1] The relevant ethical approval was obtained for the research described in this report.

Sample Results

Nine (7 male, 2 female) PGR students took part. The sample included both full and part time students and Home/EU and overseas. All years of study were represented, from four different Schools/Research Groups. A full demographic breakdown is shown in Appendix C.

Observation results

In the usability study, participants' behaviours about how they conduct the test by using the online research handbook were observed. More specifically, their exploration routes and time spent for each task were recorded. These two parameters have been selected to explain usability of the online research handbook due to the fact that the former represents whether the research handbook structure can support the user to find information effectively, and the latter shows whether the information can be found efficiently in the current handbook structure. Observation results are summarised in Table 1.

Table 1 Observation results summary

No.	Tasks	P1		P2		P3		P4		P5		P6		P7		P8		P9	
		R	T	R	T	R	T	R	T	R	T	R	T	R	T	R	T	R	T
1	Access to Brunel Research Handbook from Brunel Homepage.	1	1	2	4	1	2	2	7	1	7	2	4	2	5	2	6	2	5
2	Find information about how to change supervisors			2	7					2	8								
3	Find information about the role of your second supervisor	1	2			1	1							2	6	2	3	2	2
4	Find information about fees for your research study							1	2			1	2						
5	Find information about how to extend your research study							2	6					3	5				
6	Find information about requirement of your thesis	1	2															1	3
7	Find information about format of your thesis					2	5	4	7	2	5	2	4	1	2	1	2		
8	Find information about your viva			2	2					1	3	1	3	1	1	1	2		
9	Find information about copyright about your research					1	2					1	2						
10	Find information about the Criminal Record Bureau Information			1	1					1	1					2	4		
11	Find information about Equal Opportunities							1	1										
12	Find information about Research Conference Prize	1	2															1	1
13	Find information about purpose of Brunel Graduate School					1	2					1	1	1	1				
14	Find information about Student Representatives	2	4															1	1
15	Find information about Graduation	1	1															1	1
16	Find information about who is head of Alumni Relations							1	1	3	5								
17	Down load a PDF version Research Ethics Review Checklist			1	1	2	4					2	2	3	5	2	1	3	4
18	Find information about research process annul monitoring			2	3			1	1	1	2					1	1		

P=Participant, R=Route steps (1= 1-5 steps, 2=6-10 steps, 3=11-15 steps, 4=16-20 steps, 5= more than 20 steps), T=Time (1= 1”- 30”, 2= 31”-1’, 3=1’1”- 1’30”, 4=1’31”- 2’, 5=2’1”-2’30”, 6=2’31”-3’, 7=3’-5’, 8= more than 5’).

According to the results, it is found that:

1) Tasks which are directly linked with titles or sub-titles are easy to complete. For instance, all participants made fewer than 5 clicks to find out information about purpose of Brunel Graduate School and completed this task in less than 60 seconds. It is clear that it is easy for the participants to complete this task as it is directly linked with the category heading in the research handbook.

2) Tasks which related with detailed information in the online research handbook are difficult to complete. For example, both participants assigned the task of finding out how to extend your research study spent more than 2 minutes on this task as this information is hidden in main text. Similarly it took more than 3 minutes to explore how to change supervisors. There are three reasons to explain difficulties of these tasks: 1) these tasks required detailed information in the main context which was not highlighted; 2) the information was not well linked with category titles and sub-titles; 3) there was too much text in main context and the font size was not big enough for some users.

3) Tasks which related with extra links are the most different to be accomplished. For example it is difficult for students to enter the online research handbook from the Brunel homepage. Seven out of the nine participants spent more than 1’30” to access to the online Research Handbook. Among these, two participants spent more than 5 minutes for this task. In addition, seven participants had more than 6 clicks to find out the research handbook entrance. Another example is that the participants found it difficult to explore format of PhD thesis. Four out of six participants spent more than 1’30” to achieve this task. The main difficulty for these tasks was that sub-level links in the main context were

not highlighted. Therefore, it was easy for users to miss those links. Consequently, users spent more time than expected to complete these tasks.

Interviews results

Based on the interview, several usability problems have been explored. These problems can be divided into five parts: access, structure, information, interaction, and design.

- Access

Eight (of 9) of participants thought that it is difficult to access into the online research handbook from the Brunel website. For example, some students mentioned that '*how to access to the online research handbook is difficult, it should be clear'* and others highlighted that '*it is difficult to access the research handbook. I went to the research section from Brunel Home page, but it was not there.'* This result echoes the results from user testing observation.

Six (of 9) of participants suggested that the online research handbook should be accessible from most of places in Brunel website, such as Brunel homepage, u-link, e-vision, and intranet homepage. For instance, some students mentioned that '*There should be more clear links about research handbook*', '*Research handbook should have a link in u-link, e-vision, Brunel home page, and intranet homepage*.', and '*Normally, people will check in Research Section to find the research handbook*'. Based on researcher's observation, most of the participants tried to explore a route to the research handbook in research section and postgraduate student section in Brunel homepage, and intranet when they were doing the access task.

Four (out of 9) participants believed that popularity of the current online research handbook needs to be improved. For example some participants said that '*I have not heard about research handbook before*'. In addition, other students mentioned that '*I don't think most of the research students know there is a research handbook here*'. Furthermore, one student recommended that '*the research handbook should be presented to all the research students when they coming'*.

Three (of 9) participants emphasised on that only the latest version research handbook should be able to be found in Brunel website. For instance, some students said that '*It should be only one research handbook there, and it should be updated it, and easy to navigate to. And when you search it, it will always go to the right one*.' This result probably because when some students using 'search' function to find research handbook from Brunel homepage, it always led them to the 2007 handbook. It was very difficult for them to access into research handbook by using the search tool.

Two (of 9) participants indicated that the current research handbook links are easily to be missed. For example, some students mentioned that '*When I was in the student handbook page, the research handbook is in the top of the page, but it is very easy to be missed*.'(Fig. 18), and '*the student handbook link can be found from Brunel homepage or intranet, but it is difficult to find research handbook*' (Fig. 19). Only a few students have awareness of that the research handbook link is in Graduate School page.

Fig. 1 Student handbook page

Fig. 2 Brunel intranet home

- Structure

Eight (of 9) participants thought how to find the right classification for information is difficult. Such as some students highlighted that '*although the current information is covered everything which research students need, but it is difficult to know where to go to find information*' and '*the information structure is not clear, I would like to see something straightforward, such as your thesis, your PhD process'*.

Seven (of 9) participants believed that the information structure of the research handbook is not clear. Some students said that '*The title is not clear. I don't know what success, view, and moving on mean for their content.* ' In addition, other participants mentioned that '*it takes a couple of*

minutes to understand each title, until I see the second level titles. Taking 'success' as an example, I thought that should be linked with graduation. If I am in the first year, I would not look at in success to find my information'.

Five (of 9) participants indicated that the title 'Success' and 'Views' should be changed to some other words. 33.33% thought that the title 'links' is not clear enough. 33.33% considered that the title 'moving on' should be clear. For instance, some students suggested that '*some of the titles are not clear, such as success, views, and links. The views can be changed to views and supports. And success can be changed to progress, it will be better*' and '*some titles for each part should be renamed, such as success should be changed to PhD process'.*

In addition, some participants suggested that '*it will be clearer if it organized as first year, second year, third year, and final year*', '*the research handbook can be divided into life part and research part*', '*the sub-level title will be better if it presented like questions and answers format*', and '*some sub-level groups should be independent as they are very important, such as ethics issues.*' Based on the participants' comments, the main reason for structure problems in the research handbook is that information classification and clusters' names of the current research handbook are indistinct.

- Information

Six (of 9) participants believed that all information in the current research handbook is relevant. Five of the participants highlighted that the research handbook is very important for research students. For instance, some students emphasised that '*all the information in this research handbook in closely related with research student's life in Brunel*' and '*It is a very important book'.*

Additionally, one of the participants thought that the research handbook should include normal Brunel study information. Therefore, research students do not need to keep both student and research handbooks. For example, a student said that '*it will be better, if I only need to see one*

research handbook'. Moreover, one of the participants mentioned that language which using in the research handbook should be easy to understand for international student.

Furthermore, some suggestions have been made for adding new information into the Research Hand book:

1) Add information appendix
2) Brunel research ranking could be added
3) Complaint process
4) Detailed contacts to support if the student have some problems, they know who they should contact
5) Discussion board should be added to support communication cross different schools and departments
6) How to change supervisor in the first year?
7) How to get information from other libraries?
8) How to write a thesis
9) Information about different schools, research centres, and research projects
10) Information for international students
11) PhD process
12) PhD upgrades process information
13) Previous students experience into research handbook can help the new students
14) What you should expect from your supervisor

- Interaction

Eight (of 9) participants emphasised that links in the research handbook should be clear and highlighted. For example, some students indicated that '*the links are not highlighted as it looks like the same as the normal text*' and '*the links are difficult to find out, as it just likes the normal text, and did not highlighted*' (Fig.3 & Fig. 4).

Fig. 3 Un-highlighted link

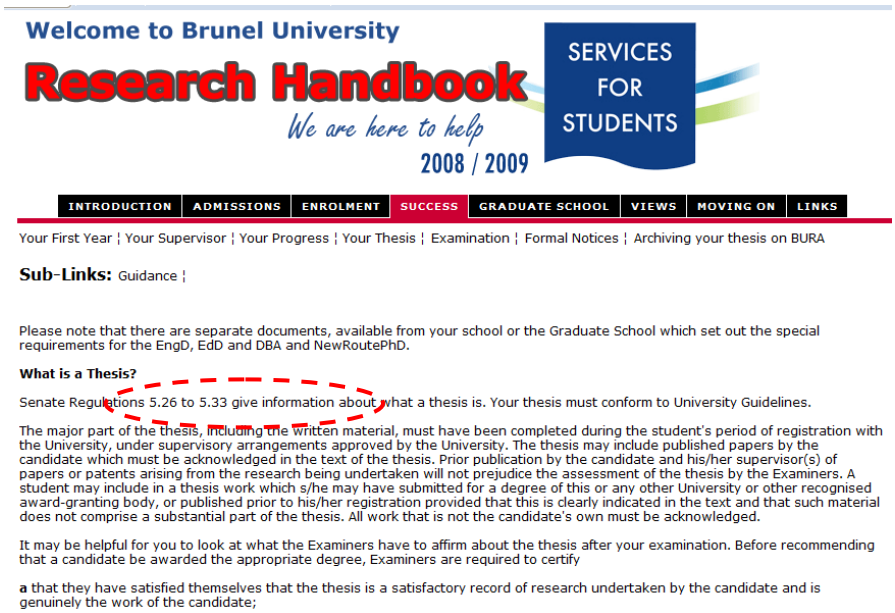

Fig. 4 Hidden link

Seven (of 9) participants indicated that a search engine which only focuses on the research handbook is needed. For example, some participants said that '*A search engine only for research handbook will be helpful'* and '*A search engine is needed to support to find information quickly*'. The current search function in Brunel website could be support users to find the right research handbook efficiently. The search engine in Brunel homepage always takes users to a research handbook 2007/2008 (figure 5). The latest research handbook was not in the search results. If using the search tool bar in the research handbook to find information (Fig.6), it will show you an error page (Fig.7).

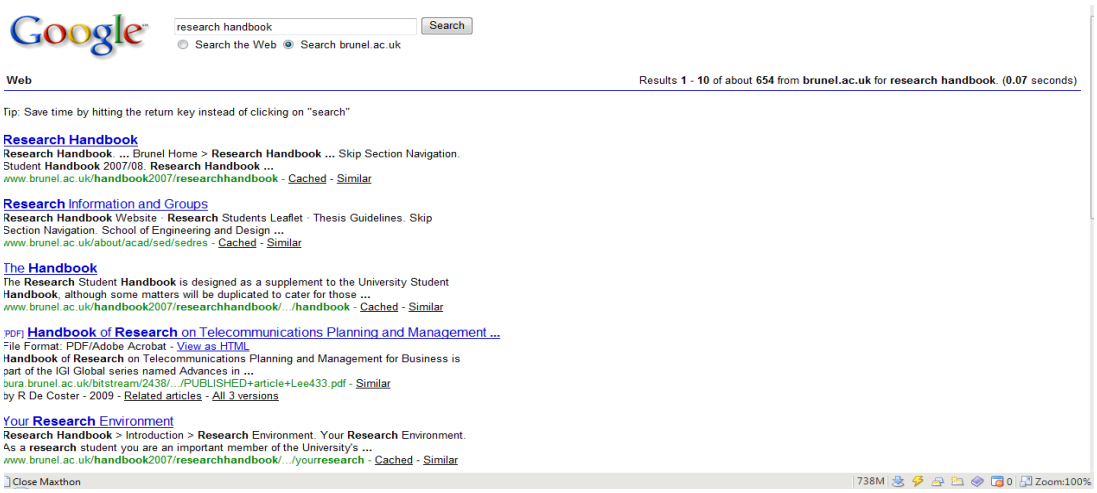

Fig.5 Search results by using a search engine in Brunel Homepage

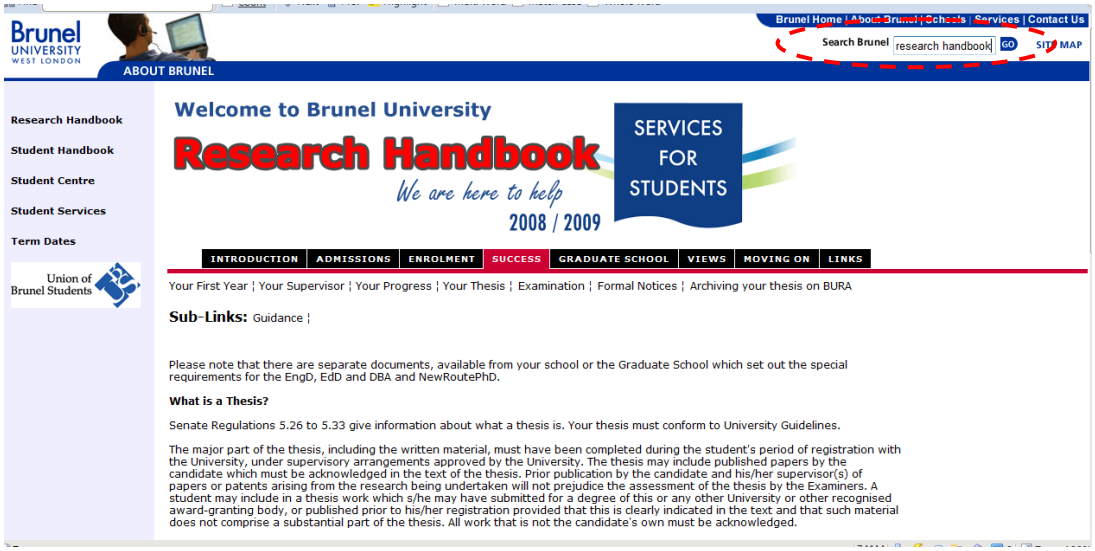

Fig.6 Search tool bar in the research handbook

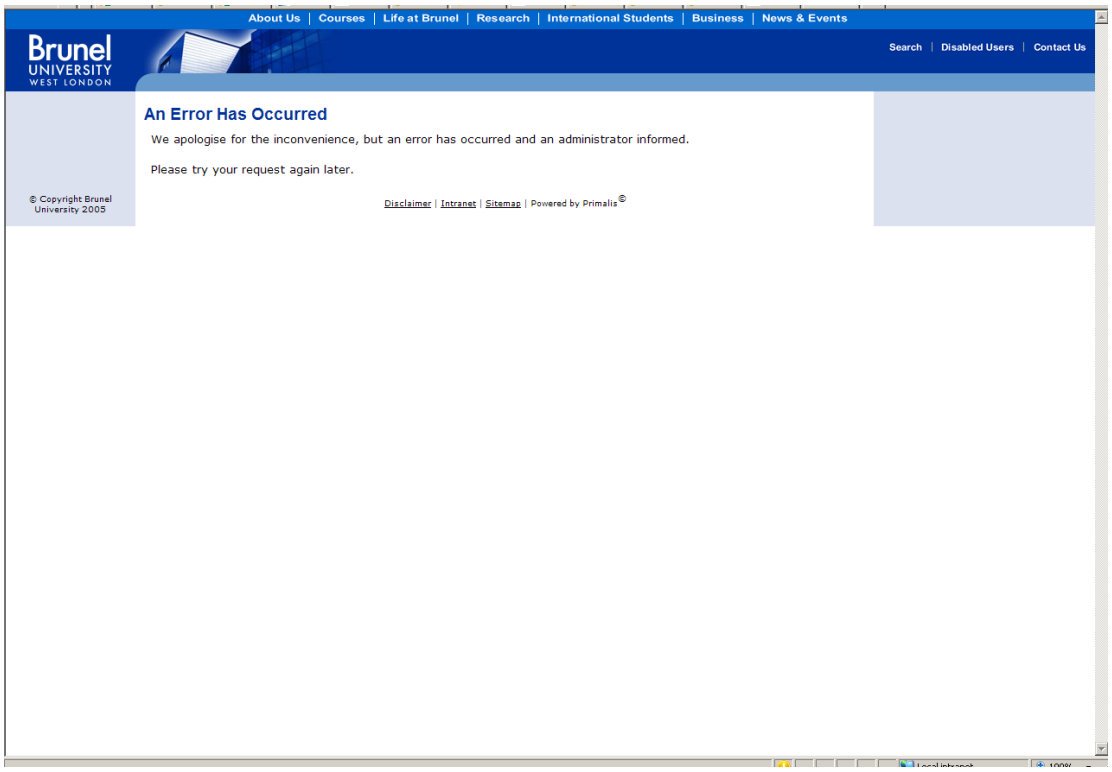

Fig. 7 Result of the search is an error page

Four of the participants thought that the sub-level information under each title should be visible without clicking it. Some students mentioned that '*Provide information of the content of each part under the main title will helps to better understand what information is under this part, and student will know if the information which you need is here or not.*'. In addition, others said that '*it will be better to have a function will allow users to browse information under each title without click it*'.

Three (of 9) participants mentioned that some of the links in the research handbook are error links. Two of the participants indicated that they felt confused about their current position in the research handbook when they using it. For example, Fig. 8 shows a web page about 'Your supervisor' under 'Success', however, there is no sign to remind users about the current location under the 'Success' section.

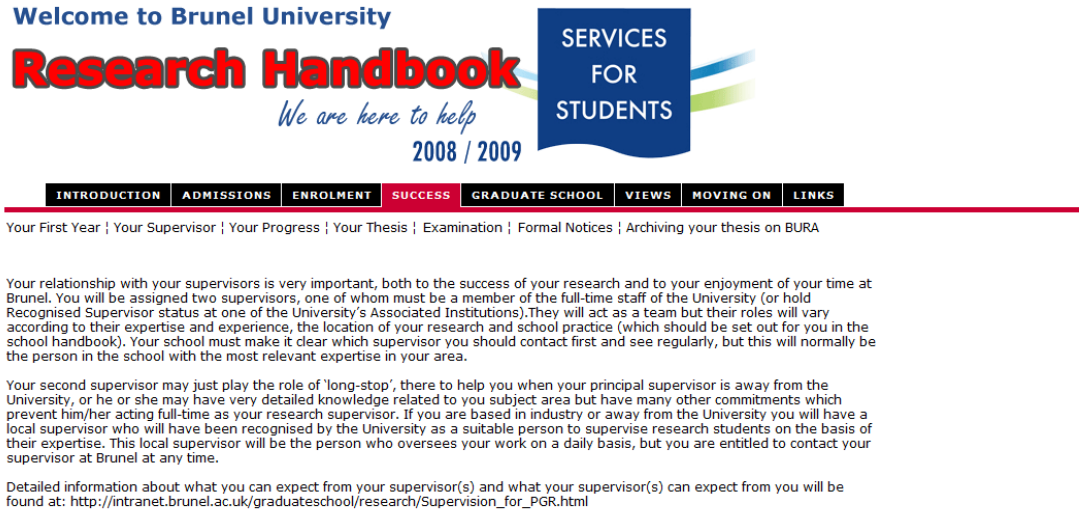

Fig. 8 Information about 'Your supervisor' under 'Success'

- Interface design

Six (of 9) participants indicated that interface of the research handbook is OK. Three of the participants thought that the current research handbook interface design is boring, and it could be much better. Two of the participants mentioned that images are very good.

In addition, some other recommendations have been made for improving interface design of the current research handbook:

1) Some text in the research handbook might should be bigger
2) The design should follow Brunel style
3) Making it full screen
4) The sub-level titles are repeated in the same page with both horizontal and vertical presentation (Fig. 9). And the 'Archiving your thesis on BURA' is displayed the horizontal list, but not appear in the vertical list.

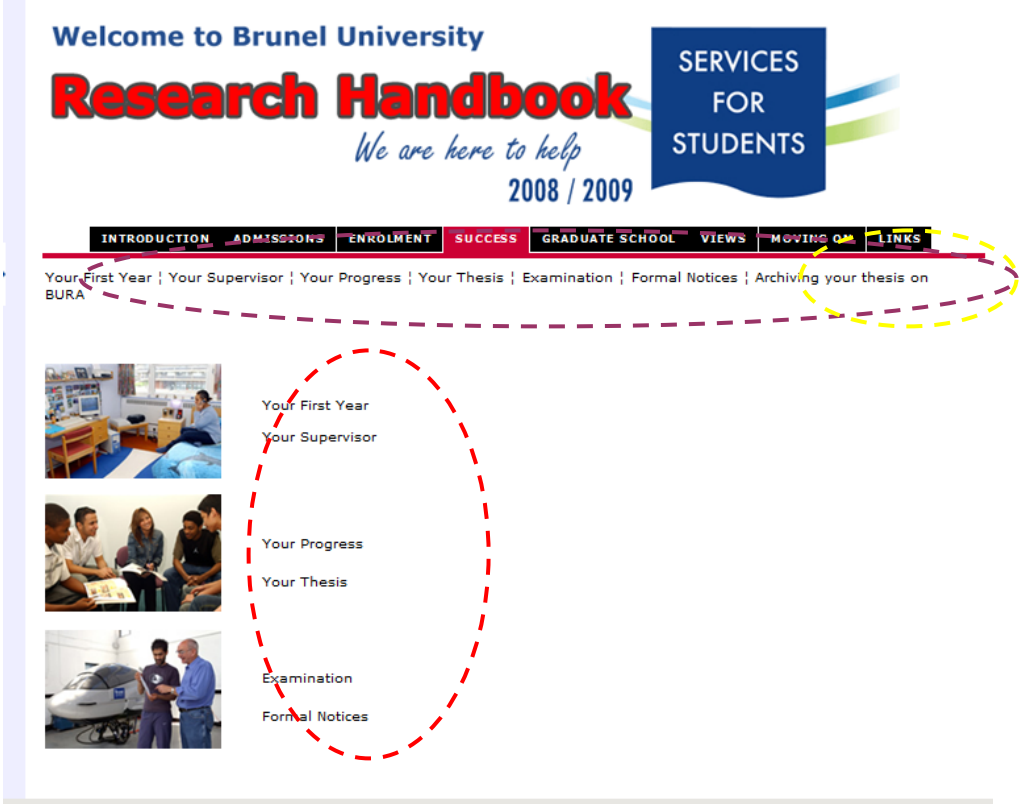

Fig. 9 Repetitive information

8.3.5 Phase 4 – Card Sorting Study

Aims and Objectives

A card sorting study was conducted to help produce a new classification of the information in the online Research Handbook in order to inform the redesign of the current menu system to make it more usable.

Methodology

Card sorting is now widely used in the design and evaluation of web sites. Nielson (1993) proposes it as a means of discovering the mapping between the user's conceptual model of a domain and the information that is displayed on the interface. It is often used to select meaningful categorizations of menu items or hyperlinks (see Lisle et al, 1998, and Rau and Liang, 2003, for two cases where web content was organized on the basis of a card sorting exercise). Card sorting can be used with words or images and can involve single participants or groups. In this study a set of 60 cards was created with each representing the key content on each page of the Research Handbook (see Table 2 for the full list). The card content was based on the actual content of current text, rather than any current link titles. Three content cards were added based on suggestions for extra content that was needed in the Handbook. A brief pilot study was conducted to ensure that sorting this number of cards was manageable within an hour time slot. In the study participants were given the complete set of cards (in random order) and were asked to sort them into 10 or fewer categories which were meaningful to them. They were then asked to name each category within their completed sort. Participants were recruited via an advertisement email sent to all PGR students and were given a nominal sum to cover expenses. Ethical issues were addressed as in Phase 3. The sorting data was entered into a web-based card sorting analysis tool (www.websort.net) which performs cluster analysis on the data to identify categories.

Sample Results

Eight PGR students (5 male, 3 female) participated in the card sorting study. The sample included both full and part time students and Home/EU and overseas. All years of study were represented, from seven different Schools/Research Groups. A full demographic breakdown is shown in Appendix D.

Cluster analysis results

Six main categories of information were identified as a result of the card sorting exercise and titles were suggested for these based on examination of both the items and the titles assigned by participants. Table 2 shows the information within each category (and for reference where this information appears within the current menu structure).

Table 2 Cluster analysis results (items in alphabetical order)

Group1: Introduction	
Information	**Current location in the Research Handbook**
Brunel Graduate School	Introduction/ your research environment
Current research projects in Brunel	N/A
Introduction of the Brunel Research Handbook	Introduction / the handbook
Ranking of Brunel Research in the world	N/A
University documents which are attached in this research handbook	Admission/ admission process

Vice-Chancellor Professor Chris Jenks's welcome speech	Introduction/welcome page

Group 2: Admission & registration	
Information	**Current location in the Research Handbook**
Admission policy	Admissions/admissions policy
Fees	Enrolment / Postgraduate Fees
Process of admission	Admission/ admission process
Registration policy	Enrolment/ enrolment
Required documents for admission	Admission/ admission process

Group 3: Policies & procedures	
Information	**Current location in the Research Handbook**
Appeals	Success / Thesis / Guidance
Complaints Procedure	Views / Complaints Procedure
Concerns or Complaints	Views / Making your views known
Copyright of your research	Success / Formal Notices / Copyright
Disclosure Intellectual property of your research	Success / Formal Notices / Intellectual Property
Equal opportunities policy	Introduction/ Equal opportunities
Ethics Committee	Links / Ethics Committee
Graduation	Moving on / Graduation
Information about how you	Success/ Your First Year

intend to use your research when it is successfully completed	
Intellectual property ownership	Success / Formal Notices / Intellectual Property
Senate regulations and council ordinances	Links / Senate Regulations and council ordinances
The Criminal Record Bureau (CRB) information and procedures	Admissions / Criminal Records Bureau
Your personal data	Success / Formal Notices / Data Protection

NB: shaded items in this category could be considered as an additional category of their own given the sorting results.

Group 4: PhD process	
Information	**Current location in the Research Handbook**
Annual monitoring report	Success/ Your Progress
Effective study support	Introduction/ your research environment
Extension to maximum regulation period	Enrolment/ enrolment
How to change supervisor	N/A
Inaugural and Professorial Lectures	Introduction/handbook
Information about what you should do in the end of your first year of PhD study	Success/ Your First Year

Periods of Abeyance or Authorised Suspension of Studies	Enrolment/ enrolment
Programme in your first year	Success/ Your First Year
Responsibilities of your second supervisor	Success / Your supervisor
Study beyond the normal period	Enrolment/ enrolment
Supports from your School	Introduction/ your research environment
University sources and services to research students	Introduction/ your research environment
Vice Chancellor's Prizes	Graduate School / Vice Chancellor's Prizes
Working outside of the University during your research study	Success/ Your First Year
Your PhD study in the first few months	Success/ Your First Year
Your relationship with your supervisors	Success / Your supervisor

Group 5: Thesis & Viva	
Information	**Current location in the Research Handbook**
Archiving your thesis on BURA	Success / Archiving your thesis on BURA
Binding the final version of your thesis	Success / Thesis / Guidance
Content of your PhD thesis	Success/ Thesis

Format of your thesis	Success / Thesis / Guidance
Requirements of your degree	Introduction/ your research environment
Submission of your thesis	Success / Thesis / Guidance
Submit your thesis to University Library	Success / Thesis / Guidance
The Viva Voce	Success / Thesis / Guidance
Viva examination	Success / Examination
Your external examiners	Success / Examination

Group 6: Support & services	
Information	**Current location in the Research Handbook**
Advice and Representation Centre	Views / Advice / Advice & representation centre
Alumni	Moving on / Alumni
Brunel International	Views/ Support / Brunel International
Brunel University community	Introduction/ Equal opportunities
Counselling Service	Views / Support / Counselling
Disability and Dyslexia Service	Views / Support / Disability and Dyslexia
If you wish to continue your career in the academic world	Success/ Your First Year
Medical Support	Views / Support / Medical Support
Representation and Feedback	Views / Making your views known
Supports from the Placement and Careers Centre	Success/ Your First Year

This categorisation gives some indication of how typical users group the information in the handbook. However, there are some limitations to the findings. Firstly the information provided on the cards was necessarily brief and the full sense of the related text may not have been appreciated by participants. Furthermore, the suggested categorisation does not take into account how information should be ordered or displayed within each category and any sub-categories that could usefully be defined.

8.3.6 Discussion and Recommendations

It is clear from the feedback provided by the research students across this study that there is considerable scope to improve the current online Research Handbook. From the studies conducted, 12 recommendations have been formulated which can be used as guidelines to improve the current online Research Handbook. The recommendations include four parts: access, structure & information, interaction, and design.

- Create direct research handbook links in Brunel homepage, Brunel intranet home, U-link, e-vision, library home, research page, postgraduate page, and BURA home
- Remove the old version research handbooks
- Increase popularity of the research handbook by promotions via Graduate School, Student union, international office, etc.

Structure & information

- Classification structure of the current research handbook should be improved
- Titles for information categories should be updated as so to better link the title and content

- Links to more information should be provided, such as PhD study process, thesis writing process, and research support and service

Interaction

- Sub-links in the research handbook should be highlighted
- Links in the research handbook should be updated
- A search engine, which only focuses on the research handbook, can significantly support users to find the right information effectively
- A drop-down menu for each category, which allows users to browse information under each category without click it, can help users to find the right classification for their targeted information effectively

Design

- The web design for the research handbook should be improved
- Size of content font in the online handbook should be bigger

A key issue is, of course, exactly how the information is categorized within the redesigned handbook. The results of the card sorting give some suggestions for this, but with the limitations as discussed above. In addition any redesign needs to consider the context of the handbook in relation to other material on the web and in particular any planned changes for the related 'Student Handbook'. A possible outline design is included in Appendix E as a starting point.

8.3.7 References

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8.3.8 Appendix A: About the authors of Student Research Handbook

Yuanyuan Yin has recently completed her PhD at Brunel University. Her research has been concentrated on increasing effectiveness of product design development through improving design process, understanding design participants and users, supporting design collaboration, and integrating design and market trend. Yuanyuan also has a Masters degree from Brunel

University, and bachelor's degree from Xi'an University of Technology, China. Her education background covers product design, collaborative design, user research, and design management. She was responsible for conducting all the user research described in this report.

Kate Hone is Director of the Graduate School at Brunel University and a Reader in the School of Information Systems, Computing and Mathematics at Brunel. She has a background in human-computer interaction. She commissioned and directed the research described in this report and contributed to final write-up and suggested design.

8.3.9 Survey Questions

1) What year of your research programme are you in?

   □ 1st year
   □ 2nd year
   □ 3rd year
   □ 4th year
   □ Others_____

2) Which school are you based in?

_____

3) Did you know there is a Brunel Research Handbook to help research student in Brunel University?

   □ Yes
   □ No

4) By which channels did you hear about the Brunel Research Handbook? (Multiple Answers)

   □ Brunel Website
   □ Flyer
   □ Graduate school staff
   □ School's Research office staff
   □ Supervisor
   □ Research student course organized by graduate school
   □ Others_____

5) When did you first hear about the Brunel Research Handbook?

- □ 1st year
- □ 2nd year
- □ 3rd year
- □ 4th year
- □ Others_____

6) Have you used the Brunel Research Handbook before?

- □ Yes
- □ No

7) What it was used for?

_____

8) By which channel you have used the Brunel Research Handbook?

- □ Paper-based Brunel Research Handbook
- □ Web-based Brunel Research Handbook

9) How often did you use the Brunel Research Handbook?

- □ Once every week,
- □ Once every month
- □ Once every six month
- □ Once a year
- □ Others_____

10) I am satisfied with the content of the current Brunel Research Handbook.

- □ Strongly disagree
- □ Disagree
- □ Neutral
- □ Agree
- □ Strongly agree

11) I am happy with the design of current Brunel Research Handbook

- □ Strongly disagree
- □ Disagree
- □ Neutral
- □ Agree
- □ Strongly agree

12) Can you give any suggestions to improve the current Brunel Research Handbook?

_____

13) Would you like to participate in another research phase submit your email address

_____

Many Thanks for your support!

8.3.10 Appendix B: Sample demographics and results for survey

In the Research Handbook Experience Survey, 51.11% (N=45) of participants were 1st year research students, 20.00% (N=45) were 2nd year research students, 15.56% (N=45) were 3rd year research students, 11.11% (N=45) were 4th year research students, and 2.11% (N=45) were 5th year research students (Fig. 1). In addition, these 43 participants cross 12 different schools and research centres in Brunel University (Fig. 2).

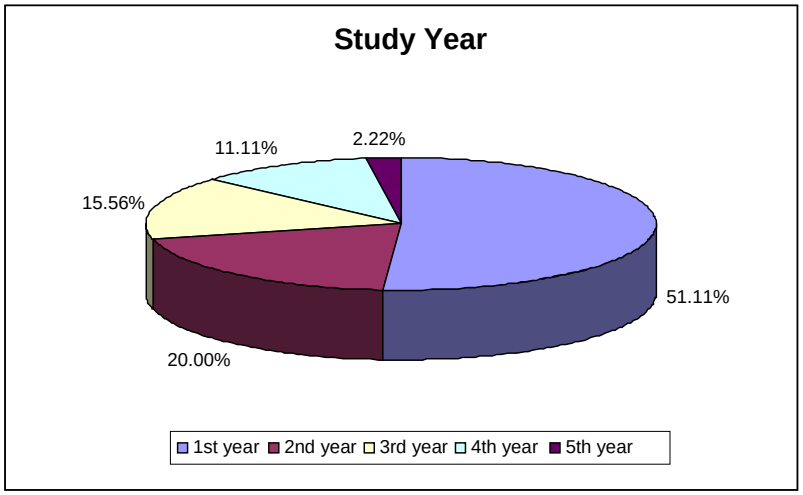


Fig. B1 Survey participants' research study year

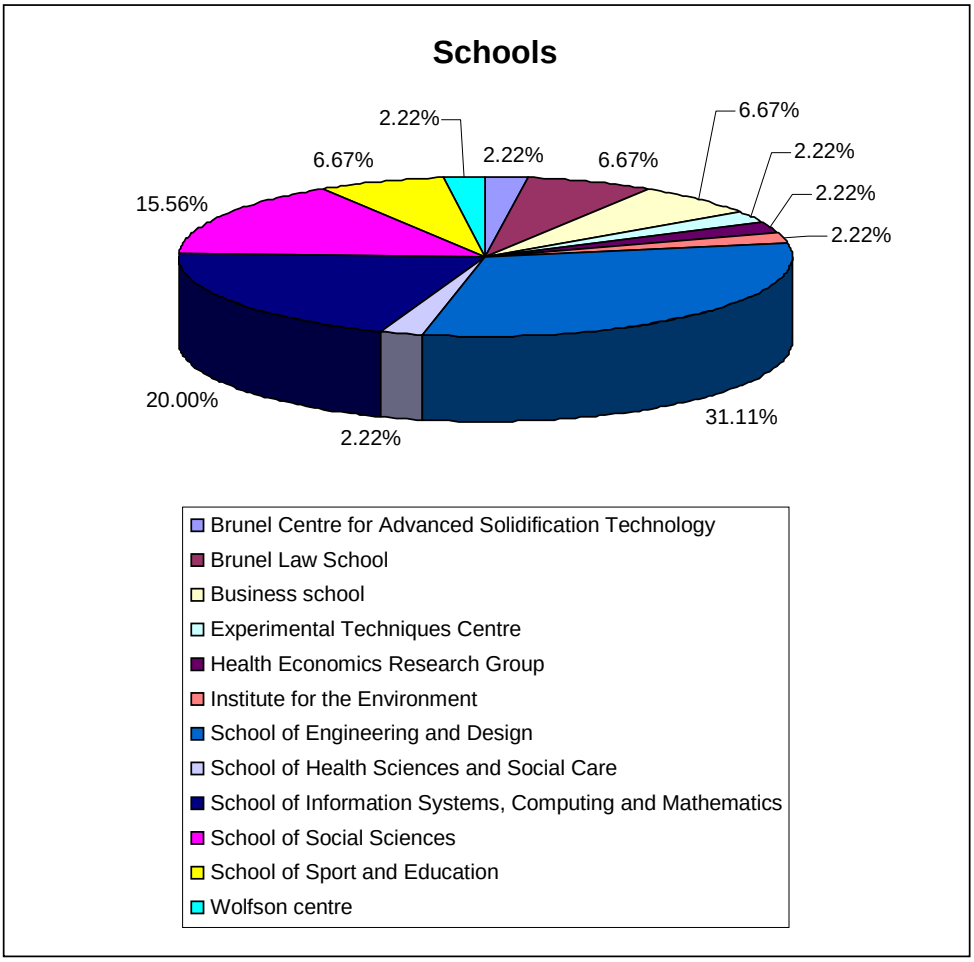


Fig. B2 Survey participants' schools

8.3.11 Research Handbook Experience Survey results

The survey was conducted to investigate current statue of the research handbook in Brunel research student's life. It concentrated on three factors: awareness, experience, and suggestions.

According to the survey results, 80% (N=45) of that participants knew existence of the research handbook. Among these students, 31.25% of the participants heard about the handbook via Brunel website, 20% via their school's research office staff, 10% via research student course organised by Graduate school (Fig.B3).

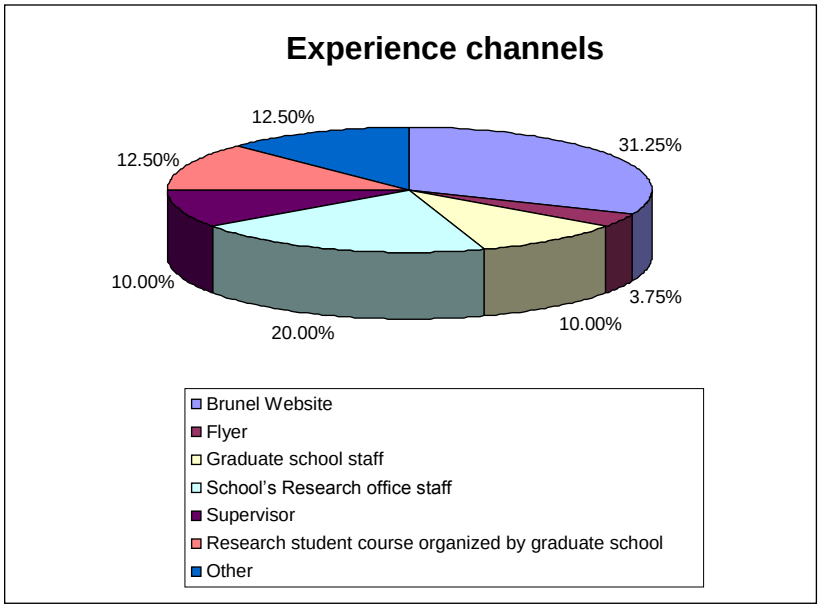


Fig.B3 Channels of the research handbook experience

63.15% (N=45) of the participants indicated that they have used the web-based research handbook (Fig.B4).

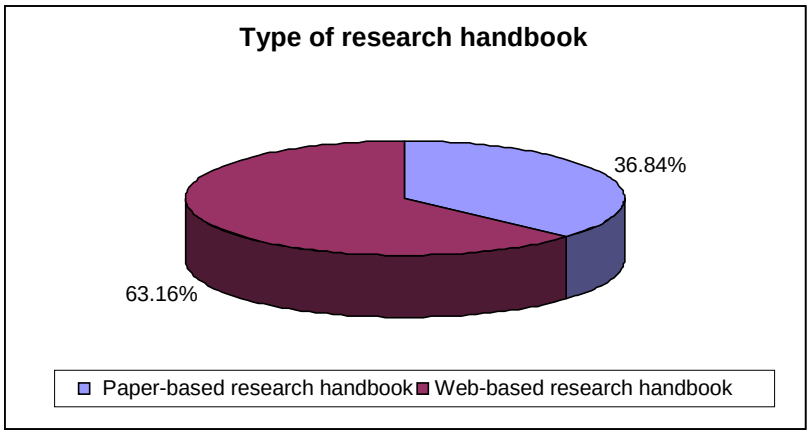


Fig. B4 Student's research handbook experience – type of research handbook

Among the 80% (N=45) of the participants who have used the research handbook before, 10 issues have been highlighted as their initial purposes of using the research handbook:

- To understand annual progress reviews
- To understand enrolment policies
- To find out how to extend of thesis
- To find out guidelines in conducting research
- To understand how to prepare and submit thesis
- To understand process of PhD study process
- To explore relationship between the student and the supervisor
- To discover research in Brunel
- To understand rules and regulation
- To explore information about suspension

Additionally, 33.33% (N=45) mentioned frequency of their usage was once every six month, and another 33.33% (N=45) mentioned their frequency was once a year (Fig.B5). Furthermore, 11.11% (N=45) of the participants satisfied with the content of current research handbook (Fig.B6), and 31.11% pleased the design of current research handbook (Fig.B7).

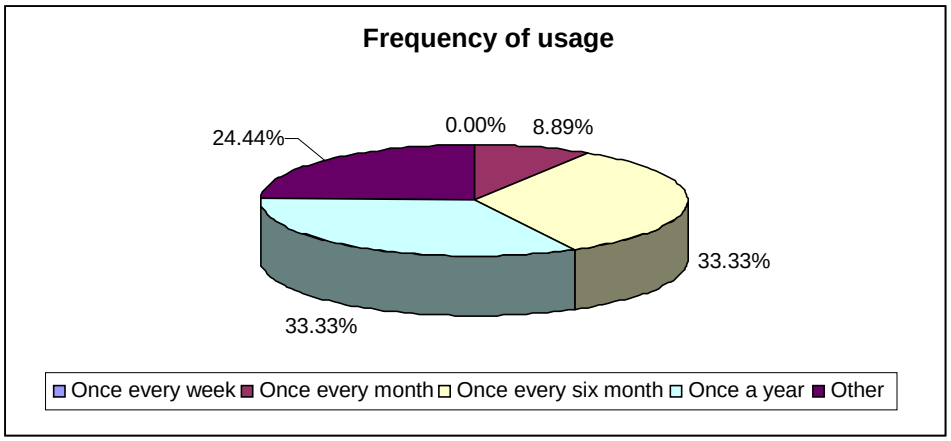


Fig. B5 Student's research handbook experience – frequency of usage

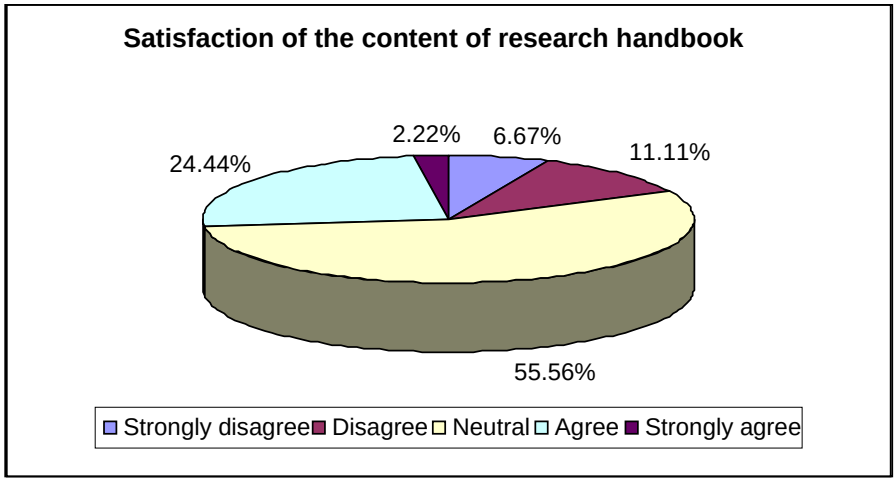


Fig.B6 Student's satisfaction of the content of research handbook

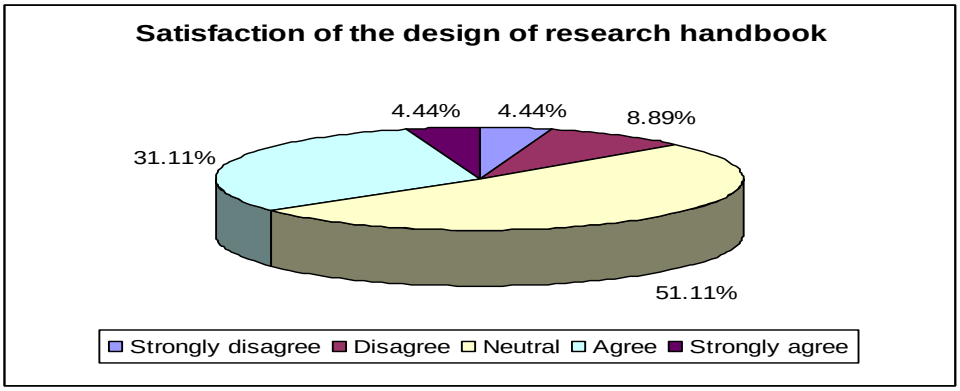


Fig.B7 Student's satisfaction of the design of research handbook

Moreover, many suggestions have been collect based on the open-ended question. These suggestions can be categorised in to 7 groups:

- Information in the research handbook should be constant and immediate updated
- The research handbook should provide more information about thesis writing (process plan, content structure, style, font, spacing, margins)
- The research handbook should offer more information about journal submission process
- More details about PhD study process should be added in the research handbook
- There should be more information about research in Brunel which includes Brunel research ranking in the world, funding for research, etc.
- Popularity of the research handbook should be improved
- The research handbook should be more accessible by providing more links for the research handbook

8.3.12 Appendix C: Sample demographics for the usability study

In the usability study, 9 PhD students joined this study. Specifically, 77.78% (N=9) of participants are male (Fig.3). 88.89% (N=9) are full time students, and 11.11% (N=9) are part-time students (Fig.4). 66.67% (N=9) of participants are international students and 33.33% (N=9) are home students (Fig.5). In addition, 22.22% (N=9) of participants are 1st year research students, 33.33% (N=9) are 2nd year research students, 11.11% (N=9) are 3rd year research students, 22.22% (N=9) are 4th year research students, and 11.11% (N=9) are 5th year students (Fig.6). Among the 9 participants, 11.11% (N=9) come from Health Economics Research Group, 44.44% (N=9) come from School of Engineering and Design, 11.11% (N=9) come from School of Information Systems, Computing and Mathematics, and 33.33% (N=9) come from School of Social Sciences (Fig.7). Furthermore, 22.22% (N=9) of the participants have completed their Viva.

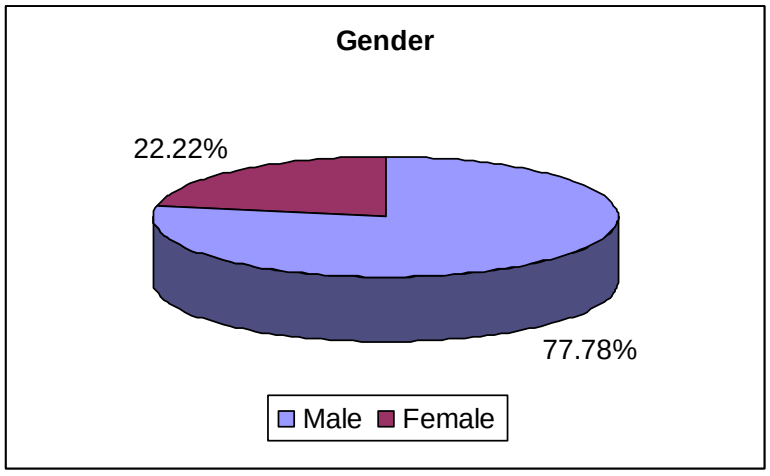


Fig. C1 User testing study participant's gender analysis

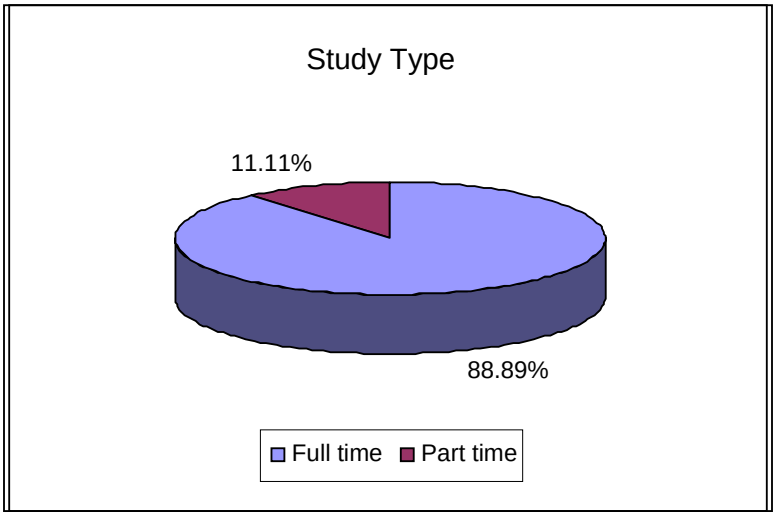


Fig.C2 User testing study participant's study types

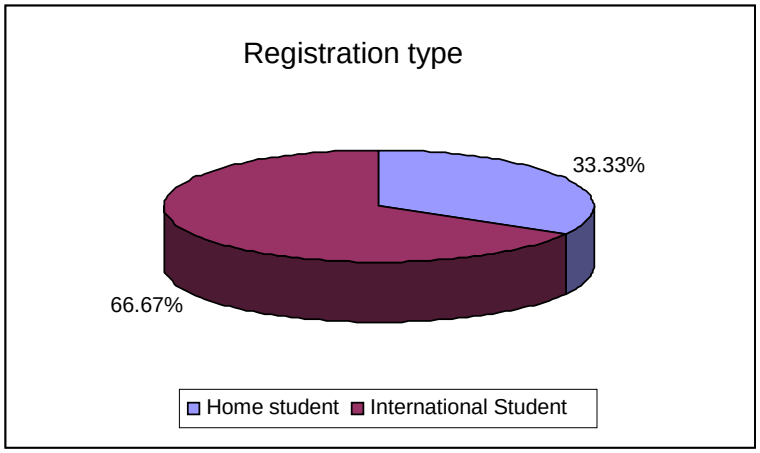


Fig.C3 User testing study participant's study registration type

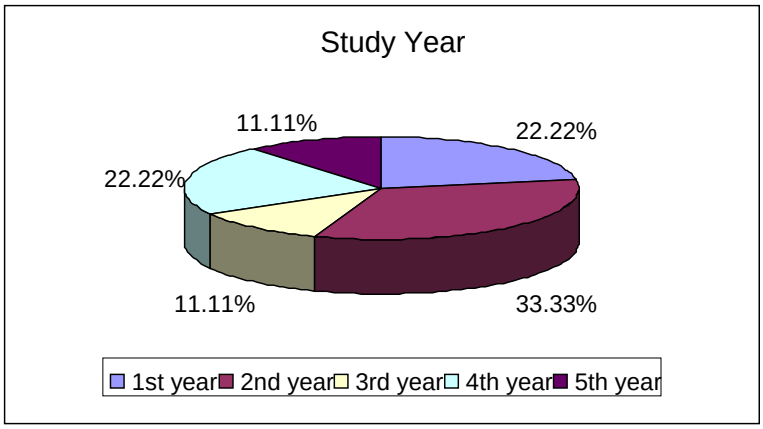


Fig.C4 User testing study participant's study year

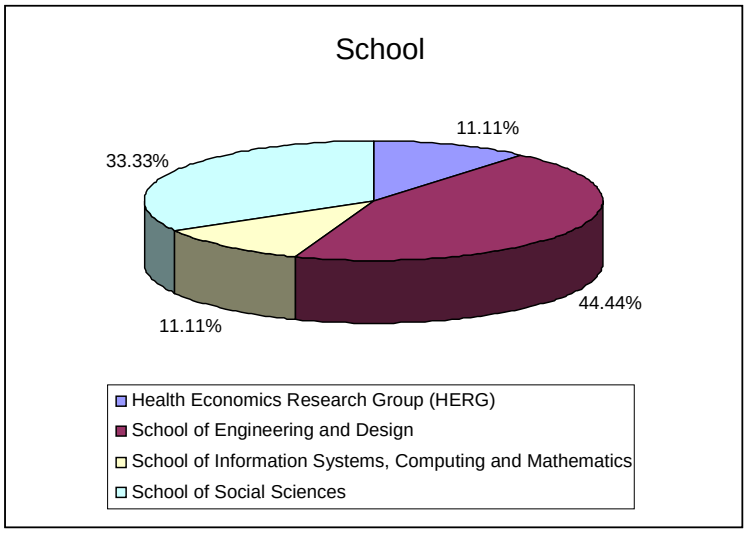


Fig.C5 User testing study participant's schools

8.3.13 Appendix D: Sample demographics for the card sorting study

In the card sorting study, 8 PhD students joined this study. Specifically, 62.5% (N=8) of participants are meal (Fig.8). 87.5% (N=8) are full time students, and 12.5% (N=8) are part-time students (Fig.9). 75% are international students and 25% are home students (Fig.10). In addition, 25% of participants are 1st year research students, 12.5% are 2nd year research students, 50% are

3rd year research students, and 12.5% are 5th year students (Fig.11). Furthermore, the 8 participants come from 7 different schools and research centres (Fig.12). Among the participants, 12.5% have completed their Viva.

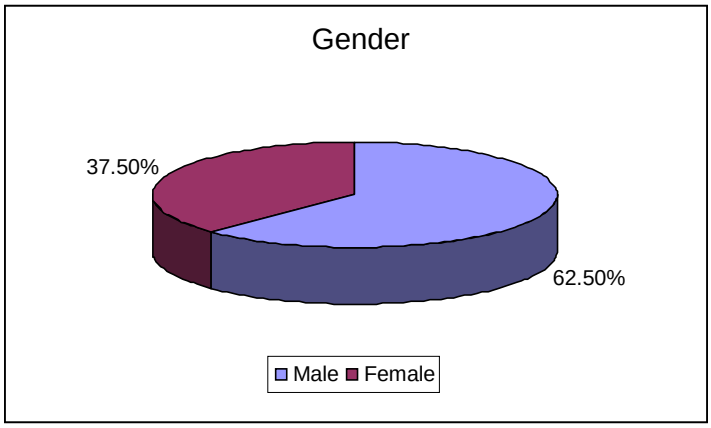


Fig. D1 Card sorting study participant's gender analysis

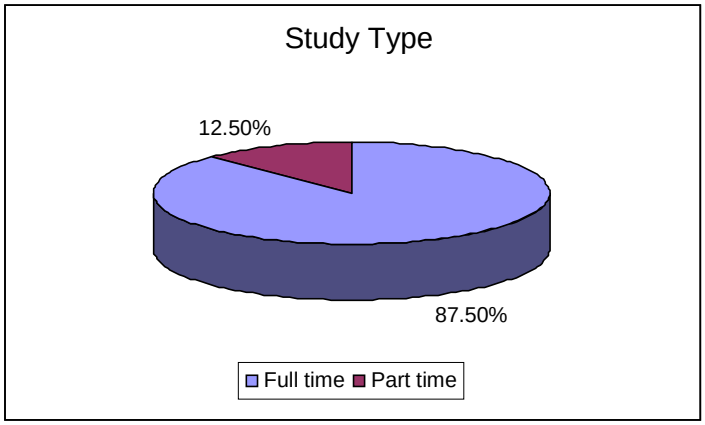


Fig. D2 Card sorting study participant's study types

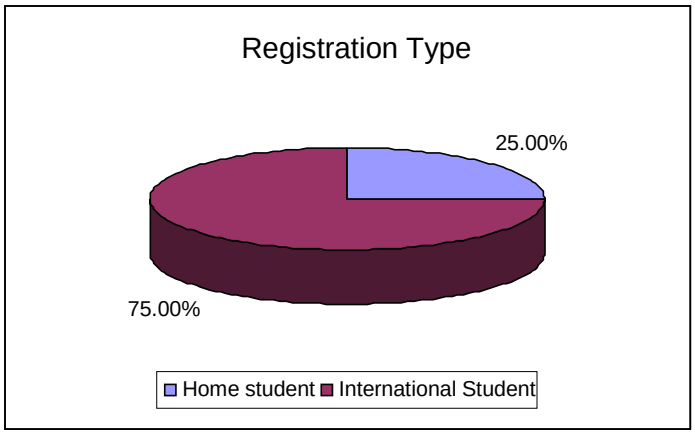


Fig. D3 Card sorting study participant's study types

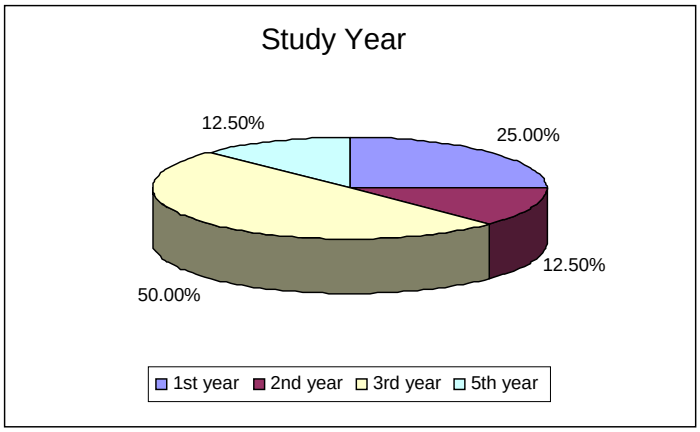


Fig. D4 Card sorting study participant's study years

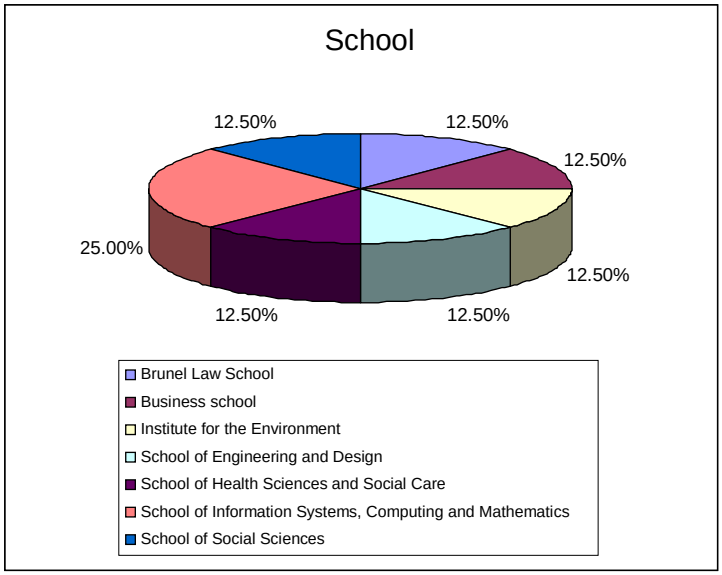


Fig. D5 Card sorting study participant's schools

8.3.14 Appendix E: Suggested Outline Design SRH

Overall structure (main page names and sub category links)

Entry / welcome page

Admission and Registration

- Admissions policy
- Admissions process
- Documents you will be provided with on admission
- Initial enrolment
- Registration periods
- Fees

Policies and Procedures

- Appeals and complaints
- Student representation and feedback mechanisms
- Academic regulations
- Research-related policy and guidance
- General policy and guidance

PhD Process and Progression

- Getting started / settling in
- Annual progression and enrolment
- Research supervision
- Research and skills training
- Extending or suspending your study
- Prizes, awards and funding
- Working while studying

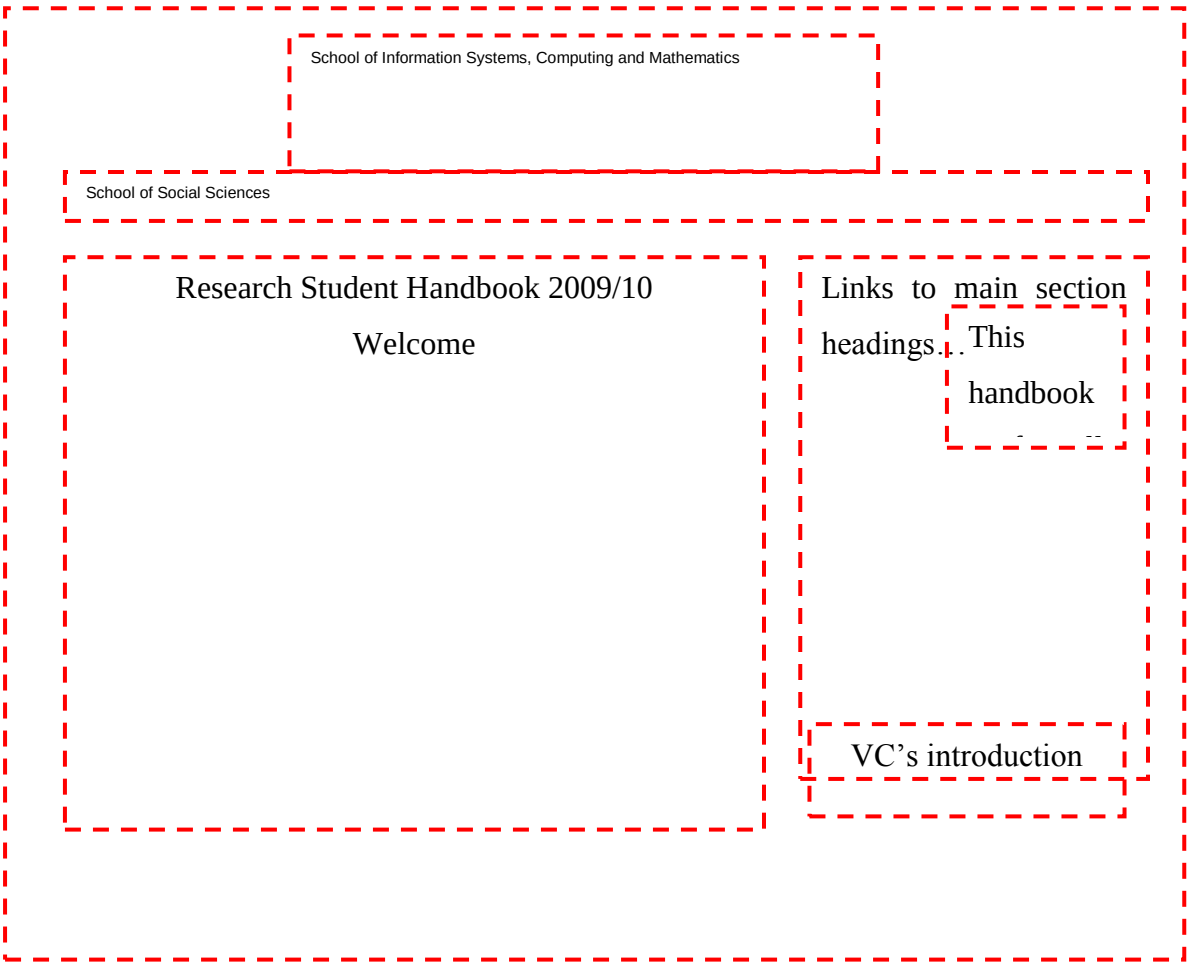
Thesis and Viva

- Requirements for your degree
- Content of your thesis
- Format and presentation of your thesis
- Submission of your thesis
- Your external examiners
- The Viva Voce
- Viva outcomes
- Binding the final version of the thesis
- Submitting your thesis to the library
- Publication and storage of your thesis
- Archiving your thesis on BURA
- Graduation

Support and Services

- Advice and representation centre
- Alumni
- Brunel International
- Counselling service
- Disability and dyslexia service
- Graduate School
- Medical support
- Student union – representation and feedback
- Placement and careers service

Entry page


School of Information Systems, Computing and Mathematics
School of Social Sciences
Research Student Handbook 2009/10
Welcome
Links to main section headings...
This handbook
VC's introduction

Admission and Registration

Link / title name	**Linked information**
Admissions policy	Link straight to pdf file – no extra level page needed
Admissions process	**Admission Process** The Head of School is responsible for ensuring that when you are made an offer of a place at the University: • you meet the requirements for admission; • appropriate supervision arrangements can be put in place and any necessary equipment or other resources for the duration of the proposed programme will be available; • your proposed research topic is an appropriate one which can be completed within the normal period of registration. The process of admission should include the submission of an application form by you, naming your referees, and an interview, (wherever possible), by at least two people in the school, one of whom is likely to be your future supervisor. If you are applying from overseas a telephone interview will be held with you, (if at all possible).
Documents you will be provided with on admission	As part of the admissions process to the University you should be given: • information about the University such as the Postgraduate Prospectus, and including advice on residential accommodation near to the campus where you will be studying (if appropriate); • the names of the two supervisors appointed to support you, and a statement as to which will be your principal or day-to-day supervisor;

	• information about the School/College in which you will be working, including the research interests of staff and, in particular, of your supervisors; • an opportunity to visit the school(s) or place where you will be carrying out your research to discuss your proposed topic of research in person, or by phone with your intended supervisor(s) and/or the Head of the School. Such a discussion should cover the identification of any special needs you might have by way of facilities or support to complete your project successfully; • a statement of the fees for the duration of your studies, and, if you are from overseas, guidance on living costs etc from Brunel International; • details of when and where you should formally register for the programme; • details of your first formal meeting with your supervisor and the induction arrangements made for you; • if appropriate, and if your first language is not English, an assessment of your oral and written English. If you are unclear on any of these matters, you should contact your supervisor or the Head of the School immediately.
Initial enrolment	**Initial Enrolment** Once you have been offered a place at the University and accepted the offer, you will be sent information that will inform you of the enrolment process. Prior to arriving at the

<table>
<tr><td></td><td>University you will be required to enrol online through the University's E-vision website. Unless you start at the beginning of an academic session (when a special enrolment event is held on the campus) or are based somewhere other than Brunel you will carry out this process by visiting the Student Centre situated on ground floor of the Bannerman Centre on the Uxbridge campus. Once the formalities have been completed (which includes the presentation of your passport for identification) you may then proceed to join the Library, the Computer Services and the Union of Brunel Students, and to be registered for access to any University buildings out-of-hours as authorised by your Head of School.</td></tr>
<tr><td>Registration periods</td><td>Your membership of the University will date from the first day of the month in which you registered or from 1 October where registration is effective from the start of the academic year. The minimum and maximum periods of registration for your award, less any periods of authorised suspension of studies, will be calculated from this point. Your initial registration may be for 'PhD subject to confirmation'. The confirmation (or re-grading to PhD) will normally take place following a review of your progress at the end of your first year.

The periods of registration for research degrees are as follows:
<table><tr><td></td><td>Normal Duration (months)</td><td>Maximum Duration (months)</td></tr><tr><td colspan="3">Full-Time Students</td></tr><tr><td>PhD/DBA/EdD</td><td>36</td><td>48</td></tr></table></td></tr>
</table>

	MPhil/MTh/LLm	12	24
	EngD and NewRoutePhD	48	60
	DrPh	36	60
	Part-time Students		
	PhD/DBA/EdD	48	96
	MPhil/MTh	24	48
	DrPh	60	72
	The Normal duration may be reduced and the maximum duration may be extended, normally by not more than 12 months (full-time) or 24 months (part-time), by application by your supervisors to the Chair of the Sub Committee for Postgraduate Research Degrees.		
Fees	Link to postgraduate fees		

Policies and Procedures

Main links	**Sub category titles**
Appeals and complaints	Complaints [general description and link to procedure] Academic Appeals
Student representation and feedback mechanisms	Becoming a student representative Finding your student rep(s) Committee structure
Academic Regulations	Senate Regulation 5 Senate Regulation 6

Research-related policy and guidance	Copyright of your research Criminal records bureau (for research access) Ethics policy for research [link to ethics committee] Intellectual property rights
General policy and guidance	Health and safety Equal opportunities policy Your personal data

PhD process and progression

Main links	**Sub categories**
Getting started / settling in	Induction The first few months [link to Graduate School training and guidance]
Annual Progression and enrolment	Annual research monitoring report Upgrades from MPhil to PhD [new content needed on this – refer to school information where applicable?] Annual enrolment [link to e-vision]
Research Supervision	Your relationship with your supervisor Recording supervision meetings [new content needed] Responsibilities of the second supervisor How to change your supervisor [new content needed] Training on dealing with your supervisor [grad school]
Research and skills training	[new content needed – link to schools and

	graduate school]
Extending or suspending your studies	Extension to the maximum registration period Periods of abeyance or authorized suspension of studies Study beyond the normal period
Prizes, awards and funding	[new content needed]
Working while studying	Working outside the university Teaching and GTA work within the university Job shop

Thesis and Viva

Link / title name	Linked information
Requirements for the award of your degree	[clear link to SR5] – SR5 is the definitive guide to the criteria for the award of a research degree. Some general guidance is provided below but please note that that there are separate documents, available from your school or the Graduate School which set out the special requirements for the EngD, EdD and DBA and NewRoutePhD. [can we link to these?] **What is a Thesis?** Senate Regulations 5.26 to 5.33 give information about what a thesis is. Your thesis must conform to University Guidelines. The major part of the thesis, including the written material, must have been completed during the student's period of registration with the University, under supervisory arrangements approved by the University. The thesis may include published papers by the candidate which must be acknowledged in the text of the thesis. Prior publication by the candidate and his/her supervisor(s) of papers or patents arising from the research being undertaken will not prejudice the assessment of the thesis by the Examiners. A student may include in a thesis work which s/he may have submitted for a degree of this or any other University or other recognised award-granting body, or published prior to his/her registration provided that this is clearly indicated in the text and that such material does not comprise a substantial part of the thesis. All work that is not the candidate's own must be acknowledged. It may be helpful for you to look at what the Examiners have

	to affirm about the thesis after your examination. Before recommending that a candidate be awarded the appropriate degree, Examiners are required to certify **a** that they have satisfied themselves that the thesis is a satisfactory record of research undertaken by the candidate and is genuinely the work of the candidate; **b** that, for a doctoral degree, the thesis forms a distinct contribution to the knowledge of the subject; **c** that the candidate has given evidence of a broad knowledge and understanding of the discipline and of associated research techniques, and has shown that they have been successfully applied; **d** that the thesis is satisfactory in its literary presentation; **e** that the thesis is suitable for publication (by placing on the shelves of the University library or otherwise) as a work approved for a higher degree of Brunel University. Separate additional criteria apply to doctoral and to Master candidates. A candidate for a doctoral degree (PhD, EngD, EdD, and DBA) must also show a satisfactory record of research and a thorough knowledge of the field of scholarship. The candidate is required to demonstrate a broad knowledge and understanding of his/her discipline and of associated research techniques and to show that they have been successfully

	applied. The thesis shall form a distinct and original contribution to knowledge in the discipline. A candidate for a Master's research degree (LLM, MPhil or MTH), is also required to demonstrate a satisfactory record of research, a broad knowledge and understanding of the field of study and of associated research techniques and to show that they have been successfully applied. The thesis should also include a critical survey of knowledge in the approved field of study. The award of a Master's degree does not require candidates to demonstrate a distinct and original contribution to knowledge in that discipline. A candidate for any research degree is required to show appropriate ability in the organisation and presentation of his/her material in the thesis, which must demonstrate clarity of expression and appropriate literary style. It must be in the English language, and must be suitable for publication, either as submitted or suitably abridged. It is most important that you acknowledge all your sources in your thesis and that you reference them in accordance with conventions in your discipline. If you fail to do so you may be charged with plagiarism which is a disciplinary offence and may result in you being expelled from the University without an award. Once you have been awarded your degree the final corrected version of your thesis should be delivered to the library in electronic format; either cd or dvd. The thesis will be stored electronically on the Brunel University Research Archive. Senate may agree that your thesis should be held under confidential cover for a specified period of time. The Registry

	issues a form about the publication of the thesis to students asking them to specify whether the thesis (in whole or in abstract) may be lodged in the Library or whether it is to be retained under confidential cover for up to 3 years. Unless the thesis is under confidential cover, the Head of Library Services may allow access to your thesis in whole or in part without further reference to you. The copyright of the thesis will be protected by a copyright declaration in the thesis. You may need to seek advice from the Brunel Enterprise Centre about the intellectual property contained within your thesis. It is likely that you will wish to see all or part of your thesis published commercially after your successful examination. Do consult your supervisor and, at minimum, show the courtesy of acknowledging his or her contribution to the work in the preface. In the case of any dispute with your supervisor over authorship of works to be published before or after your viva voce, contact your Deputy Head of School (Research) or Pro-Vice-Chancellor (student experience).
Content of your thesis	As a candidate for a research degree, you must submit a thesis on a topic approved by an authorised member of staff. Your thesis must be a substantial piece of written work in which you demonstrate a sound knowledge and critical appreciation of your discipline and of associated research techniques and show that these techniques have been successfully applied. You must organise and present the material in your thesis adequately, and demonstrate clarity of expression and an appropriate literary style. The thesis must be in English and suitable for publication, either as submitted or suitably abridged.

	You and your supervisors should ensure that you do not stray from the main objectives of your research programme by undertaking too much other work, whether related to your thesis or not, as this may adversely affect your agreed completion date. If you and your supervisors do agree to modify your thesis timetable, your supervisors should record the reasons why, together with details of any impact the change will have on the nature of the project and the date for its completion. If these changes are significant, you should seek the approval of the Head of School or designated officer, as well as that of any collaborating organisation. Your thesis must conform to Brunel University guidelines. It may include work which you have already published, with other collaborators or as the sole author, but you must acknowledge this in the text and bind all such work at the end of the thesis. Work which you have submitted for an award of Brunel or any other University or award-granting body can also be included, but this too must be clearly indicated in the text and should not make up a substantial part of the thesis. The University has clearly defined rules on plagiarism, which are set out in Senate Regulation 6. You must clearly indicate all work included in the thesis that is not your own to avoid any risk of breaking these rules. Your supervisors will advise you on your School's guidelines for what constitutes plagiarism in its academic disciplines. [link box – see graduate school intranet for courses related to thesis writing]
Format and presentation of your	You should consult British Standard 4821: Recommendations for the Presentation of Theses and Dissertations: 1990. BSI has

thesis	officially withdrawn this standard, but it should still be consulted as it provides best guidance in the presentation of theses. Essential points of this Standard are that: • the copy must be legible; • the size of character used in the main text, including displayed matter and notes, should be not less than 2.0mm for capitals and 1.5mm for x-height (height of lowercase x); • paper should be size A4, white, acid-free, and within the range 70g/m2 to 100g/m2; • text should be single sided, right hand pages only; • line spacing should be 1.5, with a 40mm margin at the binding edge and other margins not less than 15mm - margins should not include the page number. It is also important to check that any tables, diagrams, photographs etc also have suitable margins. Your thesis should be in 'Perfect Binding'; the Print Room can arrange to do this for you. Your supervisors will advise you about the number of copies which you must ask to have prepared. In addition your thesis should have the following introductory pages Title pages should be laid out as shown below. The name of your supervisors may be included in the acknowledgments but should not be mentioned on the title page. The order of introductory pages is: title page, abstract (discussed in the next section), contents, acknowledgments. Example title page:

INVESTIGATION INTO LITERACY OF PhD STUDENTS

A thesis submitted for the degree of Doctor of Philosophy

by
John Augustus Smith

School of Arts
Brunel University
May 2005

It will be helpful for you to access a recently submitted PhD thesis from the library so that you can get a good idea as to how it should look.

Abstract

Your thesis should contain an abstract, which may be edited by your supervisors. It should be on one side of A4 and no more than 300 words in length. The abstract should be bound

	after the title page and in a form suitable for separate publication since the University may publish it without further reference to you.
Submission of your thesis	**Timing** You must have completed the major part of the thesis, including the written material, during your period of registration with the University, under supervision arrangements approved by the University. Your supervisors will advise you about when, in their opinion, your thesis is ready for submission, although you are not required to adhere to this guidance. **Submitting your thesis** When you are ready to submit your thesis for examination, your principal supervisor and Head of School must certify (on 'Higher Degree Examination' form HD/E1) that you have completed the required study for the degree. Your principal supervisor will then tell you how many copies of your thesis you will need to give to him/her to submit to your school. This will vary according to the number of Examiners, but will normally be at least three. You should also keep an unbound copy of your thesis to take with you to your viva voce examination. **Note:** The University reserves the right to require the submission of an electronic version of your thesis, which will be subject to checks for originality and plagiarism. The Chair of the Learning and Teaching Committee may approve the submission and examination of a thesis before the

	end of the minimum period of registration if your Head of School and principal supervisor make a formal recommendation using form HDE1. Once you have decided to submit your thesis for examination your supervisor and the Head of School must certify that you have completed the required study for the degree on Form HD/E1. At the point of submitting your thesis, you should check in person with the Student Centre that all tuition fees for which you are liable have been paid. Please note that there may be special arrangements for the presentation of a thesis for the award of the EngD, EdD and DBA. Please ask your school for advice. Since each student takes a unique period of time to reach the point of submitting a thesis, it is sometimes the case that corrections to tuition fees due need to be applied at this stage. This could imply either an increase or a decrease. A check at this stage should avoid the possibility of your being presented with a last-minute additional bill to be paid at short-notice before you can be recommended for award.
Your external examiners	The appointment of the Board of Examiners and the arrangements for viva voce examinations are subject to the approval of the SCPGRD. Full-time and part-time candidates will be examined by at least two examiners. These will be an External Examiner appointed by the University and an Internal Examiner, normally a member of the academic staff of the school, nominated by the Head of School. But for candidates who are current members of staff or who have been employed by the University during the preceding three years, two External Examiners must be appointed, as well as an internal

	examiner. The examiners are selected by the University. Each External Examiner for a research degree normally holds a position in a UK university as Professor, Reader or Senior Lecturer and should possess appropriate, current specialist knowledge. A special case may be made by the Head of School/first supervisor for the appointment of an External Examiner who does not hold such a position. The External Examiner should not be someone personally known to you, for example the referee for your application to the University. Any prior relationship between you and the External Examiner(s) or any prior knowledge the Examiner may have of your work must be declared on Form HD/E1. The University does not normally ask the same person to serve as External Examiner for a school move than twice within a 12 month period. A former member of Brunel staff may not be appointed as an External Examiner for a research degree of the University before a period of at least three years has elapsed since s/he was a member of staff of the University. Former members of staff of the University may not be appointed as External Examiners for a research degree of the University if they were in post in the school when you were a student or member of staff, or if they were otherwise known to you. If the External Examiner is to be a former member of staff then it is likely that a second External Examiner appointment will be required. Your principal supervisor may not normally act as one of your examiners, but in some circumstances your second supervisor may do so, for example where s/he has had little formal

	contact with you. If, for exceptional reasons, your principal supervisor is to act as your examiner a second external examiner must be appointed. An independent chair, which will hold the position of Professor, Reader, or Senior Lecture of the University will be appointed. The Independent chair will oversee the examination process but will not act as an examiner. Following the appointment of an external examiner the examination fee will be raised and you will be sent an invoice. All research students have to pay an examination fee.
The Viva Voce / viva examination	**The Examination** Your School will send a copy of your thesis to your External Examiner(s), and to your Internal Examiner. Each External and Internal Examiner completes a preliminary written report prior to the viva voce examination, or, in cases where a viva is not to be held, prior to the determination by the Examiners of the award to be recommended. At this stage these reports are confidential as they will indicate the main lines of the further enquiry to be followed if a viva voce is to be held or set out reasons why no viva voce should be held. The reports will be available to all Examiners before the start of the viva voce. **The Viva Voce** A viva voce is normally held for all research degrees. It is an opportunity for you to defend your thesis and to demonstrate the breadth and depth of your knowledge. The date for the viva voce will be arranged by the Head of School or one of your supervisors in consultation with you and the examiners. The viva voce is normally held on a campus of the University

	or on a campus of an associated or accredited institution. With the permission of the Chair of the SCPGRD and your Head of School the viva voce may be held away from the University if you and all the examiners so agree, but the Chair of Learning and Teaching Committee may require another, experienced, member of staff to be present. One of your supervisors may be present at the viva voce, if you invite them to do so. You will be sent a form, in your examination pack, which you will need to complete in order to invite your supervisor to attend your viva voce. He or she may only speak during the viva voce if invited to do so by the Examiners. [link to HDE3 Viva voce] The viva voce is held in private in the presence of the examiners (and maybe your supervisor and independent chair), except where approved otherwise by SCPGRD, for example for the award of the EngD. [link – see graduate school intranet for courses on preparing for your viva]
Viva outcomes	The Recommendations of the Examiners After the viva voce, the examiners will determine their recommendations to Senate in private. Before recommending that a candidate be awarded the appropriate degree, the Examiners are required to certify: a - that they have satisfied themselves that the thesis is a satisfactory record of research undertaken by the candidate and is genuinely the work of the candidate; b - that, for a doctoral degree, the thesis forms a distinct contribution to the knowledge of the subject; c - that the candidate has given evidence of a broad knowledge

	and understanding of the discipline and of associated research techniques, and has shown that they have been successfully applied; d - that the thesis is satisfactory in its literary presentation; e - that the thesis is suitable for publication (by being held electronically in the Brunel University Research Archive) as a work approved for a higher degree of Brunel University. Separate additional criteria apply to doctoral and to Master candidates. A candidate for a doctoral degree (LLM, PhD, EngD, EdD, and DBA) must also show a satisfactory record of research and a thorough knowledge of the field of scholarship. The candidate is required to demonstrate a broad knowledge and understanding of his/her discipline and of associated research techniques and to show that they have been successfully applied. The thesis shall form a distinct and original contribution to knowledge in the discipline. A candidate for a Master's degree (LLM, MPhil or MTH), is also required to demonstrate a satisfactory record of research, a broad knowledge and understanding of the field of study and of associated research techniques and to show that they have been successfully applied. The thesis should also include a critical survey of knowledge in the approved field of study. The award of a Master's degree does not require candidates to demonstrate a distinct and original contribution to knowledge in that discipline. A candidate for any research degree is required to show appropriate ability in the organisation and presentation of his/her material in the thesis, which must demonstrate clarity of expression and appropriate literary style. It must be in the

	English language, and must be suitable for publication, either as submitted or suitably abridged. Then the examiners may recommend one of the following: The Examiners shall make a joint written report to Senate on the examination of the candidate and may make any of the following recommendations: a - If the candidate has met the criteria as specified by Senate set out above, and in paragraphs 5.1-5.4 of the regulations for postgraduate research degree programmes, the thesis is adequate, and the candidate has satisfied the Examiners at the viva voce examination, the Examiners may recommend the award of the relevant degree. b - If the thesis is otherwise adequate but requires minor amendments and if the candidate satisfies the Examiners in all other parts of the examination, the Examiners may, in writing, require the candidate to make such corrections to the thesis as will satisfy them (or one of their number as they decide). The Examiners shall specify the time available for making such corrections, up to a maximum period of four months, taking into account so far as is possible the candidate's personal circumstances. In the event that a candidate is unable to complete the minor corrections within in the time period specified by the Examiners, an extension of up to two months may be approved by the Chair of SCPGRD. c - The degree not be awarded but that the candidate be allowed to resubmit the thesis in a revised form for re-examination within twelve months, either with or without a further viva voce examination as stipulated in the examiner's

	report. d - If the thesis is judged by the Examiners to be satisfactory, but the candidate fails to satisfy the Examiners at the viva voce examination, the candidate may be allowed to present the same thesis at a second viva voce examination within six months. e - In the case of a viva voce for a doctoral award, if the thesis is judged by the Examiners to be of an insufficient standard for a doctoral award, the candidate should not be awarded the degree of Doctor, but should be re-examined, with or without a viva voce, on a resubmitted thesis, following appropriate revisions, for the award of MPhil. A report to this effect should be made and a date should be set for re-examination of the thesis within a period of not less than two months and not more than six months. A further Examiners' report form will be required in respect of any re-examination of the thesis whether or not a viva voce takes place. f - The Examiners may, upon consideration of the thesis and the candidate's performance at the viva voce, make the recommendation that the degree not be awarded. Once you have submitted your thesis you may not be assessed for an award on more than two occasions. The first formal assessment is counted as the examination of the thesis and its defence by viva voce (if required). You will be given a copy of the main report of the Examiners. If your Examiners disagree they will prepare separate reports and the disagreement will be reported to the Senate, which will, after taking advice from the Learning and Teaching Committee or its Chair, make such arrangements as are necessary to resolve the disagreement.

	Notification of any result or award will be withheld if you are in debt to the University.
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	section of the form will be copied to you), an additional, confidential report (if needed), and details of any minor amendments required to the thesis. The form is countersigned by the Vice Chancellor. **4. British Library Doctoral Thesis Agreement Form** Purpose: for students with a doctoral thesis to agree, through the University, to supply the British Library Document Supply Centre with a copy. The form also requests permission for the thesis to be copied on demand for loan or sale by the British Library, or its agents, to requesting libraries or individuals. **Sent to you by:** Registry **To be returned to:** Library. [add links to forms or Registry page of forms]
Graduation	[link to graduation page in student handbook]

Support and services

Links to:
Advice and representation centre
Alumni
Brunel International
Counselling service
Disability and dyslexia service
Graduate School
Medical support
Student union – representation and feedback
Placement and Careers service
[Others?]

8.4 Gaining the Scope of the Problem through the Interview

	Time-span	**Content**
1	0:00.0 - 0:56.4	**Question:** Basically my interview aim is to find out some kinds of problems in the current research handbook. Especially for the online one and also the paper based one so I want to ask you some questions about from your perspective. With your current problem and from information structure into action and what design perspective and also after that I would ask you some questions to understand student requirement about the research the handbook. So the first is I would like to ask you about your information, How long have you been working with the research handbook? For how many years?
2	0:56.4 - 1:11.1	**Response:**

		Oh right the research handbook since I first came to Brunel about 20 years in various forms, I've been also responsible for looking after it for the past 4 or 5 years.
3	1:11.1 - 1:19.8	**Question:** If the student has some problems of the research handbook, will they just contact you directly, to ask you for help from you?
4	1:19.8 - 1:37.7	**Response:** They may do or may go through schools, there is a variety of mechanisms they can use to talk to people about the information in the handbook. It has been very rare that students actually come and talk to me about the research handbook. Because it contains information from lots of sources that they may want to know about the information rather than about the handbook.
5	1:37.7 - 1:53.5	**Question:** ok, ok, yes. so let’s now start from the first part. and the first question part is I want to ask you from your perspective, what’s your comments or the current research book, the organisation of the material
6	1:53.5 - 2:40.0	**Response:** Right I think it is a bit of problem with the organisation, in it what section it actually named and called and how they are arranged, I think it’s a bit inaccessible at the moment. It was originally a paper based publication then put on to the web and relooked at without a lot of time to do that, so it wasn’t particularly well restructured. So there isn’t a paper based handbook anymore of the university research student handbook, just the online version. and we have been trying to move towards having links from the handbook to primary sources of information rather than recruiting the information in textual format in the handbook. But I think it needs to be looked at in a way to organise where how student will find the information they need that is one of the

		major problems.
7	2:40.4 - 2:52.6	**Question:** So you're saying both of the higher levels like for each chapter usually have chapter levels and under each chapter they have sub levels to easily get the information.
8	2:52.6 - 3:41.6	**Response:** Yeah that is where the problem is perhaps even at the top level, knowing where they're going cause there going into the top level to find the detailed information. I think they are not quite sure which section top level they have the information. So we really could do with organising maybe in a way is on the lines of how students progress from admissions right the way through to graduation, to pick out key areas. I think there are numerous ways you could sub divide it but I think a quick and clear way to straight away think well information about writing there thesis is in a section called thesis writing. Rather than anything else, all the information is in there. It may mean occasionally cross referencing based on links rather than passed text. That is one particular problem.
9	3:35.5 - 3:41.6	**Question:** Do you think if we can offer like a big view like over structure in a hierarchical map then the students can have a view for all the details like which information under each group, that will helpful
10	3:49.5 - 3:59.8	**Response:** Yes if we got a clear map on the side, that sort of umm, they do need that what is missing, it's not very clear where, the information is there but where it is, is one of the major problems
11	3:59.8 - 4:14.2	**Question:** Yea, exactly and yea umm, thank you for the first part, the second one is regarding to the whether the information is enough and whether they have some relevant information in the current handbook.

12	4:14.2 - 5:00.5	**Response:** We try to keep the information up to date as possible by using the links rather than too much text in there, it is under review once a year. Umm which may well be enough actually rather trying to review it too often. In which case information is going to change too often. There are some general information at a top level the message from the vice chancellor and bits and pieces like that. and then it gets into some more nitty gritty with references to documentation where they can find information and I don't think anything in particular that maybe relevant to research students though that is quite difficult. Hopefully from the project you are doing will find out what research students would really like to find in there. and if there is something missing or can they tell us this is really something I need to know.
13	5:00.5 - 5:05.0	**Question:** You don't have comments for the, some information needed to be added?
14	5:04.8 – 5:54.2	**Response:** Umm I can't think what needs to be added in terms of keeping up, we are keeping the research section very specific to the extra information the research students need bearing in mind it sits as a sub section of the student handbook. So most of the general information about the university of the services are applicable to all students are found in that and not repeated in the research student handbook. So I wouldn't want research students thinking absolutely everything they will ever need to know is in the research handbook, but it's the extra stuff about research students that is different and they need to also look at the student handbook, because we want to avoid the duplication, because that just more errors and want to compare.
15	5:54.2 – 6:41.1	**Question:**

		So you updated once a year ? **Response:** At the moment, yes once a year ready for the beginning of each academic year. **Question:** But if they use more links rather than text, will be better, once the information with the links get updated it will be automatically, updated with the research handbook. **Response:** That's right, that's why we went to links for specific regulatory matters, change process and procedures and guidelines, because as they are updated and changed the links will make sure that the handbook is changed. But some of the basic text you wouldn't expect to be reorganised or re jigging the structure of the book more than once year. So you have some continuity. It's some of the finer detail, that may change that may become applicable to research students. Yes that's good
16	6:41.1 – 7:34.5	**Question:** How do you say about the current online research handbook interface design, do you think the interface is friendly? **Response:** Umm because I don't actually use the handbook, I don't need to use the handbook. I provide the information elsewhere. I think it's useful to know how students think about it, because that's the important thing

		there the people who need to be happy with how it works, not at the university level and registry. Students have to use it, its how they feel. **Question:** Ok yea I'm also taking part with the students about the feeling about the handbook. **Response:** That would be very useful to know about how it's laid out and I'm not sure it is quite laid out right. and whether it is each year a few more pictures and illustrations are put in to lighten the layout and space it out a bit better. ok yea.
17	7:34.5 – 7:47	**Question:** and how do you think about , yea the interaction for how to find the research handbook from the Brunel home page. Have you tried too?
18	7:47.2 - 8:21.7	**Response:** I find it difficult to find it, if you go the extranet there is a direct link, sometime it appears on the top page. but yea I quite agree. sometimes finding it can be trouble. If you don't know it is a sub section of the student handbook. I feel it's difficult to find it. You have to go either search and even search cannot give me, the direct link to the research handbook. It brings up an odd.

		I have to go to graduate school and then some sub level and it's very deep in there and it didn't highlight as a research handbook.
19	8:26.2 – 8:37.5	I think on the intranet there is certainly a section that says information for students on the high level and on that you see handbooks but that not clear that includes the research student handbook.
20	8:37.5 – 9.49.1	**Question:** Do you think currently the research handbook online version give enough functions to the students either for like, for example if students feel I would like to find out the format for my thesis. I have to go through each one until I find it if the structure is not clear. **Response:** That is one of the main problems is finding it, the information is probably there but its finding it and have to get to it, which if you carefully thought about the structure and the breakdown and not just the structure I think the name the of the sections, so that they are quite descriptive and they do tell people what information is actually in there. **Question:** But do you think there is an option of a search engine, just specifically in the handbook, do you think that will help them? **Response:** They are always helpful, Yes if it is a good search engine that will point to where the information rather than giving you lots of different. **Question:** Like a handbook search engine rather than a university search engine, rather than all the information.

		Response: Yea, if search on the titles of the themes, titles of the sections, the descriptions, if it can pick up the information to do that. So you wouldn't have it too sophisticated, it will be overkill for what we are trying to achieve. Yea exactly, ok Thank You.
21	9:49.1 - 13:44.4	**Question:** Do you have some other suggestions? Other than what we have discussed just now. **Response:** I don't think there is anything else, I think information wise, we know what information needs to go in. We've asked what the students feel they need and compared that with what we also as a university think they ought to have access to. It would be interesting to compare the two. Ok. Sometimes I feel that students, depending on what stage they are at, don't know what they need to know at that point. Exactly. The two complex range research handbooks specific to the needs of people at different stages because research students reach those stages at a different rate. As compared to an undergraduate program year 1, 2 and 3 and all the information needs to be there. Better indexing will help,

		with the searching of the information is the main thing. Insuring that the links work and up to date and linked through and try to make the handbook fairly generic so it's not so much time dependant. We don't archive very well, so we don't really have. Know we don't have paper handbooks we don't have archives like that, make sure there is an update line of information on the web. It occasionally causes problems as you have to make sure it's applicable to all research students and not just those who entered in a particular year. **Question:** Do you think that would be a good idea like, if we say a research student has a line of the research life, from the beginning. Might be first, second or third or fourth year or you divide them into literature review or the main study, or the conclusion. **Response:** Or you could do that or even start to look at mimicking quite a good way the graduate school has broken down there skills training down into the different stages. As some students at the early stage want to be looking at how they got to develop their thesis, just the way they work. So you want to make sure the information is there. You might live dangerous if you don't start to direct students to into a particular. I don't think they know about any of this until I get to writing up my thesis in my third year, when there planning their work they need to have the long term view in mind and just a little bit of information about what they are aiming towards will help. **Question:** Rather than have a whole it's better to have a selection to allow them to

		select what they need. **Response:** Exactly, if they can select what they want and linked to what I'm looking at the moment will be a very simple page linked to one of the registry pages. Which will have very detailed process guidelines and forms they have to fill to do certain things like how submit a thesis, they just form there and process there and that will run alongside then some softer information in the research student handbook or more detailed information in the research student handbook. So well have a simple page that lists the whole of the forms that they need to fill in, depending on what they actually want to do, change supervisors, extension, abeyance, submit. These sorts of things. That will be very condensed, one page condensed to put the information on. and make sure that again is linked through to the student handbook. So when they go to the student handbook and want they information they'll be a link there to the actual procedures they have to follow and guidelines and maybe even a link to regulations if necessary. As much as possible but not too detailed, they can go further and find it. other you go over it's too much and people won't read it.
22	13:44.4 – 14:08	**Question:** The current divide of the handbook is kind of information organised by the university, if you're a research student you will need to know this, this and this. Rather than from a user orientated. Like if I have this problem, like frequency of questions.
23	14:08.3 – 14:43.8	**Response:** A section like that would be useful within the handbook. It would nice to have a handbook actually made based upon what the user needs. Because from the university perspective we don't need it. we won't use

		it as we'll go to the primary source elsewhere. I don't go to the research handbook for anything. So it really needs to be based on what the research student needs. and to an extent maybe what supervisors, research staff and schools might also want to add, but mainly for students. It would be very interesting to hear their views on what the student body would like.
24	14:43.8 – 15:22.4	because sometimes if the student asks there supervisor and secretary within their school they do not answer. So they have to go further to read through the handbook and also send email to library or other. So they find out results. It has been asked about having a paper version as well, but if you're going to design a real proper designed web-based system it's not something you can print off as a handbook as a paper copy. Because the text will be linked through. and the website is more dynamic.
25	15:22.4 - 15:54.7	exactly, rather than being paper based. I think the school generally tend to have a more paper based system even if that paper book is reproduced as opposed to web pages. They are not linked to anything there simply the web pages displayed as a document on the website. Ok that's very good.
26	15:54.6 - 17:11.3	It's also useful, which I'm not sure is in there anymore, definitive

		information. Where if they are really unsure about anything who do they contact. to find out. So sometimes there is no point of contact from the school so where do we point them? In away... Who is the right person to contact. **Question:** Yea that is really good, sometimes I want to find information from the Brunel website but I'm still confused and want to ask somebody and can't find any email address or telephone number or something. I keep going and might find another wrong to find some people I can contact. I think that is very important. **Response:** It would be useful to have students in a survey, what are the questions you would like to see on that. Particular researchers in their research career, what they have been asking. I think that last question is quite useful.
27	17:13.7 – 19.46.8	**Question:** So now moving to the next stage, I want to know some students' comments like you have discussed. You're students requirements are like? **Response:** I think if you are going to redesign it, you need to know what the user really would like to see. It may be interesting, it may come up with something quite different from the use of the handbook. Or their interpretation of the handbook should be or is maybe quite different to what the university is. as a source of information. Maybe students see it

		quite different, I don't know. We just don't know at the moment. **Question:** Did you ever get some email, either from students or other staff in Brunel to ask you some details about the handbook. The information in the handbook. **Response:** You get questions about mostly to do with research students and degrees and request of information. It's not necessarily about or the handbook says this... but what's the answer. They normally refer to the handbook. Or frequently reviewed questions or ask past students about their problems. I don't think we ever get contacts about handbook. **Question:** Does this mean the students aren't going to the research handbook? Because it just doesn't fulfil their needs? **Response:** It may be that problem. It was really based on a document that was based many years ago. and there hasn't been time to do a full blown exercise. It hasn't been overhauled in this way before. The content and the structure. It's been tinkered with each year. We haven't done anything else apart from making sure the information is there. **Question:** When I was writing my, finishing my dissertation, and I want to find out the format of the final, to the library. I searched for everything, to how it helps the format of the cover page and everything in your thesis. So

		when I really get into, the links are errors. **Response:** It's a bit more irritating that errors coming in. I sometimes find if I went in that no one actually reports it in, I think it's just accepted oh well, and gone away and tried to find information somewhere else. So we need to make sure whatever is built is good and works.
28	19:46.8 – 21.25.7	**Question:** In the following stage, I want to do scenario to do a user test. & I will offer students to do some tasks in order to find some information in the current handbook. Do you have any suggestions on which part maybe difficult for them to find out? **Response:** I think most of it is difficult to find the information because of the way the headings are used in the structure. I think defining the information on structure of thesis and the detail stuff that really comes from the library end about putting their thesis. really they often ask me questions which are definitely on there, I know it is put on, I've seen it. Is how to submit their thesis to the library once you've been awarded. Ok This has changed over the last year or so, as its electronic submission rather than being paper based. How do you do that? and information on printing the thesis and changing supervisors. All these general things, quite a lot of things add up to relationships. umm abeyance needs talking

		about, carrying out teaching as a research student, holiday entitlement is another one. Your holiday entitlement as a research student, is a question. You're not employed as a research student the statement in there about you should really regard yourself like an academic staff, and look at time period for vacations for them.
29	21:25.7 – 21.46.6	**Question:** So when I designed the scenario and designed the task which I asked them to do. I will follow your suggestion and making changes and decisions and find out the layout format for thesis and do you think I should focus on from the student need / requirement when there during their PhD. For example they want
30	21:46.6 – 23.37.0	because they want to change because they have found that requirement rather than the current one or do you think I have to put something in the journey the PhD and all the possibilities during the journey. **Response:** That's a good way to think about it, what can happen to the student, what advice do they need? Ok they are going to get the academic support from supervisors they may want to look into the handbook to find information about how they build the relationship, what are the roles and responsibilities and expectations are for both parties. Both the students and the supervisors can they access this information and I'm not sure they would even find that in the research student handbook. At the moment it tends to be much more about the process and how to do things rather than the expectations and how they do the actual academic work. They may find that is referred to much more often in the school handbook or even the school staff handbook. That's probably where that is going to be. What is going to be more interesting to know, what the students will like to find from the research handbook. That I'm actually, in a way more interested to start from that, What do you really want? in

		the research student handbook. What information do you want to access and want to find there. And build the handbook around that plus anything the university would feel we should put in there as well. So we don't put things like plagiarism and complaints because you'll find that in the student handbook. and you'll find it's exactly the same process. but if there is anything specific.
31	23:37.0 – 26.52.5	**Question:** I might need to identify the student handbook and research handbook it might have kind of overlap. That needs to look around this part, what is the, I might need to move this part and move it to student handbook. **Response:** There shouldn't be very much that is overlapping we tried to do that. Or if the research students want some of this information that needs to be duplicated. and there might be something subtly different between how the information is presented between the student and research. but knowing what the actual research student would like to see and required would be a good starting point. **Question:** Maybe I can start off, if you had some problems in research and have you tried to use the handbook to find it. and could you do it now to show me how you find your answer on line research handbook and whether you can find it or not. Why you think it is important and why you think it should be added into, things like that? Do you think that will be helpful. I design some tasks and ask them to do it.

		Response: The tasks are pre-supposing the information, they only looking at that sort of information rather than, or you could do both. Because a task will tell you how accessible it is. whereas we want to know what should be in the handbook. There maybe things in the handbook that they feel are no use so we may as well take them out. I wouldn't like to see a problem solving document entirely. The idea there is to have the softer side of being a research student, the point of relationships and all that. and not solely about a problem you have. Otherwise you'll have is a list of research students problems to solve. Rather than it being progression and growth. Do they require any general advice from there? It leaves the graduate school as a really good source of information. but we don't normally don't duplicate what the graduate school has. it's just pointless, link it through. Maybe the finding out of the views of some of the students, what they like to see in the research handbook. On top of what is there already. and maybe look at the handbook and find out what's there already and it might spur them on. i.e. I would like to know about this as well. and think your idea scenarios etc. to test whether the structure is any good. and if they kind find., because what people won't do is if you can't find it in a second you're not going to bother and you don't spend hours and hours desperately searching. It needs to be quick enough to pull things out. if there is an easy way of doing that, some mapping. Ok, yea.

32	26:52.5 - 30:04.5	**Question:** I think that is really helpful. very helpful to the research. I want to quickly show you, whether they use it and which channel. **Response:** I think we got to be careful, we are talking about the university research handbook as opposed to the school one. Oh Yes, I think sometimes it is quite easy to get confused between the two. I think they do know they got a school handbook and they don't realise there is a university handbook to base on. Make sure they know, The school and University level. So they know there is two different ones. Ok, School ones are paper and hard copy, which in some ways is more accessible. Depending on what you wanted to use it for. Ok, Can imagine how often they use the research handbook, it's not very often.

		It's simpler to ask how is the current research handbook. I wouldn't surprised it's not particularly good at the moment. I think that is what will come back. and as you say very useful to what they would like. I think an interesting part is if they gave some suggestions. It's always the most useful part anything like this, pre-text comments and what you are going to say. give them room to say that. Ok, thank you very much. I will let you know the progress of the programme. It will be handy as I've got to get something done about the handbook for September, the start of the next academic year. I think redesigning the whole thing will take time to do it properly. And make sure the outcome of this research will really impact on the research handbook. There was years when there was slight tweaks, I might change the titles for some of the areas, so bit more accessible. But not major changes to structural content. So it's sorted to try and do the job. and use your project to build a much better, new handbook for students. More clearly Just user friendly

		If probably take the information we have currently, and made it more user friendly we would be a long way down the road to solving some of the problems of the university. Thank you very much, thank you.

8.5 Node Analysis of Student Services

This section of the appendix represents the node analysis generated from Nvivo8. If the node has coverage of 100% it is the entire document. All other nodes are represented as a proportion of the whole. The figure under references is in reference to the amount of times the node occurs within the document. For example, the node accommodating new features has coverage of 5.37% of the entire student services action research cycle document. This node as indicated under references has occurred 5 times.

Internals\Nvivo Data crunching\Action Research Cycles\Student Services Action Research Cycle

Node Coding	References	Coverage
Cases\Student Services Action Research Cycle	**1**	**100%**

Node Coding	References	Coverage
Free Nodes\Accommodating new features	**5**	**5.37%**

Node Coding	References	Coverage
Free Nodes\Accommodating Organisational Change	**1**	**1.25%**

Node Coding	References	Coverage
Free Nodes\Action Required	**1**	**0.91%**

Node Coding	References	Coverage
Free Nodes\Added Web Developer Pressure	**5**	**5.61%**

Node Coding	References	Coverage
Free Nodes\Analysis and Utilisation Stage	**3**	**3.15%**

Node Coding	References	Coverage
Free Nodes\Appropriateness and Suitability	**5**	**5.35%**

Node Coding	References	Coverage
Free Nodes\Autocratic Problems	**1**	**1.10%**

Node Coding	References	Coverage
Free Nodes\Broad Perspective - Bigger Picture	**1**	**0.75%**

Node Coding	References	Coverage
Free Nodes\Browser Compatibility	**6**	**8.48%**

Node Coding	References	Coverage
Free Nodes\Coding Problem	**1**	**1.36%**

Node Coding	References	Coverage
Free Nodes\Collaborating Development	**2**	**2.09%**

Node Coding	References	Coverage
Free Nodes\Collective Agreement with Different Services	**5**	**6.59%**

Node Coding	References	Coverage
Free Nodes\Collective agreement with Manager and Web Developer	**1**	**0.75%**

Node Coding	References	Coverage
Free Nodes\Combining the Different Student Services	**5**	**5.24%**

Node Coding	References	Coverage
Free Nodes\Compare and Contrast Layout	**1**	**1.09%**

Node Coding	References	Coverage
Free Nodes\Concurrence	**1**	**0.89%**

Node Coding	References	Coverage

Free Nodes\Content and Structure	**1**	**1.03%**

Node Coding	**References**	**Coverage**
Free Nodes\Criteria with Web Development	**1**	**0.97%**

Node Coding	**References**	**Coverage**
Free Nodes\CSS Layout	**4**	**4.62%**

Node Coding	**References**	**Coverage**
Free Nodes\Democratic Agreement	**1**	**1.27%**

Node Coding	**References**	**Coverage**
Free Nodes\Design Requirement	**1**	**1.20%**

Node Coding	**References**	**Coverage**
Free Nodes\Design Testing	**1**	**1.14%**

Node Coding	**References**	**Coverage**
Free Nodes\Design Theory	**2**	**3.46%**

Node Coding	References	Coverage
Free Nodes\Develop Analytical Tool	**9**	**12.23%**

Node Coding	References	Coverage
Free Nodes\Developing On Time	**1**	**0.75%**

Node Coding	References	Coverage
Free Nodes\Development Cycle	**1**	**0.96%**

Node Coding	References	Coverage
Free Nodes\Development Difficulty	**1**	**2.03%**

Node Coding	References	Coverage
Free Nodes\Development of WBIS	**9**	**11.55%**

Node Coding	References	Coverage
Free Nodes\Different Methodologies	**3**	**2.88%**

Node Coding	References	Coverage
Free Nodes\Disagreement of accommodating content change	**1**	**1.20%**

Node Coding	References	Coverage
Free Nodes\Displaying Most Appropriate Information	**1**	**1.20%**

Node Coding	References	Coverage
Free Nodes\Drawing Conclusions	**1**	**0.70%**

Node Coding	References	Coverage
Free Nodes\Effectively	**1**	**1.04%**

Node Coding	References	Coverage
Free Nodes\Emergent Analytical Tool	**6**	**8.70%**

Node Coding	References	Coverage
Free Nodes\Emergent Aspects	**5**	**6.11%**

Node Coding	References	Coverage
Free Nodes\Emergent Information Requirements	**3**	**3.51%**

Node Coding	References	Coverage

Free Nodes\Emergent Methodologies	**4**	**5.15%**

Node Coding	**References**	**Coverage**
Free Nodes\Emergent Organisation	**9**	**14.24%**

Node Coding	**References**	**Coverage**
Free Nodes\Enhancing Web-based Aesthetics	**1**	**1.28%**

Node Coding	**References**	**Coverage**
Free Nodes\Feedback	**1**	**0.42%**

Node Coding	**References**	**Coverage**
Free Nodes\Fit for Purpose	**1**	**1.18%**

Node Coding	**References**	**Coverage**
Free Nodes\GDRASS Matrix	**5**	**6.69%**

Node Coding	**References**	**Coverage**
Free Nodes\Generating Options	**1**	**0.70%**

Node Coding	References	Coverage
Free Nodes\Generating Solutions	**1**	**1.27%**

Node Coding	References	Coverage
Free Nodes\Identify Appropriate Theories	**1**	**1.39%**

Node Coding	References	Coverage
Free Nodes\Improved Understanding	**1**	**1.80%**

Node Coding	References	Coverage
Free Nodes\Inadequate Methodologies	**9**	**10.68%**

Node Coding	References	Coverage
Free Nodes\Increase Communication	**1**	**1.76%**

Node Coding	References	Coverage
Free Nodes\Increased Motivation	**1**	**0.64%**

Node Coding	References	Coverage
Free Nodes\Information Collation	**1**	**0.75%**

Node Coding	References	Coverage
Free Nodes\International Appeal	**1**	**2.02%**

Node Coding	References	Coverage
Free Nodes\Internationalisation	**1**	**2.02%**

Node Coding	References	Coverage
Free Nodes\Internet Speed Development	**3**	**3.75%**

Node Coding	References	Coverage
Free Nodes\Language Action Perspective	**2**	**3.46%**

Node Coding	References	Coverage
Free Nodes\Layout and Design	**3**	**3.13%**

Node Coding	References	Coverage
Free Nodes\Limited capacity for future expansion	**1**	**1.01%**

Node Coding	References	Coverage
Free Nodes\Manager and Web Developer	**8**	**8.29%**

Node Coding	References	Coverage
Free Nodes\Manager Influence	**2**	**2.54%**

Node Coding	References	Coverage
Free Nodes\Manager putting across ideas	**1**	**0.97%**

Node Coding	References	Coverage
Free Nodes\Managerial Support - Backing	**1**	**1.35%**

Node Coding	References	Coverage
Free Nodes\Manager's Changes	**1**	**1.42%**

Node Coding	References	Coverage
Free Nodes\Manager's Requirements	**2**	**2.93%**

Node Coding	References	Coverage
Free Nodes\Mapping the Process	**1**	**0.74%**

Node Coding	References	Coverage

Free Nodes\Media Compatibility	**1**	**1.82%**

Node Coding	**References**	**Coverage**
Free Nodes\Meet or Communicate	**1**	**1.09%**

Node Coding	**References**	**Coverage**
Free Nodes\Meeting tight Deadlines	**1**	**1.36%**

Node Coding	**References**	**Coverage**
Free Nodes\Methodology Issue	**9**	**10.18%**

Node Coding	**References**	**Coverage**
Free Nodes\Methodology needs emergent Characteristics	**1**	**1.05%**

Node Coding	**References**	**Coverage**
Free Nodes\Mixed Methodologies	**2**	**3.04%**

Node Coding	**References**	**Coverage**
Free Nodes\New Development Ideas	**1**	**1.68%**

Node Coding	References	Coverage
Free Nodes\New or Improved Technology	**1**	**1.68%**

Node Coding	References	Coverage
Free Nodes\No Sequential Ordering	**1**	**2.54%**

Node Coding	References	Coverage
Free Nodes\Overcome Communication Problems	**1**	**1.76%**

Node Coding	References	Coverage
Free Nodes\Overcoming Critical Problems	**4**	**4.76%**

Node Coding	References	Coverage
Free Nodes\Personal Peculiarities	**1**	**1.03%**

Node Coding	References	Coverage
Free Nodes\Planning Purpose	**1**	**0.88%**

Node Coding	References	Coverage
Free Nodes\Process Incorporation	**1**	**0.89%**

Node Coding	References	Coverage
Free Nodes\Project Application	**1**	**0.74%**

Node Coding	References	Coverage
Free Nodes\Project Development	**1**	**1.76%**

Node Coding	References	Coverage
Free Nodes\Prototyping	**3**	**4.19%**

Node Coding	References	Coverage
Free Nodes\Reduce Time-to-Market	**2**	**2.25%**

Node Coding	References	Coverage
Free Nodes\Reflective Thinking	**1**	**0.80%**

Node Coding	References	Coverage
Free Nodes\Reviewing the Process	**1**	**0.61%**

Node Coding	References	Coverage
Free Nodes\Rigorous Testing	**2**	**2.63%**

Node Coding	References	Coverage
Free Nodes\Single Platform	**1**	**1.14%**

Node Coding	References	Coverage
Free Nodes\Specific Methodology	**1**	**1.42%**

Node Coding	References	Coverage
Free Nodes\Stage Analysis	**1**	**0.76%**

Node Coding	References	Coverage
Free Nodes\Static Organisation	**3**	**6.13%**

Node Coding	References	Coverage
Free Nodes\Technological Appropriateness	**1**	**1.49%**

Node Coding	References	Coverage
Free Nodes\Theory Development	**2**	**2.14%**

Node Coding	References	Coverage

Free Nodes\Theory of Deferred Action	**5**	**5.78%**

Node Coding	**References**	**Coverage**
Free Nodes\Time constraint	**6**	**6.99%**

Node Coding	**References**	**Coverage**
Free Nodes\Time consuming	**2**	**1.74%**

Node Coding	**References**	**Coverage**
Free Nodes\Time Delay	**2**	**3.02%**

Node Coding	**References**	**Coverage**
Free Nodes\Time-to-Market	**3**	**3.16%**

Node Coding	**References**	**Coverage**
Free Nodes\Timeboxing Development	**1**	**0.89%**

Node Coding	**References**	**Coverage**
Free Nodes\Unilateral Implementation	**1**	**1.10%**

Node Coding	References	Coverage
Free Nodes\Universal Platform	**2**	**2.04%**

Node Coding	References	Coverage
Free Nodes\WBIS Maintenance	**1**	**1.03%**

Node Coding	References	Coverage
Free Nodes\WBIS Student Services	**7**	**2.94%**

Node Coding	References	Coverage
Free Nodes\Web Developers Level of Knowledge	**7**	**9.63%**

Node Coding	References	Coverage
Free Nodes\Web-based Aesthetics	**4**	**6.00%**

8.6 Total Node Summary of Student Services

Total References	249
Coverage	3.91%
Total Users	1

8.7 Student and Research Handbook Node Analysis

Internals\Nvivo Data crunching\Action Research Cycles\Student and Research Student Handbook Action Research		
Node Coding	**References**	**Coverage**
Cases\Student and Research Student Handbook Action Research	**1**	**100%**
Node Coding	**References**	**Coverage**
Free Nodes\Accessibility	**2**	**2.14%**
Node Coding	**References**	**Coverage**
Free Nodes\Accommodating Organisational Change	**5**	**7.00%**
Node Coding	**References**	**Coverage**
Free Nodes\Achieving Objectives	**1**	**0.92%**
Node Coding	**References**	**Coverage**
Free Nodes\Achieving Targets	**1**	**0.88%**
Node Coding	**References**	**Coverage**

Free Nodes\Action Required	**2**	**2.69%**

Node Coding	**References**	**Coverage**
Free Nodes\Action Research Cycle	**8**	**10.44%**

Node Coding	**References**	**Coverage**
Free Nodes\Adaptability and Flexibility to Change	**3**	**4.32%**

Node Coding	**References**	**Coverage**
Free Nodes\Added Requirements	**1**	**1.26%**

Node Coding	**References**	**Coverage**
Free Nodes\Added Web Developer Pressure	**5**	**5.86%**

Node Coding	**References**	**Coverage**
Free Nodes\Analysis and Utilisation Stage	**1**	**1.89%**

Node Coding	**References**	**Coverage**
Free Nodes\Appropriate Methodology	**4**	**5.22%**

Node Coding	References	Coverage
Free Nodes\Appropriateness and Suitability	**2**	**3.65%**

Node Coding	References	Coverage
Free Nodes\Brunel Graduate School	**2**	**2.95%**

Node Coding	References	Coverage
Free Nodes\Categorisation	**11**	**16.09%**

Node Coding	References	Coverage
Free Nodes\Coding Problem	**1**	**1.18%**

Node Coding	References	Coverage
Free Nodes\Collective agreement with Manager and Web Developer	**3**	**3.25%**

Node Coding	References	Coverage
Free Nodes\Communication to Stakeholders	**1**	**0.88%**

Node Coding	References	Coverage
Free Nodes\Compile Report	**3**	**2.16%**

Node Coding	References	Coverage
Free Nodes\Completed Project	**1**	**0.84%**

Node Coding	References	Coverage
Free Nodes\Conflicting Requirements	**1**	**1.09%**

Node Coding	References	Coverage
Free Nodes\Continuous New Adjustments from Manager	**1**	**1.34%**

Node Coding	References	Coverage
Free Nodes\Continuous Process Improvement	**6**	**7.58%**

Node Coding	References	Coverage
Free Nodes\Creating Guidelines	**1**	**1.29%**

Node Coding	References	Coverage
Free Nodes\Design Testing	**2**	**2.55%**

Node Coding	References	Coverage
Free Nodes\Develop Analytical Tool	**1**	**2.02%**

Node Coding	References	Coverage
Free Nodes\Development Cycle	**5**	**6.32%**

Node Coding	References	Coverage
Free Nodes\Development of WBIS	**5**	**7.70%**

Node Coding	References	Coverage
Free Nodes\Effectiveness and Usefulness	**1**	**3.14%**

Node Coding	References	Coverage
Free Nodes\Emergent Analytical Tool	**1**	**2.02%**

Node Coding	References	Coverage
Free Nodes\Emergent Aspects	**4**	**4.59%**

Node Coding	References	Coverage

Free Nodes\Emergent Development	**2**	**2.39%**

Node Coding	**References**	**Coverage**
Free Nodes\Emergent Information Requirements	**4**	**4.81%**

Node Coding	**References**	**Coverage**
Free Nodes\Emergent Methodologies	**1**	**2.02%**

Node Coding	**References**	**Coverage**
Free Nodes\Emergent Organisation	**4**	**5.74%**

Node Coding	**References**	**Coverage**
Free Nodes\Enhancing Handbook	**4**	**3.85%**

Node Coding	**References**	**Coverage**
Free Nodes\Ensuring Accurate Changes	**1**	**0.55%**

Node Coding	**References**	**Coverage**
Free Nodes\Experienced Web Developer	**2**	**2.65%**

Node Coding	References	Coverage
Free Nodes\Future Incorporation into Projects	**1**	**0.84%**

Node Coding	References	Coverage
Free Nodes\graphic designers as web developers	**1**	**0.99%**

Node Coding	References	Coverage
Free Nodes\Hyperlinking	**3**	**3.79%**

Node Coding	References	Coverage
Free Nodes\Implementation	**7**	**8.39%**

Node Coding	References	Coverage
Free Nodes\Improved Understanding	**3**	**4.99%**

Node Coding	References	Coverage
Free Nodes\Improving Handbook	**7**	**9.79%**

Node Coding	References	Coverage

Free Nodes\Improving WBIS	**2**	**3.70%**

Node Coding	**References**	**Coverage**
Free Nodes\Inadequate Project Time	**2**	**1.55%**

Node Coding	**References**	**Coverage**
Free Nodes\Inclusive ways of researching	**1**	**0.79%**

Node Coding	**References**	**Coverage**
Free Nodes\Increased Awareness of Handbook	**2**	**2.85%**

Node Coding	**References**	**Coverage**
Free Nodes\Incremental Approach	**1**	**0.92%**

Node Coding	**References**	**Coverage**
Free Nodes\Information Collation	**2**	**1.96%**

Node Coding	**References**	**Coverage**
Free Nodes\Information Retrieval	**2**	**1.76%**

Node Coding	References	Coverage
Free Nodes\Internet Speed Development	**3**	**5.43%**

Node Coding	References	Coverage
Free Nodes\Interview	**1**	**2.34%**

Node Coding	References	Coverage
Free Nodes\Kadar Matrix	**3**	**4.70%**

Node Coding	References	Coverage
Free Nodes\Key Issues	**1**	**1.07%**

Node Coding	References	Coverage
Free Nodes\Layout and Design	**5**	**6.21%**

Node Coding	References	Coverage
Free Nodes\Level of Satisfaction	**3**	**6.24%**

Node Coding	References	Coverage
Free Nodes\Level of	**1**	**2.22%**

Technology

Node Coding	References	Coverage
Free Nodes\Loss of Continuity	**1**	**0.67%**

Node Coding	References	Coverage
Free Nodes\Low Satisfaction	**1**	**0.72%**

Node Coding	References	Coverage
Free Nodes\Manager and Web Developer	**5**	**6.64%**

Node Coding	References	Coverage
Free Nodes\Manager Influence	**1**	**1.34%**

Node Coding	References	Coverage
Free Nodes\Manager making Final Decision	**1**	**1.09%**

Node Coding	References	Coverage
Free Nodes\Manager putting across ideas	**1**	**0.87%**

Node Coding	References	Coverage

Free Nodes\Managerial Support - Backing	**1**	**1.09%**

Node Coding	**References**	**Coverage**
Free Nodes\Manager's Changes	**1**	**0.87%**

Node Coding	**References**	**Coverage**
Free Nodes\Manager's Requirements	**2**	**1.90%**

Node Coding	**References**	**Coverage**
Free Nodes\Meeting tight Deadlines	**2**	**2.47%**

Node Coding	**References**	**Coverage**
Free Nodes\Methodology Issue	**3**	**4.11%**

Node Coding	**References**	**Coverage**
Free Nodes\Methodology needs emergent Characteristics	**3**	**4.44%**

Node Coding	**References**	**Coverage**
Free Nodes\New or Improved Technology	**1**	**2.22%**

Node Coding	References	Coverage
Free Nodes\Observation	**1**	**1.45%**

Node Coding	References	Coverage
Free Nodes\Online Handbook Web-based Information System	**6**	**13.64%**

Node Coding	References	Coverage
Free Nodes\Online Web Survey	**1**	**2.38%**

Node Coding	References	Coverage
Free Nodes\Overcoming Critical Problems	**10**	**15.06%**

Node Coding	References	Coverage
Free Nodes\Parallel Development	**1**	**1.80%**

Node Coding	References	Coverage
Free Nodes\Planned Changes	**3**	**3.98%**

Node Coding	References	Coverage

Free Nodes\Post Graduate Students	**2**	**3.26%**

Node Coding	**References**	**Coverage**
Free Nodes\Problems External to Project	**1**	**0.68%**

Node Coding	**References**	**Coverage**
Free Nodes\Project Development	**2**	**1.41%**

Node Coding	**References**	**Coverage**
Free Nodes\Quality of Web Service	**1**	**0.88%**

Node Coding	**References**	**Coverage**
Free Nodes\Recommendations	**8**	**10.53%**

Node Coding	**References**	**Coverage**
Free Nodes\Reduce Time-to-Market	**1**	**1.03%**

Node Coding	**References**	**Coverage**
Free Nodes\Reflective Thinking	**1**	**1.18%**

Node Coding	References	Coverage
Free Nodes\Research investigation	**1**	**2.18%**

Node Coding	References	Coverage
Free Nodes\Rigorous Testing	**1**	**1.18%**

Node Coding	References	Coverage
Free Nodes\Senior Assistant Registrar	**1**	**2.34%**

Node Coding	References	Coverage
Free Nodes\Set Requirements	**1**	**0.99%**

Node Coding	References	Coverage
Free Nodes\Showing Manager Changes	**1**	**0.87%**

Node Coding	References	Coverage
Free Nodes\Solving Organisational Problem	**1**	**1.39%**

Node Coding	References	Coverage
Free Nodes\Sorting Card Study	**3**	**5.22%**

Node Coding	References	Coverage
Free Nodes\Specific Methodology	**1**	**1.08%**

Node Coding	References	Coverage
Free Nodes\Stage Analysis	**1**	**0.84%**

Node Coding	References	Coverage
Free Nodes\Student and Research Handbook	**22**	**28.74%**

Node Coding	References	Coverage
Free Nodes\Student and Staff	**1**	**0.58%**

Node Coding	References	Coverage
Free Nodes\Technological Tools Required	**1**	**2.02%**

Node Coding	References	Coverage
Free Nodes\Theory of Deferred Action	**1**	**1.18%**

Node Coding	References	Coverage

Free Nodes\Time constraint	**5**	**4.42%**

Node Coding	**References**	**Coverage**
Free Nodes\Time consuming	**2**	**1.55%**

Node Coding	**References**	**Coverage**
Free Nodes\Time Delay	**2**	**1.57%**

Node Coding	**References**	**Coverage**
Free Nodes\Time-to-Market	**5**	**5.72%**

Node Coding	**References**	**Coverage**
Free Nodes\Top Management Commitment to a Project	**1**	**0.88%**

Node Coding	**References**	**Coverage**
Free Nodes\Unforeseen Problems	**1**	**0.44%**

Node Coding	**References**	**Coverage**
Free Nodes\Updating Information	**1**	**0.48%**

Node Coding	References	Coverage
Free Nodes\Usability	**7**	**13.48%**

Node Coding	References	Coverage
Free Nodes\Usability Evaluation	**2**	**4.37%**

Node Coding	References	Coverage
Free Nodes\User Demands	**1**	**3.14%**

Node Coding	References	Coverage
Free Nodes\User Friendliness	**3**	**3.16%**

Node Coding	References	Coverage
Free Nodes\Web Developer Satisfaction	**2**	**2.10%**

Node Coding	References	Coverage
Free Nodes\Web Developers Level of Knowledge	**8**	**9.49%**

Node Coding	References	Coverage
Free Nodes\Web Site - Intranet	**1**	**1.83%**

Node Coding		References	Coverage
Free Aesthetics	Nodes\Web-based	**2**	**3.56%**

8.8 Total Node Summary of Student and Research Handbook

Total References	295
Coverage	4.43%
Total Users	1

8.9 Additional Action Student Services Node Analysis

Internals\Nvivo Data crunching\Action Research Cycles\Additional - Student Services Web-based Information System

Node Coding	References	Coverage
Cases\Action Research Cycles	**1**	**100%**

Node Coding	References	Coverage
Free Nodes\- Unsure of what to categorise as	**1**	**0.16%**

Node Coding	References	Coverage
Free Nodes\Accommodating Special Needs	**1**	**0.19%**

Node Coding	References	Coverage
Free Nodes\Acting Fairly and Respectfully	**1**	**0.23%**

Node Coding	References	Coverage
Free Nodes\Active Involvement	**4**	**0.99%**

Node Coding	References	Coverage
Free Nodes\Added Web Developer Pressure	**3**	**0.97%**

Node Coding	References	Coverage
Free Nodes\Additional Help	**1**	**0.30%**

Node Coding	References	Coverage
Free Nodes\Adequate Project Time	**2**	**0.50%**

Node Coding	References	Coverage
Free Nodes\Analysis and Utilisation Stage	**4**	**1.20%**

Node Coding	References	Coverage
Free Nodes\Appropriateness and Suitability	**2**	**0.52%**

Node Coding	References	Coverage
Free Nodes\Arranging Meeting	**3**	**0.45%**

Node Coding	References	Coverage
Free Nodes\Avoiding Conflict	**1**	**0.23%**

Node Coding	References	Coverage
Free Nodes\Browser Compatibility	**2**	**0.47%**

Node Coding	References	Coverage
Free Nodes\Brunel Corporate Guidelines	**6**	**1.53%**

Node Coding	References	Coverage
Free Nodes\Clear Guidelines	**2**	**1.05%**

Node Coding	References	Coverage
Free Nodes\Collaborating Development	**8**	**2.52%**

Node Coding	References	Coverage
Free Nodes\Collective Agreement with Different Services	**2**	**0.83%**

Node Coding	References	Coverage
Free Nodes\Collective agreement with Manager and Web Developer	**6**	**1.64%**

Node Coding	References	Coverage
Free Nodes\Combining the Different Student Services	**9**	**2.81%**

Node Coding	References	Coverage
Free Nodes\Communication to Stakeholders	**6**	**2.00%**

Node Coding	References	Coverage
Free Nodes\Compare and Contrast Layout	**5**	**1.48%**

Node Coding	References	Coverage
Free Nodes\Concurrence	**1**	**0.24%**

Node Coding	References	Coverage
Free Nodes\Conflicting	**5**	**1.67%**

Requirements

Node Coding	References	Coverage
Free Nodes\Consideration of Alternative Strategy	**1**	**0.36%**

Node Coding	References	Coverage
Free Nodes\Consistent Control	**4**	**0.97%**

Node Coding	References	Coverage
Free Nodes\Consolidating Methodologies	**1**	**0.75%**

Node Coding	References	Coverage
Free Nodes\Construct and Support of Web-based Information Systems	**1**	**0.32%**

Node Coding	References	Coverage
Free Nodes\Consultation and Co-operation	**6**	**1.42%**

Node Coding	References	Coverage

Free Nodes\Content Restriction	**1**	**0.67%**

Node Coding	**References**	**Coverage**
Free Nodes\Continuous New Adjustments from Manager	**2**	**0.38%**

Node Coding	**References**	**Coverage**
Free Nodes\Continuous Process Improvement	**1**	**0.36%**

Node Coding	**References**	**Coverage**
Free Nodes\Controlling Influence	**2**	**0.57%**

Node Coding	**References**	**Coverage**
Free Nodes\Corroboration	**1**	**0.57%**

Node Coding	**References**	**Coverage**
Free Nodes\Cost Reduction	**2**	**0.64%**

Node Coding	**References**	**Coverage**
Free Nodes\CSS Layout	**17**	**4.51%**

Node Coding	References	Coverage
Free Nodes\Daily meetings	**5**	**1.39%**

Node Coding	References	Coverage
Free Nodes\Data Interpretation	**1**	**0.35%**

Node Coding	References	Coverage
Free Nodes\Debate & Discussion	**1**	**0.36%**

Node Coding	References	Coverage
Free Nodes\Design a template chart	**2**	**1.44%**

Node Coding	References	Coverage
Free Nodes\Design Testing	**6**	**1.61%**

Node Coding	References	Coverage
Free Nodes\Develop Online Form	**1**	**0.76%**

Node Coding	References	Coverage
Free Nodes\Developing On Time	**6**	**1.83%**

Node Coding	References	Coverage
Free Nodes\Development Cycle	**2**	**0.48%**

Node Coding	References	Coverage
Free Nodes\Development Difficulty	**6**	**1.58%**

Node Coding	References	Coverage
Free Nodes\Development of Trust	**1**	**0.31%**

Node Coding	References	Coverage
Free Nodes\Development of WBIS	**2**	**0.52%**

Node Coding	References	Coverage
Free Nodes\Development Scrutiny	**5**	**1.56%**

Node Coding	References	Coverage
Free Nodes\Diagrammatic examples to explain process	**3**	**0.76%**

Node Coding	References	Coverage
Free Nodes\Disagreement of accommodating content change	**1**	**0.31%**

Node Coding	References	Coverage
Free Nodes\Displaying Most Appropriate Information	**6**	**2.22%**

Node Coding	References	Coverage
Free Nodes\Editing and Uploading Problems	**1**	**0.27%**

Node Coding	References	Coverage
Free Nodes\Effectively	**1**	**0.29%**

Node Coding	References	Coverage
Free Nodes\Effectiveness and Usefulness	**2**	**0.64%**

Node Coding	References	Coverage
Free Nodes\Efficiently or Cost Effective	**1**	**0.29%**

Node Coding	References	Coverage
Free Nodes\Email Inbox Flooded	**1**	**0.32%**

Node Coding	References	Coverage
Free Nodes\Emergent Aspects	**6**	**1.59%**

Node Coding	References	Coverage
Free Nodes\Emergent Methodologies	**1**	**0.31%**

Node Coding	References	Coverage
Free Nodes\Enhancing Web-based Aesthetics	**4**	**1.54%**

Node Coding	References	Coverage
Free Nodes\Ensuring Accurate Changes	**1**	**0.24%**

Node Coding	References	Coverage
Free Nodes\Ethical Considerations	**1**	**0.32%**

Node Coding	References	Coverage
Free Nodes\Excess Information	**2**	**0.47%**

Node Coding	References	Coverage
Free Nodes\Expectation Fulfilment	**1**	**0.41%**

Node Coding	References	Coverage
Free Nodes\Experienced Web Developer	**1**	**0.36%**

Node Coding	References	Coverage
Free Nodes\Feasibility Study	**4**	**1.19%**

Node Coding	References	Coverage
Free Nodes\Feedback	**15**	**4.18%**

Node Coding	References	Coverage
Free Nodes\Fixed meeting Times	**4**	**0.78%**

Node Coding	References	Coverage
Free Nodes\Future Incorporation into Projects	**8**	**2.42%**

Node Coding	References	Coverage
Free Nodes\Gaining Approval	**7**	**2.18%**

Node Coding	References	Coverage
Free Nodes\Generating Solutions	**6**	**2.51%**

Node Coding	References	Coverage
Free Nodes\Getting the Analysis Correct with Corporate Information Strategy	**1**	**0.32%**

Node Coding	References	Coverage
Free Nodes\graphic designers	**2**	**0.63%**

as web developers

Node Coding	References	Coverage
Free Nodes\Group Discussion	**2**	**0.95%**

Node Coding	References	Coverage
Free Nodes\Happy feeling to talk in Meeting	**1**	**0.64%**

Node Coding	References	Coverage
Free Nodes\Hyperlinking	**3**	**1.25%**

Node Coding	References	Coverage
Free Nodes\Ikonic Five Box Development Process	**2**	**0.74%**

Node Coding	References	Coverage
Free Nodes\Implementation	**2**	**0.58%**

Node Coding	References	Coverage
Free Nodes\Inadequate Methodologies	**4**	**1.82%**

Node Coding	References	Coverage
Free Nodes\Inclined to Work Harder	**1**	**0.41%**

Node Coding	References	Coverage
Free Nodes\Inclusive ways of researching	**1**	**0.29%**

Node Coding	References	Coverage
Free Nodes\Increase Communication	**3**	**1.05%**

Node Coding	References	Coverage
Free Nodes\Increased Awareness of Student Services Portal	**6**	**1.87%**

Node Coding	References	Coverage
Free Nodes\Increased Motivation	**1**	**0.39%**

Node Coding	References	Coverage

Free Nodes\Incremental Approach	**1**	**0.30%**

Node Coding	**References**	**Coverage**
Free Nodes\Ineffective Communication	**1**	**0.30%**

Node Coding	**References**	**Coverage**
Free Nodes\Influencing the Design Process	**1**	**0.07%**

Node Coding	**References**	**Coverage**
Free Nodes\Information Collation	**1**	**0.34%**

Node Coding	**References**	**Coverage**
Free Nodes\International Appeal	**1**	**0.26%**

Node Coding	**References**	**Coverage**
Free Nodes\Internet Speed Development	**10**	**3.35%**

Node Coding	**References**	**Coverage**

Free Nodes\Iterative Process	**6**	**2.45%**

Node Coding	**References**	**Coverage**
Free Nodes\Keeping Up to Date - Information	**1**	**0.33%**

Node Coding	**References**	**Coverage**
Free Nodes\Lack of Criticality	**1**	**0.20%**

Node Coding	**References**	**Coverage**
Free Nodes\Layout and Design	**11**	**3.37%**

Node Coding	**References**	**Coverage**
Free Nodes\Less effective way of designing	**1**	**0.08%**

Node Coding	**References**	**Coverage**
Free Nodes\Level of Satisfaction	**1**	**0.32%**

Node Coding	**References**	**Coverage**

Free Nodes\Level of Technology	**3**	**0.72%**

Node Coding	**References**	**Coverage**
Free Nodes\Limited choice	**1**	**0.03%**

Node Coding	**References**	**Coverage**
Free Nodes\Logging of Queries	**1**	**0.28%**

Node Coding	**References**	**Coverage**
Free Nodes\Maintaining Good Relations	**2**	**0.57%**

Node Coding	**References**	**Coverage**
Free Nodes\Maintaining Objective	**1**	**0.30%**

Node Coding	**References**	**Coverage**
Free Nodes\Management Perspectives	**4**	**1.10%**

Node Coding	**References**	**Coverage**

Free Nodes\Manager and Web Developer	**19**	**5.65%**

Node Coding	**References**	**Coverage**
Free Nodes\Manager Influence	**3**	**0.83%**

Node Coding	**References**	**Coverage**
Free Nodes\Manager making Final Decision	**5**	**1.41%**

Node Coding	**References**	**Coverage**
Free Nodes\Manager putting across ideas	**2**	**0.28%**

Node Coding	**References**	**Coverage**
Free Nodes\Managerial Support - Backing	**1**	**0.37%**

Node Coding	**References**	**Coverage**
Free Nodes\Meet or Communicate	**4**	**1.36%**

Node Coding	**References**	**Coverage**

Free Nodes\Methodology Issue	**11**	**3.12%**

Node Coding	**References**	**Coverage**
Free Nodes\Misunderstanding the System Requirements	**1**	**0.10%**

Node Coding	**References**	**Coverage**
Free Nodes\More Detail needed	**1**	**0.48%**

Node Coding	**References**	**Coverage**
Free Nodes\Nervous in Development Process	**1**	**0.30%**

Node Coding	**References**	**Coverage**
Free Nodes\New or Improved Technology	**2**	**0.78%**

Node Coding	**References**	**Coverage**
Free Nodes\No Scrolling for Content	**1**	**0.41%**

Node Coding	**References**	**Coverage**

Free Nodes\One to One Input	**2**	**0.39%**

Node Coding	**References**	**Coverage**
Free Nodes\Open Source Software	**1**	**0.20%**

Node Coding	**References**	**Coverage**
Free Nodes\Organisational Intentions	**3**	**0.91%**

Node Coding	**References**	**Coverage**
Free Nodes\Overcome Communication Problems	**1**	**0.09%**

Node Coding	**References**	**Coverage**
Free Nodes\Overcoming Critical Problems	**10**	**3.26%**

Node Coding	**References**	**Coverage**
Free Nodes\Paper based system	**1**	**0.29%**

Node Coding	**References**	**Coverage**

Free Nodes\perception of trust	**1**	**0.05%**

Node Coding	**References**	**Coverage**
Free Nodes\Primalis Training	**2**	**0.77%**

Node Coding	**References**	**Coverage**
Free Nodes\Process Incorporation	**1**	**0.30%**

Node Coding	**References**	**Coverage**
Free Nodes\Prohibited External Links	**1**	**0.52%**

Node Coding	**References**	**Coverage**
Free Nodes\Project Failure	**2**	**0.44%**

Node Coding	**References**	**Coverage**
Free Nodes\Prototyping	**4**	**1.02%**

Node Coding	**References**	**Coverage**
Free Nodes\Rapid Application	**3**	**0.60%**

Development

Node Coding	References	Coverage
Free Nodes\Record Maintenance	**1**	**0.33%**

Node Coding	References	Coverage
Free Nodes\Reflective Thinking	**8**	**2.87%**

Node Coding	References	Coverage
Free Nodes\Relevant Student Information	**2**	**0.79%**

Node Coding	References	Coverage
Free Nodes\Reviewing the Process	**2**	**0.86%**

Node Coding	References	Coverage
Free Nodes\Rigidity of Development Structure	**1**	**0.15%**

Node Coding	References	Coverage
Free Nodes\Rigorous Testing	**4**	**0.94%**

Node Coding	References	Coverage
Free Nodes\Risk Analysis	**3**	**1.10%**

Node Coding	References	Coverage
Free Nodes\sending around a web link at the end of the week	**3**	**0.91%**

Node Coding	References	Coverage
Free Nodes\Showing Manager Changes	**1**	**0.24%**

Node Coding	References	Coverage
Free Nodes\Siegal Web Design Phases	**1**	**0.28%**

Node Coding	References	Coverage
Free Nodes\Stage Analysis	**2**	**0.72%**

Node Coding	References	Coverage
Free Nodes\Stakeholder satisfaction	**2**	**0.53%**

Node Coding	References	Coverage
Free Nodes\Start Development Process Early	**1**	**0.23%**

Node Coding	References	Coverage
Free Nodes\Strict Guidelines for Submission	**1**	**0.45%**

Node Coding	References	Coverage
Free Nodes\Technological Appropriateness	**6**	**2.12%**

Node Coding	References	Coverage
Free Nodes\Technological Tools Required	**1**	**0.33%**

Node Coding	References	Coverage
Free Nodes\Time constraint	**34**	**8.53%**

Node Coding	References	Coverage
Free Nodes\Time consuming	**24**	**6.76%**

Node Coding	References	Coverage
Free Nodes\Time Delay	**2**	**0.44%**

Node Coding	References	Coverage
Free Nodes\Top Management Commitment to a Project	**2**	**0.43%**

Node Coding	References	Coverage
Free Nodes\Unbiased	**1**	**0.26%**

Node Coding	References	Coverage
Free Nodes\Unforeseen Problems	**2**	**0.58%**

Node Coding	References	Coverage
Free Nodes\Universal Platform	**2**	**0.71%**

Node Coding	References	Coverage
Free Nodes\User Demands	**7**	**2.26%**

Node Coding	References	Coverage
Free Nodes\User Friendliness	**2**	**0.40%**

Node Coding	References	Coverage
Free Nodes\Waterfall Model couldn't accommodate change needed	**1**	**0.22%**

Node Coding	References	Coverage
Free Nodes\WBIS Maintenance	**1**	**0.48%**

Node Coding	References	Coverage
Free Nodes\Web Developers Level of Knowledge	**7**	**1.92%**

Node Coding	References	Coverage
Free Nodes\Web-based Aesthetics	**27**	**6.86%**

Node Coding	References	Coverage
Free Nodes\Weekly Meetings	**5**	**1.69%**

8.10 Total Node Summary of Additional Action Student Services

Total References	546
Coverage	1.70%
Total Users	1

8.11 Interview with Dr M Node Analysis

Internals\\Nvivo Data crunching\Interviews\Interview with Dr Mullins

Node	References	Coverage
Coding		
Cases\Interview with Dr Mullins	**1**	**100%**

Node	References	Coverage
Coding		
Free Nodes\- Unsure of what to categorise as	**12**	**3.02%**

Node	References	Coverage
Coding		
Free Nodes\Absence of Paper Based Handbook	**1**	**0.44%**

Node	References	Coverage
Coding		

Free Nodes\Accessibility	**5**	**4.05%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Action Required	**1**	**0.83%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Added Requirements	**2**	**1.03%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Admission through to Graduation	**1**	**0.65%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Appropriate Point of Contact	**3**	**1.32%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Appropriate Search Engine	**4**	**1.93%**

Node	References	Coverage
Free Nodes\Appropriateness and Suitability	**3**	**1.18%**

Node	References	Coverage
Free Nodes\Avoiding Conflict	**1**	**1.29%**

Node	References	Coverage
Free Nodes\Avoiding Duplication of Information	**1**	**1.29%**

Node	References	Coverage
Free Nodes\Badly Structured	**1**	**0.61%**

Node	References	Coverage
Free Nodes\Based on Outdated document	**2**	**0.55%**

Node	References	Coverage

Coding		
Free Nodes\Better Handbook indexing	**1**	**0.10%**

Node	References	Coverage
Coding		
Free Nodes\Categorisation	**6**	**4.05%**

Node	References	Coverage
Coding		
Free Nodes\Clarity of Structure and Breakdown	**1**	**1.38%**

Node	References	Coverage
Coding		
Free Nodes\Clear Guidelines	**1**	**0.77%**

Node	References	Coverage
Coding		
Free Nodes\Clear Route Map	**1**	**0.74%**

Node	References	Coverage
Coding		
Free Nodes\Communication by	**3**	**1.69%**

Email - Telephone - Fax

Node	References	Coverage
Free Nodes\Communication to Stakeholders	**1**	**0.48%**

Node	References	Coverage
Free Nodes\Compare and Contrast Layout	**4**	**2.70%**

Node	References	Coverage
Free Nodes\Comprehensive Levels of All student Guidelines	**2**	**0.97%**

Node	References	Coverage
Free Nodes\Concurrence	**18**	**1.70%**

Node	References	Coverage
Free Nodes\Conflicting	**1**	**0.84%**

Student and University Interpretation		
Node	**References**	**Coverage**
Coding		
Free Nodes\Conforming to Rules and Regulations	**1**	**0.83%**
Node	**References**	**Coverage**
Coding		
Free Nodes\Continuous Focus and Guidance	**2**	**1.69%**
Node	**References**	**Coverage**
Coding		
Free Nodes\Continuous Focus from Early stage to End	**1**	**1.32%**
Node	**References**	**Coverage**
Coding		
Free Nodes\Continuous Process Improvement	**3**	**1.35%**
Node	**References**	**Coverage**
Coding		
Free Nodes\Continuously	**4**	**1.62%**

Updating Information

Node	References	Coverage
Coding		
Free Nodes\Continuity	**1**	**0.47%**

Node	References	Coverage
Coding		
Free Nodes\Creating Student Focus at an Early Stage	**2**	**1.95%**

Node	References	Coverage
Coding		
Free Nodes\Cross Referencing Links	**1**	**0.67%**

Node	References	Coverage
Coding		
Free Nodes\Defining the Information Structure	**1**	**0.55%**

Node	References	Coverage
Coding		
Free Nodes\Describing Content and Sections	**1**	**1.38%**

Node	References	Coverage
Coding		
Free Nodes\Descriptive naming of Sections	**1**	**1.38%**

Node	References	Coverage
Coding		
Free Nodes\Design Testing	**1**	**0.63%**

Node	References	Coverage
Coding		
Free Nodes\Designing Tasks for Students	**1**	**1.94%**

Node	References	Coverage
Coding		
Free Nodes\Detailed Information	**2**	**1.84%**

Node	References	Coverage
Coding		
Free Nodes\Development Difficulty	**1**	**0.68%**

Node	References	Coverage
Coding		
Free Nodes\Development	**8**	**4.11%**

of WBIS

Node	References	Coverage
Coding		
Free Nodes\Different Developmental Stages	**1**	**0.46%**

Node	References	Coverage
Coding		
Free Nodes\Different Schools	**1**	**0.46%**

Node	References	Coverage
Coding		
Free Nodes\Different Ways of Communicating	**3**	**1.38%**

Node	References	Coverage
Coding		
Free Nodes\Different Handbook Versions and Functionality	**1**	**0.75%**

Node	References	Coverage
Coding		
Free Nodes\Difficulty in Locating Information	**5**	**3.18%**

Node	References	Coverage
Coding		
Free Nodes\Displaying Most Appropriate Information	**1**	**0.55%**

Node	References	Coverage
Coding		
Free Nodes\Document to Aid Students	**1**	**1.27%**

Node	References	Coverage
Coding		
Free Nodes\Documentation References	**1**	**1.31%**

Node	References	Coverage
Coding		
Free Nodes\Dr Mullins Perspective	**3**	**1.93%**

Node	References	Coverage
Coding		
Free Nodes\Ease of Information Access	**3**	**3.09%**

Node	References	Coverage

Coding		
Free Nodes\Effectiveness and Usefulness	**7**	**3.16%**

Node	References	Coverage
Coding		
Free Nodes\Emergent Aspects	**1**	**0.23%**

Node	References	Coverage
Coding		
Free Nodes\Emergent Information Requirements	**1**	**0.83%**

Node	References	Coverage
Coding		
Free Nodes\Emphasis on Information rather than Content and Structure	**1**	**0.55%**

Node	References	Coverage
Coding		
Free Nodes\Enhancing Handbook	**2**	**0.98%**

Node	References	Coverage
Coding		

Free Nodes\Excess Information	**1**	**0.61%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Fairly Comprehensive Handbook	**3**	**1.64%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Feedback	**10**	**4.49%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Focus on Need rather than Information Overload	**2**	**0.81%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Frequency of Use	**1**	**0.29%**

Node	**References**	**Coverage**
Coding		
Free Nodes\General and Formal Information	**1**	**1.31%**

Node	References	Coverage
Coding		
Free Nodes\Generating Useful Selection for Students	**3**	**1.44%**

Node	References	Coverage
Coding		
Free Nodes\Handbook may not be particularly good	**1**	**0.58%**

Node	References	Coverage
Coding		
Free Nodes\Help and Assistance	**1**	**0.48%**

Node	References	Coverage
Coding		
Free Nodes\Helps to retrieve most appropriate Information	**1**	**0.39%**

Node	References	Coverage
Coding		
Free Nodes\How to Submit Thesis to Library	**1**	**0.66%**

Node	References	Coverage
Free Nodes\Hyperlinking	**14**	**7.65%**

Node	References	Coverage
Free Nodes\Improving Handbook	**4**	**1.98%**

Node	References	Coverage
Free Nodes\Inaccessibility	**1**	**0.68%**

Node	References	Coverage
Free Nodes\Increase Communication	**1**	**0.48%**

Node	References	Coverage
Free Nodes\Increased Awareness of Handbook	**2**	**0.37%**

Node	References	Coverage
Free Nodes\Influencing the	**1**	**0.33%**

Design Process

Node	References	Coverage
Coding		
Free Nodes\Information Collation	**2**	**1.79%**

Node	References	Coverage
Coding		
Free Nodes\Information Gathering	**2**	**1.25%**

Node	References	Coverage
Coding		
Free Nodes\Information Required	**4**	**2.03%**

Node	References	Coverage
Coding		
Free Nodes\Information Retrieval	**4**	**2.13%**

Node	References	Coverage
Coding		
Free Nodes\Interaction between Student and Research Handbook	**3**	**3.22%**

Node	References	Coverage
Coding		
Free Nodes\Interaction with Web	**1**	**0.52%**

Node	References	Coverage
Coding		
Free Nodes\Interface Design	**2**	**0.97%**

Node	References	Coverage
Coding		
Free Nodes\Interview	**1**	**0.38%**

Node	References	Coverage
Coding		
Free Nodes\Iterative Process	**1**	**0.13%**

Node	References	Coverage
Coding		
Free Nodes\Just Updated Online Handbook Versions	**1**	**0.69%**

Node	References	Coverage
Coding		

Free Nodes\Key Issues	**1**	**0.65%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Laborious process in finding appropriate Structure	**1**	**0.30%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Layout and Design	**9**	**4.98%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Low frequency of Communication	**1**	**0.36%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Many sources of Information	**1**	**0.52%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Mapping the Process	**1**	**1.23%**

Node	References	Coverage
Coding		
Free Nodes\Meet or Communicate	**1**	**0.48%**

Node	References	Coverage
Coding		
Free Nodes\Minor Accommodating difficulties	**1**	**0.58%**

Node	References	Coverage
Coding		
Free Nodes\Minor Structural Changes	**1**	**0.61%**

Node	References	Coverage
Coding		
Free Nodes\Moved from Paper based to Electronic Submission	**1**	**0.39%**

Node	References	Coverage
Coding		
Free Nodes\Multiple Handbooks	**1**	**0.70%**

Node	References	Coverage
Free Nodes\Need of Clarity	**1**	**0.24%**

Node	References	Coverage
Free Nodes\New Approach	**1**	**0.17%**

Node	References	Coverage
Free Nodes\No Paper Handbook Archive	**1**	**0.69%**

Node	References	Coverage
Free Nodes\Not School Handbook	**1**	**0.44%**

Node	References	Coverage
Free Nodes\Not User friendly	**1**	**0.31%**

Node	References	Coverage

Free Nodes\Online Availability of Handbook	**1**	**0.45%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Online Handbook Web-based Information System	**2**	**0.92%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Online Web Survey	**1**	**0.39%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Only as Required	**1**	**0.58%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Open Ended Feedback	**1**	**0.50%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Organising	**2**	**1.10%**

Levels of Information

Node	References	Coverage
Coding		
Free Nodes\Overall Picture	**1**	**0.78%**

Node	References	Coverage
Coding		
Free Nodes\Overcome Communication Problems	**1**	**0.66%**

Node	References	Coverage
Coding		
Free Nodes\Overcoming Critical Problems	**19**	**11.63%**

Node	References	Coverage
Coding		
Free Nodes\Paper Based Handbook	**3**	**1.43%**

Node	References	Coverage
Coding		
Free Nodes\Paper based system	**2**	**1.08%**

Node	References	Coverage

Node	References	Coverage
Coding		
Free Nodes\Pictures and Illustrations	**1**	**0.51%**

Node	References	Coverage
Coding		
Free Nodes\Primary Source Information	**1**	**0.69%**

Node	References	Coverage
Coding		
Free Nodes\Problem Locating Information	**3**	**2.78%**

Node	References	Coverage
Coding		
Free Nodes\Problem Solving	**1**	**0.66%**

Node	References	Coverage
Coding		
Free Nodes\Progress Report	**1**	**0.20%**

Node	References	Coverage
Coding		
Free Nodes\Question about	**3**	**1.64%**

Sufficient Information

Node	References	Coverage
Coding		
Free Nodes\Questioning Students Intentions	**2**	**0.42%**

Node	References	Coverage
Coding		
Free Nodes\Range and Complexity of Handbook	**1**	**0.61%**

Node	References	Coverage
Coding		
Free Nodes\Recent Changes to Regulation	**2**	**3.47%**

Node	References	Coverage
Coding		
Free Nodes\Reduction of Inaccuracies	**1**	**1.29%**

Node	References	Coverage
Coding		
Free Nodes\Relevant Student Information	**3**	**2.39%**

Node	References	Coverage
Coding		
Free Nodes\Responsible for Up Keep of Research Student Handbook	**1**	**0.66%**

Node	References	Coverage
Coding		
Free Nodes\Rigorous Testing	**1**	**0.63%**

Node	References	Coverage
Coding		
Free Nodes\Section listing Proforma	**1**	**0.69%**

Node	References	Coverage
Coding		
Free Nodes\Seek information elsewhere	**1**	**0.61%**

Node	References	Coverage
Coding		
Free Nodes\Shared Experience from past Students	**1**	**0.29%**

Node	References	Coverage
Coding		
Free Nodes\Skills Training Stages	**1**	**0.62%**

Node	References	Coverage
Coding		
Free Nodes\Specific and Relevant to Research	**2**	**1.32%**

Node	References	Coverage
Coding		
Free Nodes\Structure of Information	**3**	**2.31%**

Node	References	Coverage
Coding		
Free Nodes\Student Advisory Support	**2**	**6.13%**

Node	References	Coverage
Coding		
Free Nodes\Student and Research Handbook	**58**	**36.39%**

Node	References	Coverage
Coding		

Free Nodes\Student Requirements	**8**	**3.48%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Student Requirements other than Handbook	**1**	**0.68%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Student Satisfaction through Usage	**3**	**1.22%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Students	**1**	**0.36%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Sub section for Research Student Handbook	**4**	**2.18%**

Node	**References**	**Coverage**
Coding		
Free Nodes\Sufficient	**1**	**0.50%**

Information

Node	References	Coverage
Free Nodes\Textual Format Handbook	**1**	**0.69%**

Node	References	Coverage
Free Nodes\Time constraint	**4**	**1.83%**

Node	References	Coverage
Free Nodes\Time-to-Market	**1**	**0.46%**

Node	References	Coverage
Free Nodes\Too many levels to search	**2**	**1.29%**

Node	References	Coverage
Free Nodes\Top Level Categories	**2**	**0.93%**

Node	References	Coverage
Coding		
Free Nodes\Unable to report back errors	**1**	**0.61%**

Node	References	Coverage
Coding		
Free Nodes\Updating Information	**2**	**1.02%**

Node	References	Coverage
Coding		
Free Nodes\Usability	**1**	**0.54%**

Node	References	Coverage
Coding		
Free Nodes\User Demands	**9**	**4.91%**

Node	References	Coverage
Coding		
Free Nodes\User Friendliness	**16**	**9.82%**

Node	References	Coverage
Coding		
Free Nodes\Web-based	**3**	**1.57%**

Aesthetics		
Node Coding	**References**	**Coverage**
Free Nodes\Yearly Review	**6**	**2.58%**

8.12 Total Node Summary of Dr M Interview

Total References	423
Coverage	2.31%
Total Users	1

8.13 K's Questions Node Analysis

Internals\Nvivo Data crunching\Interviews\K Questions		
Node Coding	**References**	**Coverage**
Cases\K - Administrator	**1**	**100%**
Node Coding	**References**	**Coverage**
Free Nodes\- Unsure of what to categorise as	**1**	**1.40%**
Node Coding	**References**	**Coverage**

Free Nodes\Adaptability and Flexibility to Change	**1**	**1.98%**

Node Coding	**References**	**Coverage**
Free Nodes\Changes with Microsoft Word and Sent Via Email	**1**	**5.87%**

Node Coding	**References**	**Coverage**
Free Nodes\Check List of Paper Based Systems	**1**	**5.30%**

Node Coding	**References**	**Coverage**
Free Nodes\Computer Literacy	**1**	**2.10%**

Node Coding	**References**	**Coverage**
Free Nodes\Consultation and Co-operation	**1**	**2.79%**

Node Coding	**References**	**Coverage**
Free Nodes\Controlling Influence	**3**	**7.16%**

Node Coding	References	Coverage
Free Nodes\Development Difficulty	**1**	**0.28%**

Node Coding	References	Coverage
Free Nodes\Disagreement of accommodating content change	**1**	**1.91%**

Node Coding	References	Coverage
Free Nodes\Editing and Uploading Problems	**2**	**3.39%**

Node Coding	References	Coverage
Free Nodes\Email Inbox Flooded	**2**	**2.58%**

Node Coding	References	Coverage
Free Nodes\Emergent Aspects	**1**	**2.14%**

Node Coding	References	Coverage
Free Nodes\Enhancing Web-based Aesthetics	**1**	**1.77%**

Node Coding	References	Coverage
Free Nodes\Established way of working	**1**	**1.66%**

Node Coding	References	Coverage
Free Nodes\Gaining Approval	**1**	**1.50%**

Node Coding	References	Coverage
Free Nodes\I don’t feel confident enough to change the process	**2**	**3.96%**

Node Coding	References	Coverage
Free Nodes\International Appeal	**1**	**1.54%**

Node Coding	References	Coverage
Free Nodes\Lack of Confidence	**1**	**1.08%**

Node Coding	References	Coverage
Free Nodes\Maintaining office	**1**	**8.15%**

systems

Node Coding	References	Coverage
Free Nodes\My deadline is fixed	**2**	**1.64%**

Node Coding	References	Coverage
Free Nodes\Paper based system	**1**	**0.41%**

Node Coding	References	Coverage
Free Nodes\Possible Solution to Size of email problem	**1**	**3.87%**

Node Coding	References	Coverage
Free Nodes\Same system from previous years	**1**	**0.71%**

Node Coding	References	Coverage
Free Nodes\Start Development Process Early	**1**	**1.50%**

Node Coding	References	Coverage

Free Nodes\Time constraint	**2**	**2.46%**

Node Coding	**References**	**Coverage**
Free Nodes\Time consuming	**2**	**1.91%**

Node Coding	**References**	**Coverage**
Free Nodes\Variety of software packages	**1**	**3.06%**

Node Coding	**References**	**Coverage**
Free Nodes\Web-based Aesthetics	**1**	**1.50%**

8.14 Total Node Summary of K's Questions

Total References	37
Coverage	5.99%
Total Users	1

8.15 Brunel University Management Structure