Evolution of a Discipline: The History of the Formation and Growth of the Information Systems Discipline in Victorian Universities from 1960 to 2011

by

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Table of Contents

List of Tables .... **v**
List of Figures .... **vii**
List of Appendices .... **x**
Abstract .... **xi**
Declaration .... **xii**
Acknowledgements .... **xiii**

CHAPTER 1: INTRODUCTION AND CONTEXT FOR THE STUDY 1

1.1 Introduction to the study 1

1.2 Background and rationale for the study 1

1.3 Features of the study and its contribution to knowledge 2

1.4 Study objectives and research questions 5

1.5 Structure of the thesis 6

CHAPTER 2: THE EDUCATIONAL CONTEXT: UNIVERSITIES, DISCIPLINES AND THEIR CURRICULA 8

2.1 Chapter content and purpose 8

2.2 Universities as educational institutions 9

2.3 The structure of knowledge and the concept of disciplines 12

2.4 Curriculum as an educational problem 16

2.5 Disciplines, curricula and the roles of the university 19

2.6 Universities and the Australian Higher Education System 21

2.7 Conclusions and implications 28

CHAPTER 3: INFORMATION SYSTEMS AS AN ACADEMIC DISCIPLINE: ITS ORIGINS AND EVOLUTION 31

3.1 Introduction to IS as a discipline 31

3.2 Pre-history – IS before computers? 32

3.3 The information systems discipline as an intellectual construct 34
3.3.1 In the Beginning … : Computers, Data Processing and MIS 34
3.3.2 Beyond MIS: 1980-1996 41
3.3.3 The 'anxiety discourse' and the search for identity: 1996 - present day 45

3.4 The social dimension: the role of the ACM and the DPMA 51

3.5 IS curriculum and the ACM model curriculum 54

3.5.1 1973 - the first IS model curriculum 55
3.5.2 1981 – The first ACM model up-grade and the DPMA alternative model curriculum 59
3.5.3 Unification and the combined curriculum – IS95, IS97 and IS2002 62
3.5.4 Flexibility and a change in orientation - IS2010 65

3.6 Conclusions 68

CHAPTER 4: HISTORICAL RESEARCH AND THE CONDUCT OF THE STUDY 70

4.1 The study and its research method 70

4.2 Key problems and controversies in the study of history and historical research method 71
4.2.1 The purpose of historical research 73
4.2.2 Selection of themes for historical research 75
4.2.3 Explanation, interpretation and the use and development of theory in historical research 76
4.2.4 Knowing the past: facts and their sources 77
4.2.5 Historical writing and the use of narrative 78
4.2.6 Objectivity in historical research 80

4.3 The research approach adopted in this study 81
4.3.1 Conduct and scope of the study 82
4.3.2 The purposes of the study 83
4.3.3 Study themes 85
4.3.4 Use of theory 86
4.3.5 Data sources for the study 90
4.3.6 Presentation of findings 91
4.3.7 Objectivity and the researcher's biases 92

4.4 Conclusions and implications for the study 93

CHAPTER 5: ORIGINS AND EARLY DEVELOPMENT: COMPUTING EDUCATION AND THE ORIGINS OF IS PROGRAMS IN VICTORIAN TERTIARY EDUCATION INSTITUTIONS - 1960-1990 94

5.1 Introduction and overview 94

5.2 Computers, computing and the origins of computer education in Australia 95

5.3 Overall patterns in the establishment of computing and information-related programs 98

5.4 An overview of applied computing programs – their origins and patterns of growth 101

5.5 Disciplinary influences on applied computing programs 104
5.5.1 Business-based applied computing programs 104
5.5.2 Science-based applied computing programs 107
5.5.3 Information-based applied computing programs 109
5.5.4 Implications 111

5.6 Market influences: Industry and student demand for applied computing 111

5.7 Structural issues: The institutional location of applied computing programs 115

5.8 Information Systems and applied computing 119

5.9 Curriculum content of applied computing and Information Systems programs 123

5.9.1 General patterns in applied computing curricula 123
5.9.2 Information Systems curricula 127

5.10 Summary 128

CHAPTER 6: ESTABLISHING THE DISCIPLINE: IS AND IS CURRICULUM IN VICTORIAN UNIVERSITIES FROM 1990 TO 1997 131

6.1 The impact of the Dawkins reforms 131

6.2 Overview: Overall patterns in Computing/IT departments and programs 133

6.3 Structural and disciplinary influences on the formation of IS departments and programs 135
6.3.1 IS programs in business faculties 136
6.3.2 IS programs in science faculties 143
6.3.3 IS programs in computing faculties 150
6.3.4 Summary 153

6.4 Market issues for IT and IS – levels of student demand 155

6.5 IS Curriculum 160
6.5.1 Programs with origins in Business 162
6.5.2 Programs with origins in Science 165

6.6 Summary and conclusions 166

CHAPTER 7: RISE AND FALL - THE EVOLUTION OF IS AND IS CURRICULUM IN VICTORIA FROM 1997 TO 2011 169

7.1 Introduction and overview of developments in this period 169

7.2 Overall patterns in the development of IT and information-related programs 170

7.3 Market demand for IT and IS programs 173
7.3.1 Demand for IT in secondary schools 174
7.3.2 Student preferences and enrolments for IT programs overall 176
7.3.3 Program-level data on trends in student demand for IT programs 178
7.3.4 Student demand for IS programs 182

7.4 Disciplinary and structural impacts on IS 185
7.4.1 IS department/program formation 186
7.4.2 Disciplinary diversification and expansion of scope of IS 189
7.4.3 Mergers of IS with other established disciplines 191
7.4.4 Downgrading or closure of IS disciplinary program 194
7.4.5 Outcome of changes in IS departments and programs 197

7.5 Curriculum content of IS programs 198
7.5.1 The core curricula of IS programs 199
7.5.2 Elective units offered in IS programs 202

7.6 Summary 205

CHAPTER 8: AN ORGANIZATIONAL CASE STUDY OF THE EVOLUTION OF IS AND IS CURRICULUM 208

8.1 Monash University as an organizational case study **208**

8.2 Monash as an institution **210**

8.3 1960-1990: From the origins of computing to the Dawkins reforms **212**
8.3.1 Computing and IS at Monash 213
8.3.2 Computing and Information Systems at Caulfield/Chisholm 220
8.3.3 Computing and Information Systems at GIAE 225
8.3.4 Summary - key influences on computing and IS at Monash Clayton and at CTC/CaIT/CIT 226

8.4 1991-1997: IS at Monash after the Dawkins reforms **228**
8.4.1 The Dawkins mergers and the formation of the Faculty of Computing and IT 228
8.4.2 IS at Monash Clayton – The Department of Business Systems and the Bachelor of Business Systems 233
8.4.3 IS at CIT/Monash(Caulfield) – the DIS and the BIS 236
8.4.4 Computing and Information Systems at the Gippsland and Peninsula campuses 239
8.4.5 DLAR and the Bachelor of Information Management 240
8.4.6 Summary of developments in IS in this period 244

8.5 1997-2002: Expansion and growth **245**
8.5.1 Overview of developments in IT at Monash 245
8.5.2 Business Systems at the Clayton campus 249
8.5.3 IS and Information Management and Systems at the Caulfield campus 250
8.5.4 Summary of developments in IS during this period 260

8.6 2003-present: Decline and program closure **262**
8.6.1 Overview of developments in IT at Monash 262
8.6.2 Overview of Impacts on IS at Monash 267
8.6.3 IS at Clayton - the Bachelor of Business Information Systems (BBIS) 268
8.6.4 IS at Caulfield – the IS major 270
8.6.5 Summary of developments in IS in this period 272

8.7 IS curriculum **273**
8.7.1 IS curriculum at Monash Clayton 274
8.7.2 IS curriculum at Chisholm/Monash Caulfield 276
8.7.3 Summary of curriculum evolution 282

8.8 Summary and conclusions **283**

CHAPTER 9: SUMMARY AND CONCLUSIONS 286

9.1 Introduction **286**

9.2 “Showing what actually happened” and understanding why **286**

9.3 Implications of the study **293**

9.4 Value of the study and directions for future research **300**

REFERENCES 302

List of Tables

Table 2.1 Disciplinary groupings as a reflection of differences in the nature of their knowledge content 14

Table 2.2 The main mergers of Victoria institutions which followed from the Dawkins reforms to the tertiary education system 26

Table 2.3 Student enrolment profiles for Victorian universities in 2011................. 28

Table 5.1 Program objectives for a sample set of applied computing programs .. 103

Table 5.2 Academic department and/or programs which were known by the name of 'Information Systems' in 1990 120

Table 5.3 Major study areas in computing as designated in 1990 VTAC Guide 121

Table 6.1 Impact of mergers on the creation of business-based IS programs and departments 137

Table 6.2 Impact of mergers on the creation of science-based IS programs and departments .. 144

Table 6.3 Impact of mergers on the creation of IS programs and departments in computing-oriented faculties 150

Table 6.4 Overview of specialist IS departments and academic programs in existence in 1996/97 154

Table 6.5 IT programs used in analysis of student demand for IT 157

Table 7.1 IS teaching departments and undergraduate programs in 2011........... 198

Table 8.1 Key influences on the evolution of IS: 1960-1990................................. 227

Table 8.2 Total enrolments in BBusiness Systems Degree.................................... 236

Table 8.3 Measures of student demand for BIM, 1996-98.................................... 242

Table 8.4 Key influences on the evolution of IS: 1990-1997.................................. 244

Table 8.5: Measures of Student Demand for BBusiness Systems, 1997-02............ 250

Table 8.6 SIMS Academic structure, staffing and teaching in February 2000 257

Table 8.7: Measures of market demand for BIMS/BIS, 1997-02............................. 259

Table 8.8: Key influences on the evolution of IS: 1997-2003 261

Table 8.9: Measures of market demand for BBusiness Systems/ 269
BBusiness Information Systems, 2003-2011

Table 8.10: Measures of market demand for Information Systems at Caulfield 272
Campus, 2002-2011

Table 8.11: Key influences on the evolution of IS: 2003-2011 273

Table 8.12: Core IS units at Caulfield campus, 1991 277

Table 8.13: Units in IS Major at Caulfield campus, 1991-1996 278

Table 8.14 Elective units in BIS, 1997 278

Table 8.15 BIMS Elective units, 2003 280

Table 8.16 BIS Elective units, 2004 281

List of Figures

Figure 3.1 Units and unit sequence in undergraduate curriculum, 1973.................. 58

Figure 3.2 Comparison of activities, degree programs, and supply and demand with respect to technical and organizational knowledge dimensions 60

Figure 3.3 Units and unit sequence in 1982 revised undergraduate curriculum 61

Figure 3.4 IS97 units and unit sequence 64

Figure 3.5 IS as a part of the CC2005 framework.. 66

Figure 3.6 IS2009 core units.. 68

Figure 4.1 Theoretical framework for the study... 86

Figure 5.1 Students graduating from CaIT/CIT applied computing programs......... 1966-1988 115

Figure 6.1 Sample IT Programs: Total of VTAC Preferences 1-4,........................... 1991-1997 158

Figure 6.2 Sample IT programs: Total of VTAC full-time enrolments,................... 1991-1997 158

Figure 6.3 Sample IT programs: Weighted average ENTER of Year 12 .... enrolled students, 1991-1997 158

Figure 7.1 Number of IT programs offered in all Victorian universities,................ 1997-2011 173

Figure 7.2 Enrolments in Year 12 IT units at Victorian secondary schools,............. 1992-2011 175

Figure 7.3 Domestic student demand for ASCED-classified IT programs,............... 1997-2011 177

Figure 7.4 Sample IT programs: Total of VTAC Preferences 1-4, 1997-2011........... 180

Figure 7.5 Sample IT programs: Number of Year 12 students offered places......... through VTAC, 1997-2011 180

Figure 7.6 Sample IT programs: Average of published Clearly-in ENTERs,.............. 1997-2011 180

Figure 7.7 IS programs: Total of VTAC Preferences 1-4, 1997-2011 183

Figure 7.8 IS programs: Number of Year 12 students offered places through........ 183
VTAC, 1997-2011

Figure 7.9 IS programs: Average of Published Clearly-in ENTERs, 1997-2011......... 183

Figure 8.1 Institutional Origins of Monash Computing.. 211

Figure 8.2 Students graduating from CIT applied computing programs,................ 223
1966-1988

Figure 8.3 Organizational Structure of Monash FCIT after the Dawkins 230
reforms

Figure 8.4 Total of VTAC preferences 1-4 for IT degrees at Monash 232
Clayton and Caulfield campuses

Figure 8.5 VTAC enrolments for IT degrees at Monash Clayton and 232
Caulfield campuses

Figure 8.6 Average ENTER Score of Year 12 Students Admitted to 232
Monash IT Programs at Clayton & Caulfield campuses

Figure 8.7 Total of VTAC Preferences 1-4 for IT Degrees at Monash...................... 235
Clayton and Caulfield Campuses, 1991-97

Figure 8.8 VTAC Enrolments for IT Degrees at Monash Clayton and 235
Caulfield campuses, 1991-97

Figure 8.9 Average ENTER Score of Year 12 Students Admitted to 235
Monash IT Programs at Clayton & Caulfield Campuses,
1991-97

Figure 8.10 Monash FIT Faculty Structure in 2002 246

Figure 8.11 Trends in Monash FIT Student Load : 1991-2002.................................. 247

Figure 8.12 Total of VTAC Preferences 1-4 for All Monash FIT Degrees,.................. 248
1997-2003

Figure 8.13 Total VTAC Enrolments in All Monash FIT Degrees, ... 248
1997-2003

Figure 8.14 Weighted ENTER of Year 12 Students Admitted to Monash.................. 248
IT Single Degree Programs - Clayton & C'field Campuses,
1997-2003

Figure 8.15 Trends in Monash FIT student load : 1991-2012................................... 263

Figure 8.16 FIT Full-time Equivalent Staffing Levels.. 263

List of Appendices
(Contained in Volume 2)

Appendix A Major studies of the nature of IS academic literature A1

Appendix B Outline of principal data sources used in the study B1

Appendix C Data relating to the development of applied computing and IS C1
programs at Victorian tertiary institutions from 1960-1990

Appendix D Data relating to the development of applied computing and IS D1
programs at Victorian tertiary institutions from 1990-1996

Appendix E Data relating to the development of applied computing and IT E1
programs at Victorian tertiary institutions from 1997-2011

Appendix F Data relating to the development of IS programs at Monash F1
University

Abstract

This thesis is an historical study of the development of the Information Systems (IS) discipline as it has been implemented in specialist academic departments and undergraduate programs in several Australian universities. The thesis traces the evolution of the discipline through the formation of these departments and their programs, and analyses the differences in perceptions of the nature of the discipline, as it has been expressed through their undergraduate program curricula. As well as examining the development of IS across the group of universities as a whole, the study also provides an in-depth case study of the formation and growth of the discipline within Monash University, which is the largest university in the group, and also the largest in Australia.

The main stimulus for the research was the ongoing debate about the nature of IS as an academic discipline. Debate and discussion about a variety of issues relating to the nature of IS have been a major theme in the discipline's academic literature since the time of its birth as a field of study in the early 1960s. The last decade has seen an intensification of these controversies, with few signs of any resolution of the differences in perceptions of the discipline. The study uses the examination of the implementation of the discipline in practice across the case study universities as a means of describing the key differences in perceptions of the nature of the discipline, analysing and understanding how these different perceptions have formed, and assessing their implications for the discipline's future.

The study shows that across the case study universities, the formation and growth of the discipline has generally followed an evolutionary path. Differences in perceptions of the nature and cognitive content of the discipline have followed as a consequence of differences in its evolutionary path in each university. Three interacting sets of forces are identified as having been the dominant influences on these patterns of evolutionary growth:

- Disciplinary forces: Felt through the influence of the 'parent' discipline from which IS programs evolved; they caused each IS department/program to inherit, at least in part, some of that discipline's key characteristics.
- Organizational structural influences: Felt through organizational decision-making within each university about where the academic groups which taught IS programs should be located relative to other disciplines.
- Market forces: Felt initially through the influence of the nature of work force demand for skilled computing professionals, and then through the impact of changes in patterns of student demand for IT-related programs.

The study shows how the unique combination of these influences shaped the IS discipline and its curriculum in each university. It shows how the differences in these influences were reflected in differences in the nature of the discipline as practised in each institution, and how these were in turn expressed through variations in the curricula of their undergraduate IS programs. In doing so, the study demonstrates the contribution which historically-based research of the implementation of IS in practice can make to our understanding of the discipline and its future prospects.

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution. The thesis is my own work and contains no material previously published or written by another person, except where due reference is made in the text.

Martin Atchison

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Chapter 1: Introduction and context for the study

1.1 Introduction to the study

This thesis examines the nature of the Information Systems (IS) discipline as it has been implemented in specialist IS academic departments and undergraduate programs in a number of Australian universities. The thesis traces the evolution of the discipline through the formation of these departments and their programs, and analyses their conception of the nature of the discipline, as it has been expressed through their program curricula.

The group of tertiary education institutions chosen for the study comprises all the universities currently based in the state of Victoria in Australia. The study begins with a broad overview of the origins and early development of undergraduate IT programs of all types in these institutions, and tracks the evolution of all the departments and programs which subsequently came to identify themselves as being associated with the IS discipline. In addition to this broad investigation of the development of IS across the group of universities as a whole, the study also provides an in-depth case study of the formation and growth of the discipline within Monash University, which is the largest university in the group, and also the largest in Australia. This case study examines in more detail some of the key aspects of disciplinary development which emerged from the cross-institutional component of the study.

In its investigation of the evolutionary paths followed by the IS programs and departments within these universities, the study seeks to identify the differences in the influences which shaped the discipline at each one. It examines how the differences in these influences were reflected in differences in the nature of the discipline as practised in each institution, and how these were in turn expressed through variations in the curricula of their undergraduate IS programs. In doing so, the study aims to find what insights an historical analysis of the evolution of IS and its curriculum can contribute to our understanding of the current state of the discipline and its prospects in the future.

1.2 Background and rationale for the study

The main stimulus for the research on which the thesis is based is the ongoing debate about the nature of Information Systems (IS) as an academic discipline. Almost since the time of its birth as a field of study in the early 1960s, the discipline has been plagued by doubts and divisions over a variety of issues relating to its identity and disciplinary boundaries, its core components, its research methods and its claims to disciplinary legitimacy. The study of the nature of the discipline itself has been a popular theme in the IS academic literature, which is replete with examples of research directed towards developing an understanding of its key characteristics. The following are just a few of the aspects of the discipline which have subject to work of this kind, together with representative examples of studies of each one, spread across the history of the discipline:

- the dominant themes in the published IS literature (for example, Hamilton & Ives (1982), Farhoomand (1987), Alavi & Carlson (1992), Swanson & Ramiller (1993), Claver et al (2000), Vessey et al (2002), Chen & Hirschheim (2004));
- the concepts and artifacts which are held to constitute the fundamental core of IS (for example, Banville & Landry (1989), Wand & Weber (1995), Hirschheim et al (1996),

Checkland & Holwell (1998), Orlikowski & Iacono (2001), Benbasat & Zmud (2003), Nevo et al (2009));

- the characteristics of its academic community (for example, Culnan (1987), Athey et al (1993), Jiang & Rajasekaran (1995), Avgerou et al (1999), Sherer (2002), Clark & Warren (2006);
- its scholarly journals (for example, Vogel & Wetherbe (1984), Gillenson & Stutz (1991), Hardgrave & Walstrom (1997), Mylonopoulos & Theoharakis (2001));
- its research methods (for example, Mumford et al (1985), Lee (1991), Orlikowski & Baroudi (1991), Landry & Banville (1992), Galliers (1993), Walsham (1995), Lee (1999).

Studies such as these have provided important insights into the characteristics of the field as it has evolved, but they have failed to resolve the fundamental questions about the nature of IS as a discipline. In fact the last decade has seen an intensification of the controversy, with many of the discipline's leading scholars engaged in vigorous debate over the key issues (for example, see King & Lyytinen (2006)). In the eyes of some of these scholars, the ongoing conflict over these issues constitutes a crisis for the discipline. They believe that the inability of its academic practitioners to resolve them conveys a sense of division and disunity which may damage the standing of IS in the academic community, and may even lead to its extinction (see for example, Benbasat & Weber (1996), Markus (1999), Weber (2003), Benbasat & Zmud (2003), Hirschheim & Klein (2003)). On the other hand, other distinguished figures in the field have been more sanguine, arguing that conflicts of this nature are inevitable in a discipline as young as IS. In fact some see differences of opinion on these issues as a defining feature of the discipline; they believe the diversity of its characteristics and of the views of its practitioners about its characteristics should be regarded as a strength rather than a weakness (see, for example, King (1993), Robey (1996), Baskerville (2002), King & Lyytinen (2004) and Galliers (2003)).

In recent years, the debates over the nature of IT have been given an extra edge by the widespread trend of decline in student enrolments in IT-related courses (George et al, 2005, Granger et al, 2007, Hirschheim, 2007, Walstrom et al, 2008). This trend has not been confined to IS programs, and has affected other IT disciplines such as Computer Science, Computer Engineering and Software Engineering. But some scholars believe that the absence of a unified and consistent view of the IS discipline has exacerbated the impact of its declining student enrolments, and may jeopardise its existence in some universities.

The persistence of these debates over the nature of the discipline throughout its history, and the extent to which they have been the focus of attention of its leading scholars during the last decade provides a clear justification for research in this area.

1.3 Features of the study and its contribution to knowledge

Much of the published research about the nature of IS has been based on discussions of an abstract theoretical or philosophical nature about the characteristics required of an academic discipline or on inductivist analyses of its research literature. Given the prevalence of this form of research, it seemed unlikely that much could be gained from an additional study of that type. Instead it was felt that a more useful approach would be to investigate the implementation of IS in practice, with a particular focus on the IS undergraduate curriculum as the embodiment of the key elements of the discipline. To date there have been relatively few studies of the IS discipline and its curriculum in universities, and the studies which have addressed this theme have tended to focus on their current state, rather than on the factors which caused them to take that form. This study was based on the belief that historically-based research, which examined the evolution of the discipline from the time of its formation, might expose some of the factors which had caused the present-day disciplinary divisions and curriculum differences.

Therefore, the study can claim three features which combine to distinguish it from previous published research on the nature of IS:

(i) The study focuses on the historical evolution of the discipline: Despite the amount of time and effort devoted to reflection and introspection about the discipline, the IS academic literature has shown few signs of interest in the history of the discipline and the way in which it has evolved. Hirschheim & Klein (2012) suggested that 'the last serious analysis' of the history of the field was conducted by Dickson in 1981. On the local scene, Clarke (2006) noted that he could find "…no formal histories of the discipline in Australia …., and few of the discipline elsewhere" (p123). Issues relating to the discipline's evolving role and influence on computer usage have figured in some historical studies about the impacts of computers and computer systems, but the primary interest and orientation of these studies was not on the nature of the discipline itself.

    In neglecting the history of their discipline, IS scholars seem oblivious to the important role it can play in addressing issues of disciplinary identity and legitimacy. In his famous study of the progress of science, Kuhn (1962) argued that disciplinary histories are one device commonly used to create a sense of unity and cohesion, and to maintain support for dominant disciplinary paradigms. In their study of the functions and uses of disciplinary histories, Graham et al (1983) highlighted a variety of ways in which these histories have addressed problems of identity and academic legitimacy across a range of disciplines. For IS, where there currently appears to be no dominant paradigm and much confusion over questions of identity and legitimacy, an understanding of history can help both to explain how alternative paradigms have formed, and to serve as a justification for them.

    By providing a historical analysis of the development of the IS discipline within the selected institutions, the study aims to examine the ways in which variations in the discipline's origins and evolutionary path within each institution have affected the form which the discipline and its curriculum have taken.

(ii) The study focuses on the organizational status and placement of the discipline in universities: One of the achievements which the IS literature has often claimed for the discipline has been its success in building a significant community of scholars who identify themselves and their work as belonging within IS. Measures which are commonly used as evidence of this success include such things as the numbers of scholars belonging to IS professional groups or labelling themselves as IS academics, the number of authors and papers submitted to IS journals, attendance at IS conferences, and the like. Although these are undoubtedly important and useful indicators of the levels of interest in IS in the academic community overall, they do not say anything about the strength of the discipline in terms of the organizational structures which are in place to support and maintain it within tertiary institutions. Regardless of the strength of its 'virtual' global community, a discipline needs to have a secure place within institutional structures to ensure its survival and ability to grow.

The study examines and compares the nature of the academic environments in which IS has formed and become established within the organizational structures of the universities being studied. This analysis is used to assess the ways in which organizational factors have affected the development of the discipline and the form which it has taken in these universities, and their impact on the level of success which IS has achieved in its attempts to establish a strong disciplinary presence.

(iii) The study focuses on the undergraduate curriculum offered by universities as a key expression of the nature of the discipline: An underlying assumption of the study is that an academic curriculum should reflect the fundamental concepts of a discipline, as it is perceived within an academic institution. At undergraduate level the curriculum aims to initiate students into a discipline, to teach them its basic concepts and core content, and prepare them for professional careers as its practitioners or for advanced study as its future scholars (Marsh, 1997). Within an academic institution, curriculum plays an essential role in defining the identity of a discipline within that institution, and establishing its place within the overall framework of the institution's academic programs.

Aside from studies of curriculum in principle aimed at prescribing idealised curriculum models, studies of IS curriculum in practice have generally taken the form of individual studies outlining aspects of the curriculum at a specific institution (for example, Dwyer & Knapp (2004) and Soe & Hwang (2007)) or broadly-based studies of the general patterns of curriculum across many institutions (for example, Athey (1990), Maier & Gambill (1996), Gill & Hu (1998), Williams & Pomykalski (2006), Kung et al (2006), Apigian & Gambill (2010) and Sagheb-Tehrani (2011). This study aims to steer a middle course between these two approaches, by giving a detailed comparative analysis across a number of universities, which will highlight points of similarity and of contrast between their IS undergraduate disciplinary curricula. The results of this analysis offers valuable insights into the points of similarity and difference in the way in which a discipline is perceived within those institutions.

There have been few studies published in the IS literature which have focussed on any one of these features of the discipline individually, and none which have combined consideration of all three. The nearest such study in Australia was a recent project investigating the current state of the IS discipline in Australia and selected countries in the Pacific rim. Its overall results can be found in (Gable et al, 2008), and detailed analyses of the findings for specific groups of universities were published in special issues of the

Australian Journal of Information Systems (AJIS, 2006) and the Communications of the AIS (CAIS, 2007).

Gable et al's (2008) study provided a useful inventory of IS-oriented departments, and offered a valuable overview of the way in which the discipline has spread throughout the region. But it was carried out at too broad a level to provide the depth of insight which this study aims to achieve. In particular it did not address any of the three key areas of focus described above for this study: it focussed mainly on the current state of the discipline at each university and its recent past, without examining the historical factors which influenced its formation and growth; it imposed a relatively standardised framework as the basis for analysis of the position which IS occupied in the academic hierarchy at each institution, which limited its coverage of the way in which these organizational circumstances had affected the nature of the disciple; and it gave little attention to the specifics of the curriculum taught at each institution. (Gable (2006) noted that the original intention of his study had been to include an analysis of the historical evolution of the discipline, but this had proved too difficult, and was not pursued).

Therefore, in its focus on these three aspects of IS, the study makes a significant and original contribution to our understanding of the nature of the discipline and the causes of the disciplinary divisions which have pre-occupied its scholars throughout its existence.

1.4 Study objectives and research questions

The issue of the nature of the outcomes which can be achieved through an historical study of this kind is a complex and controversial one, which will be addressed in detail in Chapter 4. For the present, the key purposes which the thesis aims to achieve and the specific questions which it aims to answer can be grouped into three broad categories as follows:

(i) Descriptive/exploratory: The thesis aims to provide a factual description of the key events in the formation of the IS discipline and the main patterns in the evolutionary development of the discipline and its undergraduate curriculum in the institutions being studied. Typical key questions to be addressed by the study are:

- What were the historical roots of the IS discipline as it emerged within each university?
- Where was the IS discipline positioned within the organizational structures of each university, and how has its position changed over time?
- How has the content of the IS curriculum developed and changed over time within each university?
- What are the key points of similarity and differences in the way in which the IS discipline has became established in the universities being studied?

(ii) Analytical/explanatory: The analytical/explanatory elements of the thesis have two different focuses, one directed internally at the institutions being studied and the other externally at the IS discipline as a whole. The internal focus aims to identify and analyse the key causal factors which influenced the development of the IS discipline within the institutions being studied. The external focus aims to use the findings from the analysis of these institutions as a basis for explaining the nature of the IS discipline and its curriculum problems which affect the IS discipline. Typical key questions to be addressed by the study in this area are:

- What were the main historical influences which affected the form which the IS discipline and its curricula took at each university?
- How do the IS curricula at the universities compare with one another?
- How does the discipline as expressed through the university curricula compare with the conceptualisations of the discipline published in the academic literature and its curriculum models?
- To what extent can the similarities and differences in the implementation of IS in its curricula at different universities be attributed to historical influences?

(iii) Predictive/prescriptive: The final aim of the thesis is to use the experiences at these universities as the basis for assessing the future prospects for the discipline, and for suggesting what (if anything) the discipline can or should do to address its identity crisis. As with the analytical/explanatory issues, the focus is directed both internally at the institutions being studied and the externally at the IS discipline as a whole. Typical key questions to be addressed by the study in this area are:

- What does the history of IS at these universities suggest about the future prospects for the discipline at each one?
- What lessons do the differences in the progress of the discipline at each of these universities have for the overall future of IS?

1.5 Structure of the thesis

The thesis consists of nine chapters, which can be grouped into two parts as follows.

Chapters 1-4 provided the essential context to the study; they review the background literature, and describe and explain the research method which was used:

- Chapter 1 introduces the study and provides the rationale for its content and research approach.
- Chapter 2 provides a brief discussion of the fundamental educational concepts relating to universities, academic disciplines and their curricula which are integral to the study of an academic discipline. It also identifies the universities which were used in the study, and briefly identifies their main characteristics within the context of the Australian higher education system.
- Chapter 3 provides a number of the theoretical perspectives of the nature of the IS discipline as expressed through the IS academic literature and through an influential model IS undergraduate curriculum.
- Chapter 4 discusses the nature of historical research, describes the key features of the research method followed in the study, and assesses its main strengths and deficiencies.

Chapters 5-9 set out the key research findings of the study and analyse and discuss their implications:

- Chapter 5 describes and analyses the evolution of IS in tertiary institutions in Victoria from 1960 to 1989;
- Chapter 6 describes and analyses the evolution of IS in universities in Victoria from 1989 to 1996;

- Chapter 7 describes and analyses the evolution of IS in universities in Victoria from 1997 to 2011;
- Chapter 8 gives a case study of the evolution of IS at Monash University from the early 1960s to 2011;
- Chapter 9 summarises the key findings of the study and its implications for the discipline

Chapter 2: The educational context: Universities, disciplines and their curricula

2.1 Chapter content and purpose

The aim of this chapter is to provide a brief discussion of some of the fundamental educational concepts which underlie the main themes of the study. This discussion may appear at first to be far removed from the study's primary purpose of studying the nature of IS, but it provides essential context for the remainder of the study. The importance of this context will become more apparent in the next chapter, which will show how the long-running debates about the nature of IS referred to in Chapter 1 have frequently raised (sometimes directly and sometimes by implication) major issues relating to these fundamental concepts.

The first half of the chapter is devoted to a brief theoretical overview of three educational entities which are central to any study of the nature of an academic discipline:

- Universities - their role and purpose as institutions within the higher education system;
- Disciplines and the structuring of knowledge – the nature of academic disciplines as a method of structuring knowledge, the key characteristics which define disciplines, and the processes by which they are formed and achieve academic legitimacy;
- Curriculum - the nature and purpose of an educational curriculum as an expression of the core concepts of an academic discipline.

The discussion focuses on each of these elements in turn as an abstract educational problem, largely independent of the other two, and divorced from any specific educational setting.

The second half of the chapter then briefly illustrates the way in which these three entities and the interactions between them have affected the implementation of higher education systems in practice. This is done first at a broad general level, and then specifically for the Australian higher education system. The latter part of this discussion also serves the purpose of identifying and describing the Victorian universities on which the study focuses, and highlighting the ways in which they changed during the course of the period covered by the study. An understanding of these changes will be seen in later chapters to be vital to the investigation of the evolution of the study of IS.

It should be noted that themes addressed in the chapter involve matters which have long been highly contentious issues in educational theory and philosophy. The diversity and complexity of these issues means that the chapter must be extremely selective in its coverage of them, and can highlight only a few of the main points of contention. In its presentation of the issues the chapter aims to take a neutral stance, which neither endorses nor opposes any particular educational approach, but seeks only to provide an explanation of the issues and the key differences in the institutional approaches which have been taken towards them.

The chapter is structured as follows:

- Sections 2.2 - 2.4 provide a broad introduction to universities, academic disciplines and the curriculum as fundamental elements of higher education.

- Section 2.5 then discusses briefly the collective impact of these issues on the structure and operations on higher education systems in general.
- Section 2.6 describes how these issues have affected the structure and operation of the Australian higher education system, with particular focus on the higher education institution in Victoria which are used in the study.
- Section 2.7 summarises the main points to emerge from the chapter, and states their implications for the study.

2.2 Universities as educational institutions

As the pre-eminent higher education institution in Western culture, the university has played a major role in the shaping of disciplines and disciplinary knowledge, and in the development of the educational programs and curricula which support them. But throughout the history of the university, the variability in size, structure, intellectual orientation and social role of the educational institutions which have identified themselves by that name have been reflected in significant variations in their approaches to their educational mission (Verger, 1992). The range of educational functions which each university has performed has always been shaped by the unique blend of historical, geographical, social and political factors which have influenced its formation and growth. Frijhoff's (1996) analysis of the state of European universities in the late 18th century concluded that they could in fact be divided into five different sorts of institutions according to what was perceived to be their primary educational function:

> "· To provide education as part of the life cycle; this function was often the most important one at universities having a large arts faculty;
> · To provide a general education;
> · To train candidates for a profession or promote scientific knowledge; this function led to specialist disciplines;
> · To form an elite - the function of socialization;
> · The custodial function, that is, to teach in a community the discipline of a way of life; this was done especially by the collegiate university"
>
> (Frijhoff, 1996, p67)

.

The evolution of the university as an institution in modern times has been influenced heavily by three idealised models – the German, French and British – which emerged in the first half of the 19th century (Kerr, 1995). The French model, which was developed at the instigation of Napoleon 1, was vocationally oriented, and replaced the traditional multi-disciplinary university with small specialist schools which focussed on individual disciplines. These schools maintained close links with business and government, and their curricula were designed and managed with the objective of providing a steady stream of graduates equipped with the knowledge and skills needed in the workplace. Research and scholarship were of only minor concern and were actively pursued in only a few of the institutions which adopted this model (Charle, 2004). The German model, developed by the educational reformer, Wilhelm von Humboldt, was a deliberate rejection of its French counterpart (Ruegg, 2004). It saw the university as a place of scholarship and scientific research, in which knowledge was pursued for its own sake, independent of its application in practice. The German model was based around the division of knowledge into separate disciplinary specialisations, which encouraged the formation of discipline-based societies and scientific communities.

The British model is best exemplified in Cardinal Newman's famous series of lectures published as 'The Idea of a University' (Newman, 1960), which rejected the educational philosophies which underlay both the French and German models. Newman proposed that students should be required to take a multi-disciplinary curriculum, because the unity of learning which he sought could be achieved only by the integration of knowledge and understanding across a variety of academic areas. He acknowledged that the German model's disciplinary division of knowledge might be the most effective way of advancing the state of knowledge within each discipline, and the French model might be the most cost-effective way achieve the economic imperative of training a skilled workforce. But he argued that neither of them focussed on the primary objective of the university, which should be aim to improve the student's mind through the acquisition of knowledge for its own sake.

Both the French and German models of the university were implemented widely, initially in Europe and then throughout the world (Shils & Roberts, 2004). But neither was able to survive for long in its pure form, even in the countries of their birth. In France, concerns about the inability of the vocational schools to support research and innovation were voiced as early as the 1830s, and became widespread when Germany's superiority in these areas was identified as a factor in France's defeat in the Franco-Prussian war of 1870, (Charle, 2004). This led to a broadening of the higher education system to include the formation of a tier of multi-disciplinary research-oriented universities to supplement the specialist schools. Similarly, by the end of the 19th century the Humboldt model had also run into problems in Germany (Ruegg, 2004). The pressures which forced it to change came from two directions: first, vocationally-oriented institutes, which had formed to provide the specialised professional training which universities discarded, received such levels of public support that they too began to claim the status of universities; secondly, the increasing popularity of university education meant that universities attracted a larger student population, a significant proportion of whom wanted courses and curricula which were more closely aligned with their future professional careers. Hence, many German universities compromised and took on some of the vocational elements of the French model (Charle, 2004).

The British model was even less successful in terms of its implementation in practice, despite its popularity as a theoretical ideal. According to Charle (2004) it existed, even in Britain, only as a concept based on the traditional picture of Oxford and Cambridge as providers of a finishing school for the sons of the elite, for whom "…their educational ideal was still that of the generally educated gentleman, to whom morality was as important as scholarly knowledge" (Charle, 2004, p54). Newman himself had little success in his attempts to put his own version of it into practice when he was made the inaugural rector at the newly-founded Catholic University of Dublin (Ker, 2011). The enduring significance of the model lay in the alternative picture which it presented of the way in which universities might conceive and pursue their educational aims. This became a popular reference point for those who were disenchanted with the French and German university models.

The issues of educational philosophy encapsulated in these different models have been an important consideration governing the choices which individual universities have made when deciding what educational functions they would aim to perform and what relative priorities they would assign to them. But they are by no means the only factors which have had be taken into account. Every university has many stakeholder groups, both within and outside the university, who have input, either directly or indirectly, into these decisions. Examples of such groups include the students, the academics, the university administration, public authorities (usually government), funding bodies, professional and business communities, donors and foundations (Kerr, 1995). Clark Kerr, one of the most distinguished figures in the history of American higher education created the neologism ‘multiversity’ to describe the modern university which has resulted. In his view the university is now a “city of infinite variety” (Kerr, 1995, p41). Rather than satisfying a single vision of what it should be, the modern university is a composite of many competing visions, each of which is a product of the history of the institution as a whole.

Analyses of universities in practice have confirmed the diversity of the university as an institution implied by Kerr’s characterisation, while also identifying some patterns of commonality between universities which share broadly similar characteristics and objectives. For example, Perkin (1987) sub-divided British universities into 13 different categories, while Veysey’s (1965) classic study of the higher education system in the US identified 10 different types of American university. Both these authors noted that even these groupings involved many broad generalisations, and suggested that it would be possible to extend their analyses into an even finer level of disaggregation according to the institutions’ priorities in regard to their educational role and purpose. Even in Australia, where the higher education system has developed over a much shorter time period in a relatively more uniform social and educational setting, a number of different categories have been identified into which universities can be grouped according to differences in their key characteristics (see for example, Marginson, 1997, Moodie, 2012).

The reality of the diversity of the university, both in the past and the present day, is often not acknowledged by those writing about the institution. In particular, it has been commonplace for critics of the modern university to attack aspects of its operations as a betrayal of its alleged traditions, historical purposes and values. These critiques often carry with them the twin implications that the modern university is failing to live up to some ‘correct’ educational model, and that this was a model to which at some time during the institution’s history all universities aspired. Eminent and long-lived universities such as those at Bologna, Paris, Oxford, Cambridge, Harvard and Yale are often cited as exemplars of this ‘true model’ of the university, despite the fact that each of them have undergone many changes in their roles, objectives, structures and operations during the course of their history.

Propositions of this kind may serve as useful rhetorical devices, but do not stand up when tested against the picture of the university which emerges from the classic works on its history, such as those by Ruegg (2004), Vesey (1965) and Reisman (1958 and 1980). Any meaningful debate or analysis of the institution should be based not on theoretical idealizations, but on the realities which histories like these reveal about the diversity of universities and their educational objectives and priorities. As the leading American educationalist Burton Clark observed:

> “There is nothing more pointless than the debates that have now lasted for centuries about the ideal nature of higher education. … The debates will remain sterile until they are based upon an understanding of how higher education operates and how it changes” (Clark, 1983, p22)

2.3 The structure of knowledge and the concept of disciplines

Within the academic world, the concept of disciplinary specialisation and its associated schemes for the division and classification of knowledge have been with us for thousands of years. The works of Aristotle provide one of the earliest documented examples of a scheme for dividing and classifying educational programs into separate and distinct branches of learning (Klein, 2004). But despite the long-standing usage of the concept of disciplines, both the word itself and the systems of classification which it denotes have tended to be very broad and poorly-defined. Terms like 'field of knowledge', 'discipline', and 'sub-discipline' have been used widely and loosely in the educational literature, without any precise agreed definition or explanation of what each one means, and what distinguishes one from the others.

A major complicating issue in the designation of disciplines and their place in the disciplinary framework has been the pressure imposed on them by the rapid and ongoing expansion in human knowledge. This expansion was a major factor in the creation of the modern system of academic disciplines during the 19th century (Klein, 1996, Stichweh, 2001). Its continuation has caused disciplinary structures to remain in a constant state of flux, and led to continuous growth in the number of specialist fields of study. Metzger (1987) identified a number of processes by which the growth in knowledge has drive the formation of new academic disciplines:

- Specialisation and subject parturition: in which the growth of knowledge within a single broad discipline leads to it becoming partitioned into several more narrowly-focussed specialist ones; for example, the single nineteenth century discipline of natural philosophy sub-divided into a number of specialised modern disciplines such chemistry, physics, geology, astronomy, biology, and the like; subsequently, they too have come under pressure to sub-divide further into still more specialised disciplines.
- Subject overlap: in which a new discipline forms where two existing disciplines have begun to cover similar subject matter. For example, the overlap of knowledge between chemistry and biology led to the emergence of the discipline of biochemistry.
- Subject dignification: in which the accumulation of knowledge leads to disciplinary status being conferred on areas of knowledge previously regarded as not worthy of that designation; the case of engineering, which is a prime example of a discipline being formed in this way, will be discussed later in this chapter
- Subject dispersion: in which a discipline extends its scope to create diversified specialised forms of itself (eg the study of history became diversified into multiple specialist forms focussing on particular time periods or localities).
- Program affiliation: in which a group of otherwise separate and independent areas of study are brought together to serve the interests of a particular professional group (exemplified in Halpern's (1987) analysis of the formation and growth of professional schools in American universities).

The impact of the knowledge explosion on disciplines and on opinions about what constitutes a discipline, can be seen in the significant differences in estimates of their number. For example Klein (2004) suggested that there had been an increase from about 20-25 recognisable disciplines at the end of the 19th century to as many as 4000 disciplines by 2004. By contrast, Veysey (1973)) claimed that during this time period the basic disciplinary structure in universities had exhibited relatively little change, a view which was supported by Frank & Gabler's (2006) study of academic structures . The difference in these wildly contrasting estimates appears to come from the fact that new areas of knowledge which Klein classified as new disciplines were assessed by Veysey as being sub-specialisations within an existing discipline, rather than new disciplines in their own right.

Clark (1997) provided a useful illustration from the field of biology to demonstrate how such discrepancies can occur. He quoted a biologist's estimation that in the United States this discipline now had as many as one hundred different sub-specialisations, each with their own sub-disciplinary societies – ecologists, physiologists, microbiologists, biochemists, and so on. In some respects these specialisations function as separate groups which can be regarded as independent disciplines, but in others they merge and work together as if under the single umbrella of the discipline of biological science. Clark noted that the propensity of groups of this sort to operate together and regard themselves as part of one discipline or to operate independently as separate disciplines may vary from one situation to another. The decision as to which approach to adopt may be driven as much by what is advantageous to the group as by any abstract intellectual principles.

Historically, the intellectual content of a body of knowledge and/or the pedagogical aspects of its teaching were generally cited as the fundamental determinant of the definition of a discipline (Stichweh, 2001). Scholars studying the same or closely-related phenomena, using similar cognitive concepts and theories and applying similar research techniques naturally gravitated towards one another and formed disciplinary communities on the basis of their shared academic interests. Collaborations of this kind are clearly key factors in the first two of Metzger's processes of disciplinary formation listed above. The best-known attempts to classify and divide the world of knowledge have invariably been based on its intellectual content, with notable schemes being devised by Francis Bacon, Auguste Comte and Herbert Spencer as updates to Aristotle's original model (see, for example, Wernick, 2006).

In modern times, the most often-cited schemes for categorising disciplinary knowledge are those of Biglan (1973a and 1973b) and Kolb (1981), which grouped disciplines according to the broad cognitive characteristics of their content. Like their historical predecessors, these approaches invoked a realist perspective, which sees a discipline as an objective stable reality defined by the inherent qualities of the field of knowledge. For example, Biglan's (1973a) classification system was based around the belief that disciplines could be grouped according to three aspects of the 'cognitive style' of their subject matter:

- A division between 'hard' disciplines which are 'paradigmatic' in the sense described by Kuhn (1962), and 'soft' disciplines which generally do not have paradigms;
- A division between 'pure' disciplines which focus on abstract knowledge, and 'applied' disciplines which emphasise its application in practice;
- A division between disciplines which deal with living organisms and those which study inanimate objects.

Biglan's (1973a) model, which used these forms of categorization to position disciplines in relation to one another on a 3-dimensional grid, has been widely used for various forms of disciplinary analysis. For example, Becher (1987) used a modified version of it in order to distinguish between the forms of knowledge sought by practitioners of different disciplines, as shown in Table 2.1.

Disciplinary Group	Nature of Knowledge
Pure sciences “hard/pure/object-oriented” (physics)	Cumulative; crystal-like or tree-like - break problems up into separate bits; concerned with universals, quantification; aims to simplify, explain, discover
Humanities and pure social sciences - “soft/pure/people-oriented” (history, anthropology)	Reiterative; holistic (organic/river-like); same problem re-visited constantly; concerned with particulars, qualities, complication; aims to understand/interpret
Technologies “hard/applied/object-oriented” (engineering)	Purposive; pragmatic (know-how via hard knowledge); blends quantitative and qualitative; concerned with mastery of environment to create products/techniques
Applied social sciences “soft/applied/people-oriented” (education)	Functional/utilitarian (know-how via soft knowledge); concerned with enhancement of practice; aims to understand rather than master (as hard applied does); creates protocols/procedures

Table 2.1: Disciplinary groupings as a reflection of differences in the nature of their knowledge content

(Source: Becher, 1987)

In contrast to approaches which have focused on cognitive content as the basis for disciplinary definition and classification, analysts coming from a sociological perspective have argued that content represents only one aspect of the formation of disciplines and disciplinary structures. They hold that a discipline comprises not just a collection of knowledge, but also a community of scholars, whose actions in regard to disciplinary formation are affected by a range of social factors. Thus, a study of disciplinary formation and differentiation by Storer & Parsons (1968) concluded that:

> “The organization of the academic profession into disciplines, each concerned with a particular area of knowledge, is probably due as much to the exigencies of social organization as to the intellectual correctness of dividing knowledge into separate parts” (Storer & Parsons, 1968, p111)

Becher (1981, 1989 and 1994) and Becher & Trowler (2001) borrowed an anthropological analogy between academia and tribal cultures to explain the way in which social processes act in the delineation of disciplines in the academic world. Under this analogy, each disciplinary community is depicted as a tribe, and academic knowledge is divided up into a set of ‘territories’, with the ‘ownership’ of each territory being claimed by a particular tribe. The members of each tribe are united by their common disciplinary culture of shared values, beliefs, attitudes and customs. Although a particular cultural feature may be seen in several different tribes, the overall blend of these features is unique for each tribe. A tribe tries to maintain its unity by ensuring that the behaviour of its members conforms to its cultural norms; failure of members to do so may lead to them being excluded from the tribe. In general, tribes do not mix, though they may occasionally try to raid each other’s territory.

Becher & Trowler (2001) suggested that their ‘tribes and territories’ analogy helps explain the social elements of disciplinary formation, growth, division and competition. The members of each disciplinary tribe are well aware of its cultural norms and its territory, and are also aware of the boundaries between its territory and that of neighbouring tribes. There is a lot of variation in the characteristics of these boundaries; some are rigid and closely guarded, while others are very permeable and allow free movement and exchange in both directions. Becher & Trowler (2001) suggested that the nature of the boundaries is related to the nature of the disciplines involved. Where disciplinary communities are ‘convergent’ - tightly knit with a high level of conformity to tribal norms – the boundaries are likely to be clearly-defined and well-guarded; where the disciplinary communities are ‘divergent’ – loosely knit and lacking a strong sense of cohesion – boundaries will usually be poorly-defined and hard to defend. A shared interest by adjoining tribes over the same piece of intellectual territory may lead to conflict over it, or may lead towards unification, depending on the level of compatibility of the tribal cultures.

The fluidity of the concept of a discipline and the importance of its organizational and social dimensions are shown in the criteria which have been proposed as being necessary for a body of knowledge to acquire disciplinary status. Roy (1979) proposed a very simple criterion that a body of knowledge can be classified as a discipline when its popularity reaches a certain critical mass, which he defined as being the existence of 12-20 universities with departments of that name covering much the same subject matter. Other definitions have included a much wider range of human and organizational elements, including such things as: the number of people involved in the study of the body of knowledge, and their status; the extent of its support in the organizational structures of universities; its ownership of a place in national academies and their councils; and the length of time for which it has sustained these forms of support (see, for example, Kiger (1971) and Apostel (1972)).

To confuse matters still further, some studies of the disciplines have challenged the appropriateness of the disciplinary concept as the basis for the sub-division of knowledge. They have argued that its implementation within educational institutions causes the fragmentation of knowledge, and creates inter-disciplinary boundaries which inhibit a truly holistic understanding. Instead they have urged the adoption of inter-disciplinary or trans-disciplinary structures (for example, Klein & Doty 1994, Gibbons et al, 1994). The less radical of these options accept the ongoing retention of specialist disciplines, but advocate inter-disciplinary structures which enable and encourage cross-disciplinary thinking and collaboration. For example, Campbell (1969) proposed what he called a fish-scale model of disciplines in which the boundaries of the specialist disciplines are designed to overlap. More radical alternatives argue that knowledge should be treated as a unified whole, and that independent specialist disciplines should be merged into super-disciplines. Inter-disciplinarity has been a recurrent topic of interest in disciplinary studies, and has generated a vast amount of coverage in the educational literature (see for example, Klein, 1996 and Augsburg, 2005). Weingart & Stehr (2000) observed that much of this literature has focussed on theoretical arguments in favour of the concept on moral and educational grounds, and against the traditional discipline-based structures in universities. However, they claimed that the main studies that have examined attempts to implement inter-disciplinarity have found few examples which can be shown to have worked in practice. Consequently, to date its ideas have generally had little effect in disturbing the established discipline-based order in tertiary institutions.

Studies of the development of disciplines within educational institutions show the strength of their predisposition towards specialisation, and highlight the interplay of organizational, social and intellectual factors involved in disciplinary formation (see for example, Abbott (2001). An excellent example is Clark's (2003) description of the introduction of Computer Science as a new discipline at the University of Leeds. His study presents the primary cause for the initial emergence of the discipline as an intellectual one - the development of a large and rapidly-growing body of specialised knowledge deriving partly from mathematics and partly from electrical engineering. However, the way in which this new discipline evolved and the shape which it took was influenced heavily by a variety of social and institutional factors, such as the competition for resources between organizational units and the personal relationships between key individuals in the university.

This brief introduction to the concept of academic disciplines has highlighted the fact that disciplinary development is subject to a mixture of forces. An academic purist might prefer to address the problem of the classification and division of knowledge in purely intellectual terms, based on a scientific analysis of its subject matter. But in practice the processes of formation and maintenance of disciplines and disciplinary structures are complex and dynamic, and are subject to a wide variety of social and organizational influences.

2.4 Curriculum as an educational problem

Throughout the lengthy history of the university, curriculum issues have been a constant source of conflict, to the point where Hefferlin (1969) characterised curriculum as '… the battlefield at the heart of the institution'. Differences in ideologies and philosophies of education have been a major source of this conflict. This was highlighted by Levine & Nidiffer (1997) who demonstrated the diversity of opinions which have affected approaches to the development of curriculum: firstly by summarising and contrasting the works of seven influential philosophers of education who have influenced ideas about curriculum; and then by describing twenty-one proposals put forward by contemporary authors or groups who have advocated change in undergraduate curriculum. Many of these ideas have never been implemented in practice, but all have had an impact in debates over curriculum issues.

The term 'curriculum' encompasses a wide variety of aspects of an educational program (see, for example, Squire (1990), Gaff Ratcliffe & Associates, 1997), but for the purposes of this study the aspects of greatest interest are those concerning the academic content of an educational program and its relationship with the program's underlying educational objectives.

An excellent introduction to the main fundamental issues relating to these aspects of curriculum is a parody of them by Benjamin (1939), in an essay titled 'The Sabre-tooth Curriculum'. The main target of Benjamin's parody was curriculum in secondary schools, but the general issues it identified can be applied to curriculum design at all educational levels. The essay related the tale of the first ever curriculum for an educational program devised by a stone-age tribe. The program was designed to pass on to the young children of the tribe a range of essential skills needed for their survival in a hostile environment – skills needed in hunting for food and in warding-off the attacks of the fierce sabre-tooth tigers. The teaching of these skills started in an informal way, but became so successful that educational institutions were established to formalise it into a body of knowledge and an associated curriculum. But over time, there were changes in the environment in which the tribe lived, which made many elements of the curriculum out-of-date or redundant; for example those relating to the sabre-tooth tiger were rendered obsolete when the animal became extinct. The changes also brought new hunting opportunities and new threats, for which new areas of knowledge and skill were needed. But the educational institutions which had been built around the original program were reluctant to change them. They remained wedded to the curriculum with which they were familiar, and could find no room to include in it any of the newly-emerging survival skills and techniques. They justified their reluctance to change by arguing that although the techniques of the original curriculum may now look out-dated, the real object of the educational program was not the specifics of the techniques, but the fundamental principles which underlay them; hence, the extinction of the sabre-tooth tiger did not lessen the value of the curriculum elements which related to it, because the principles involved in fighting off sabre-tooth tigers applied equally well to the protection of the tribe from the predators which replaced them. When challenged by the community over their recalcitrance in accepting the need for curriculum change, they responded that the measure of the quality of a curriculum is its timelessness amid the chaos of its changing surroundings.

Benjamin’s essay raises a wide variety of issues associated with the complex inter-relationships which exist between the knowledge and educational requirements of a community, the educational curriculum which is designed to meet those community needs, and the academic discipline around which it is based. Three of them are of particular interest for this study:

- The conflict between stakeholder interests: Benjamin’s story established a clear divide between two groups with different interests in the curriculum. On the one hand was the community, who were its principal users, and whose interests in it lay in the immediate value which they could gain from the practical knowledge and skills which it could teach them. On the other hand were the educators, who ‘owned’ the curriculum, and whose primary interests in it lay in its role as an expression of their body of expertise. The differences in the attitudes which these two stakeholder groups took to the curriculum reflected these differences in their respective interests.
- The conflict between pure knowledge and its application: Initially the curriculum of the teaching program in Benjamin’s story was based around vocational needs and the application of knowledge to a specific problem. But the academic discipline which established itself around the program ultimately rejected this vocational and practical emphasis. Instead it argued that that form of instruction is not true education, but training; the primary aim of a disciplinary curriculum should be to teach fundamental principles, independent of their direct application to the problems of the day.
- The conflict between stability and change in a curriculum: When societal needs and the educational environment change in Benjamin’s story, the curriculum came under community pressure to adapt to them, through addition of new materials or by modification or replacement of existing content which is seen to have become irrelevant. On the other hand, the discipline that was formed around the curriculum sought consistency and stability in the subject matter which it taught, and was reluctant to adapt to these changing demands.

In the story, the changes in societal conditions and their implications for curriculum needs are presented as being clearly identifiable and beyond dispute; hence, the discipline's reluctance to adapt is easily portrayed as stubborn and self-serving. But where environments are chaotic and confused, the direction of change may be less obvious and the best way to respond may be a matter of controversy. Benjamin's story was slanted to highlight the problems caused by reluctance to accept the need for curriculum change, but an equally persuasive story could be written to highlight the damage which can result from over-eagerness to react to the fads and fashions of the day.

As indicated earlier in this section, curriculum issues of this kind have been perennial problems in all educational systems, and responses to been based on a range of widely varying educational philosophies and ideologies. Amidst the confusion of different approaches, there are a number of factors which have affected the patterns and variations in the way in which these issues have been addressed.

The first and most obvious of these is simply that of time; the popularity of different points of view about curriculum has waxed and waned as social, economic and cultural circumstances have brought changes in educational fashions. Fuhrmann (1997) provided a broad overview of the general patterns of these changes in the American educational system, and more detailed discussion and explanation can be found in Rudolph's (1977) historical study of the American university curriculum.

A second factor is the nature of the academic disciplines. As the level of compartmentalization and specialisation of knowledge has increased, different academic disciplines have adopted different approaches to curriculum to accord with their specialised disciplinary culture and with the nature of the knowledge and skill requirements of their practitioners. For example, a science-based discipline is likely to approach these issues with a different attitude to that of a business-based discipline. Illustrations of these differences can be seen in comparative studies of curriculum practices across disciplines, such as those in Gaff Ratcliffe & Associates (1997).

Finally, curriculum philosophy is strongly influenced by the aims, objectives and other characteristics of the educational institution which offers it. That is, institutions will approach curriculum problems in ways which accord with the way in which they perceive their educational function. This has been made clearly evident in a number of historical studies of the American tertiary system. For example, Veysey's (1965) classic study of the history of the American university explained its evolution into a variety of institutional types, ranging from the prestigious Ivy League universities, through institutions such as the land grant colleges and the black colleges which were established to meet specific social needs, to the locally-based community colleges. His study showed how the curricula evolved in different ways in each of these different types of institution to suit their differing characteristics. Tierney (1989) provided a narrower but more detailed analysis of these impacts on modern-day curriculum approaches in a comparative study of seven American institutions of varying types. Perkins (1987) and Hooper (1971) have described similar patterns of variation through the British tertiary education system.

This brief discussion demonstrates that although an educational curriculum aims to provide a representative expression of disciplinary knowledge, it is subject to forces which go beyond the purely intellectual. Curriculum development must also take account of the broader social needs which drive the needs for education programs, and the educational setting in which the curriculum is taught. Every educational institution must make decisions about the nature of its curriculum to support the type of educational outcomes which it aims to achieve. These decisions in turn will affect the forms of disciplinary knowledge within the institution. Therefore the study of disciplinary curriculum must take account not only of disciplinary and intellectual issues, but also of social, organizational and historical factors which have affected its development.

2.5 Disciplines, curricula and the roles of the university

The diversity of the university as an institution has been reflected in the diversity of the ways in which different universities have addressed the interacting issues identified in the previous sections concerning their educational function, the classification and division of knowledge and the objectives and content of academic curricula. Derek Bok, a long-time president of Harvard University, suggested that it is difficult to conceive of any idea and approach to these issues which has not been proposed and tried somewhere within the higher education system. In his view, nothing has been found to constitute a perfect solution, but also few serious proposals have been shown to be devoid of any merit (Bok, 1986). Bok suggested that these issues will remain the subject of recurrent debates in educational philosophy and practice in universities, and will continue to be fought over without any hope of a final resolution. The specifics of these debates will change in accordance with the circumstances of the day, but the fundamental issues will remain the same.

Bok's comments related largely to the impact of disputes over educational philosophies and theories on universities' decision-making on disciplinary and curriculum matters. These alone are sufficient to make the resolution of these issues a complex task. But it is made even more difficult by the need to temper educational ideals with pragmatic considerations relating to the needs and expectations of the wider community within which the university resides. The effects of these issues have already been mentioned briefly earlier in the chapter, in the discussion of the way in which both the French and German ideal university models had to be modified in order to satisfy the demands of their respective communities. The following outline of the history of engineering as a university discipline (based largely on Guagnini, 2004) provides a useful example to illustrate the clash between pragmatic needs and the educational ideals underlying the university's approach to knowledge.

For many centuries, studies in engineering and technology were excluded from university disciplinary structures for academic reasons which date back to the very origins of the institution. From the beginning, universities had followed the example of the ancient Greeks, in favouring disciplines which focused on pure knowledge, independent of its application in practice. They were unwilling to engage with technology-based fields like engineering, which they identified as being too utilitarian and lacking in the theoretical foundations and formal methods which were deemed appropriate to a university discipline. Denied entry to universities, the fields of study associated with technology and the applied sciences were forced to rely initially on the support of guilds and apprenticeship systems as the basis for developing and passing on the knowledge associated with their practice (Ruegg, 2004a).

As societal needs for suitably trained scientists and technologists increased, a variety of alternative educational institutions were established, either to complement the apprenticeship system or to replace it. The number and size of the engineering schools and the standards of training they offered varied from country to country. In Britain, for example, the educational system in this area remained small and largely ineffective, because industry had become so strongly wedded to the apprenticeship system and on-the-job training (Rolt, 2007). Formal qualifications from engineering schools in Britain were widely scorned by the engineering profession, and admission to professional bodies such as the Institution of Civil Engineers was based almost entirely on practical experience. In fact, when the involvement of universities in engineering education was eventually proposed in Britain in the mid-nineteenth century, it was strongly resisted by both the universities and by practising engineers. The universities based their opposition on their longstanding objections to applied and vocationally-oriented education, while engineering organizations believed universities were too theoretical in their orientation and lacked the practical understanding required to address work force needs (Rolt, 2007).

In Germany, by contrast, the technical education schools were large and numerous, and the standard of education they offered quickly rose to be equivalent to that offered in universities. By the mid-nineteenth century, the contribution of these schools was perceived to be a key part of Germany's industrialisation and economic success, and many other countries began to create academic institutions in line with the German example. But despite their high educational standards and acknowledged importance to industry, these institutions were still generally regarded as inferior to universities (Guagnini, 2004).

The last quarter of 19th century saw a rapid rise in the complexity of theory and the sophistication of experimental work required in engineering education. Technical schools recognized the importance of theory to the practice of engineering, and provided increased theoretical content in their programs. This created further pressures, firstly for the engineering schools to be upgraded to the status of universities, and secondly for the established universities to take on engineering as a legitimate disciplinary area. Attitudes within the engineering profession gradually changed to support the idea of having engineering education included within the university system, but the universities remained reluctant to change:

> "….The transformation of the [engineering] schools into university level institutions from the 1880s onwards encountered tenacious opposition from the academic elites, not only the professors of the traditional liberal disciplines, but also those in the pure sciences. Despite the changes in the syllabuses, the close association with utilitarian pursuits was still regarded as hard to reconcile with the ideals of higher learning. The hostility was as strong in the industrialized countries as it was in the late comers." (Guagnini, 2004, p623)

The ultimate success of engineering in breaking down the resistance of the universities was due as much to the influence of pragmatic realities as it was to the changes in university perceptions of the engineering discipline. Government and community needs for a well-trained engineering work force and student interest in pursuing an education in engineering created pressures which universities were eventually unable to resist. By the end of World War 1, despite continuing opposition in some parts of the university system, engineering had become established as one of fastest growing sectors of the higher education system.

The range of pragmatic factors of the kind which caused universities to end their opposition to engineering has increased substantially since the second world war. These new factors have been related both to the acceleration in the rate of growth and the diversity of knowledge and to changes in societal demands for higher education. A list of such factors in Becher & Trowler (2001) included the following:

- increasing levels of disciplinary specialisation which have increased the fragmentation of disciplinary structures;
- growing market demands for higher education, to the point where universities are increasingly expected to play the role of mass market provider of educational services in much the same manner as the secondary school system (Trow,1970);
- increasing government involvement and expectations of higher education outcomes, particularly where universities rely on government funding (Gumport, 1993);
- increasing funding pressures on universities, and expectations that they will operate more as ‘corporations’ (Marginson & Considine, 2000);
- increasing industry connections and expectations that universities will promote innovation and work in partnership with industry (see, for example, Gibb & Hannon, 2006, Etzkowitz, 2004);
- increasing trends towards globalization of higher education, particularly in the form of student movement between countries (Marginson & van der Wende, 2007).

These trends have increased the pressures on universities to be more responsive to community needs, and to accept the need for ongoing change in their educational roles and in their management of disciplinary and curriculum issues. The impacts of these pressures have helped to increase still further the diversity of universities and the differences in their management of disciplinary and curriculum issues. Every institution has had to develop its own set of strategies to respond to the variety of challenges which the changes present in a way which best fits its circumstances. The changes have helped to tip the balance in university operations and decision-making further in favour of the forces of pragmatism and away from the forces of academic principle. The model of the university as an independent centre of scholarship and learning for its own sake has been largely replaced by one which sees it as a provider of educational and research services to the community. Institutional decisions on academic matters relating to disciplines and curricula have increasingly been driven by the demands of government, industry and the student marketplace.

As indicated earlier, these changes have been heavily criticised, particularly by academics who believe that disciplinary and curriculum issues should be determined solely on academic grounds, and should not be subject to the vagaries of community and market demands (see for example, Aronowitz (2001), Bloom (1987), Biggs & Davis (2002), Hayes & Wynyard (2002), Lucas (1996)). But regardless of the merits of their arguments in terms of academic principle or educational philosophy, in practice they no longer hold sway in most universities. Therefore, the approach to these issues which has been adopted in this study has been based around the realities of university practice rather than the ideals of academic theory.

2.6 Universities and the Australian Higher Education System

The Australia higher education system is much smaller than its counterparts in the United States, Great Britain and in most European countries, and its history is nowhere near as long or as complex. Nevertheless it has encountered many of the same sorts of issues, albeit on a smaller scale (for example, see Goedegebuure et al (1994)). The following account outlines the evolution of the tertiary education system in Australia, with particular emphasis on its main features during the period covered by the study. In particular it focuses on higher education in Victoria, and briefly describes the characteristics of the Victorian universities used in the study.

For the purposes of the study, the history of institutional arrangements for higher education in Australia can be divided into three distinct time periods: the first of these started with the birth of higher education and lasted up to the early-1960s, when the so-called binary system was introduced; the second covered the period from the early-1960s to the late 1980s, when the binary system was scrapped as part of what are commonly known as the Dawkins reforms; and the third has lasted from then until the present day.

During the first period, a diverse range of educational institutions were established in each Australian State to meet post-secondary educational needs. A university was established in each of the Australian states to act as the elite level of higher education, generally aiming to imitate the British model as it existed in the mid-nineteenth century. Martin (2007) suggested that prior to the second world war these universities could be dismissed with a simple generalization: "... they were small, poor and for the most part treated with indifference by [Australian] society" (p178). They did little by way of research or promotion of innovation, but saw their main role as teaching and scholarship, with their primary clientele being the children of the wealthy (Martin, 2007). Not surprisingly, for much of the period Australia had low levels of participation in tertiary education. By the early 1950s, total enrolments in the country's universities stood at only around 30,000 (Karmel, 1991), and about 12,000 of these were returned soldiers who were granted university places under a government-funded post-war training scheme (Blainey, 1989).

In Victoria, the University of Melbourne, which was established in 1853, remained the state's only university for over 100 years. For much of this period it was widely criticised "...as a feeble imitation of Oxford and Cambridge, because – like them – it was exclusively the domain of the rich" (Rich, 1990, p31). Financial difficulties in the early 20th century forced it to adopt a more "utilitarian" approach, and it established a number of vocationally-oriented programs in fields such as veterinary science, agricultural science and engineering (Blainey, 1957). By 1957 it had just under 8000 students (Marginson, 2000), and was still widely perceived as "... a small and comfortable enclave of professional training and elite culture" (Marginson, 2000, p6).

Outside the universities, there were two main sources of post-secondary education: senior technical schools and technical colleges, which offered vocationally-oriented certificate, technician, trade, and diploma-level programs in a variety of fields of study; and teachers colleges, which provided 2-3 year programs of pre-service education and training for primary and secondary school teachers. In addition to these main suppliers there was a miscellaneous collection of other specialist educational institutions such as colleges of agriculture, forestry and horticulture, conservatoria of music, military and administrative colleges, and schools for training in specialist medical fields such as physiotherapy, pharmacy and nursing.

The demarcation line between universities and other educational institutions as providers of vocational education was uncertain, and frequently a source of conflict (Goozee, 2001). As occupations achieved professional status and established boards of registration for practitioners, the qualification for registration was often up-graded from a diploma to a degree, thereby requiring the transfer of the relevant educational programs to universities. According to Goozee (2001), both the universities and the organizational groups representing the professions have been responsible for this; he claimed that in Australia:

> "… The history of technical education … is one where the top levels of technical education courses have been continually creamed off by higher education institutions and subsequently upgraded to degrees, usually at the request of the relevant professional body." (Goozee, 2001, p9)

During the 1950s, interest in higher education began to increase, and it soon became evident that the existing institutions would be unable to cater for the growing demand. More universities were established, and the federal government initiated a series of enquiries to decide on the best ways of structuring higher education to meet community needs. As a consequence of these inquiries, in the early-1960s the federal government adopted what was known as the binary system for higher education. Under this system, institutions offering tertiary education programs were grouped into two tiers: the top tier comprised the universities, which would offer bachelors degree and postgraduate programs and would have research as a primary focus; the second tier grouped the other tertiary institutions under the general title of Colleges of Advanced Education (CAEs); they were to be vocationally-focussed and do minimal research, and would mainly offer diplomas as their highest level of qualification. In theory the two tiers would complement each other in meeting a variety of tertiary educational needs; the phrase "…equal but different" was used to emphasise that the division between the two sectors was supposed to indicate a difference in purpose, but not in status.

The binary system aimed to address the perennial issue of the division between pure knowledge and applied vocational training outlined earlier in the chapter. Its fundamental underlying principle was to keep separate the education programs of an applied practical nature which were seen to be province of the technical colleges, from those which were more theoretical and taught higher cognitive skills, which should be the preserve of the university. In the words of the first of the major government enquiries which led to the introduction of the binary system:

> "A technical college, or another institution of a similar type, which is performing excellently in its proper function of producing the technicians and craftsmen for whom there is an urgent national need, may be led by a false sense of values to try its hand at producing another type, the professional engineer or technologist and so lessen its effectiveness for its own particular task." (Commission on Australian Universities, (1957), cited in Goozee, 2001, p9).

The establishment of the binary system led to a major re-structuring of the higher education sector, as institutions responded to the pressures and opportunities created by the new arrangements. For universities the changes were relatively straightforward, with the main impact being a need to increase research output and ensure an appropriate level of theoretical content in their academic programs. In Victoria, three new universities were established in quick succession to join the University of Melbourne in the top tier. The first two of these, Monash (established in 1958 and officially opened in 1961) and La Trobe (established in 1964 and officially opened in 1967), were created from scratch as entirely new organizations. Deakin University followed in the mid-1970s, but was formed through the amalgamation of two pre-existing vocationally-oriented training institutions - Gordon Institute of Technology and the Geelong Teachers College. Deakin was based in the provincial city of Geelong, as part of a State government initiative to promote regional development outside Melbourne. The decisions to implement the merger to create the institution as a university were based as much on political as on educational grounds (Hay et al, 2002). Despite its up-graded status, its characteristics initially remained more akin to those of a second-tier institution, with a strong focus on vocational educational programs.

In the second tier, uncertainty over what roles and purposes the CAEs were supposed to serve made their situation confused and unstable. The tier included a wide range of institutions with varied characteristics, diverse institutional origins and organizational histories, and different types of educational programs and program content. This made it difficult to establish an agreed common role and purpose. Roche (2003) suggested that the only clearly defined common characteristic of the CAEs was that they were not recognised as universities. Within the second tier there was constant change throughout the 1970s and 1980s, as the institutions sought to modify their operations to fit within changing perceptions of their role in the new higher education framework.

One of the few specific points of differentiation between the sectors in the federal government's original proposal had been that only universities had the right to confer bachelor's degrees, but this was subverted almost immediately by the State governments (Roche, 2003). Within a year of the implementation of the binary policy, the Victorian Institute of Colleges (VIC), which the State government had established to oversee CAEs, granted the Victorian College of Pharmacy the right to grant a bachelor's degree, and by 1971 it had approved a further 17 degree courses in CAEs as part of a policy of encouraging colleges to upgrade their courses to that level. Dr Phillip Law, the then executive vice-president of the VIC later explained and claimed justification for this policy on the grounds that if the CAEs had restricted themselves to offering diplomas they would never be recognised as truly equal to universities (Advanced Education Council, 1982).

Law's comments gave voice to a widely-held view that, despite the government's stated aim for the two tiers to be seen as equal, the second tier institutions were generally regarded as of lower academic status. In particular their levels of funding were perceived to be significantly lower to the university sector, which led to them sometimes being referred to sarcastically as "equal but cheaper" (Treyvaud & McLaren, 1976). Ongoing financial problems meant that CAEs came under periodic pressure from government to increase the efficiency of the sector by rationalising and merging institutions. At the time of the creation of the binary system, Victoria had 34 CAEs of various kinds, but by 1981 amalgamations and rationalisations had reduced this number to sixteen (Roche, 2003). Despite its aim of simplifying things, the immediate effect of the rationalisation program was to add to the turmoil, as the enlarged institutions which were formed from the mergers tried to establish new organizational structures and adapt their academic programs to cope with the change. The studies by Roche (2003) and Gamage (1992) provide excellent case studies of the impacts of these amalgamations on institutions and their academic programs.

The problems of the binary system eventually led to its abolition and to the transition to the third and most recent period in the development of the tertiary education sector. This period began with the announcement by the federal government in late 1987 of the so-called Dawkins reforms to the sector (named after the federal education minister of the day). These reforms called for the abolition of the binary system and its replacement with a new unified national system for tertiary education. A round of mergers and organizational re-structures occurred almost immediately throughout the higher education sector, with CAEs amalgamating with existing universities or merging with one another and taking the steps needed to upgrade their operations to achieve recognition as a university. This process resulted in the elimination of the second tier of the binary system, and left universities as virtually the only providers of higher education in Australia.

The Dawkins reforms had three major impacts which are of significance to this study:

- Breaking the pure knowledge - vocational training divide: The elimination of the binary system's distinction between CAEs and universities caused pressures for change in both types of institution: the universities faced pressures to adopt a more vocationally-based approach in line with the needs of the student market, while the former CAEs faced pressures to establish and demonstrate the soundness of the disciplinary base for their programs. Another important issue for the merged institutions was the need to resolve conflicting imperatives of research-oriented and teaching-oriented educational cultures. The institutional traditions associated with the CAEs, which had been based around vocationally-oriented teaching and which involved little or no research, now had to blend with a university culture which had generally extolled scholarship and research, and professed to shun vocationally-oriented education.
- Institutional mergers and re-structures: Although they did not mandate organizational re-structures and mergers, the effect of the Dawkins reforms was to make them essential for virtually all institutions. All post-Dawkins universities in Victoria were affected by mergers, and had to re-structure their academic units and academic programs accordingly. The mergers usually affected all aspects of organizational operations, and frequently involved negotiations and trade-offs over matters which had as much to do with organizational politics as academic issues (see, for example, Davison & Murphy (2012), Hatton (2002) and Harman (2002)). Decisions about merger arrangements were taken at high levels within the universities, sometimes leaving individual academic disciplines and departments with little input to the re-structure process or control over its outcomes. Consequently, the decisions about the changes to academic structures and programs which were made necessary by the amalgamations were often driven by pragmatic organizational considerations as well as academic disciplinary ideals.
- University funding: The changes which the Dawkins reforms brought to the funding arrangements for universities increased their exposure to market forces. Universities were increasingly treated as mass-market education providers, which were expected to move towards financial self-sufficiency and eliminate their dependency on government grants. This caused the tertiary education system to become increasingly competitive, and encouraged the trend towards corporatization of the sector. Competition became a key issue, not only between universities fighting for an increased share of the student market, but also within each institution, as academic units sought to maintain or enhance their revenue base. Thus, the decision-making in the university mergers and re-structures had to take account not only of issues relating to what constituted academically 'respectable' disciplines, but also issues relating to the level of success which disciplines and their academic programs were likely to meet in attracting students.

The re-structuring and amalgamations which occurred under the Dawkins reforms took place very quickly, with most of the action happening over a 2-3 year period, beginning in about 1990, as shown in Table 2.2. The main exception was the merger of La Trobe University and Bendigo CAE; as the table shows, they officially merged in 1991, but the university chose not to combine their separate academic structures fully at that time. Instead, the academic programs and departments at the Bendigo campus continued to function largely as they had done before the merger; full integration of the academic disciplines across the campuses did not take place until 2005. In the other universities the structural changes associated with the institutional amalgamations were generally dealt with immediately, and were largely completed by the mid-1990s.

Pre-Dawkins Institutions	Date of Integration into University	Post-Dawkins institutions
Deakin University Victoria College Warrnambool Institute of Advanced Education	 Jan 1992 Aug1990	Deakin University
La Trobe University Bendigo College of Advanced Education Lincoln Institute of Health Sciences Wodonga Institute of Tertiary Education	 Jan 1991 Jan 1988 Jan 1994	La Trobe University
Monash University Chisholm Institute of Technology Gippsland Institute of Advanced Education Victoria College of Pharmacy	 July 1990 Jan 1990 July 1992	Monash University
Royal Melbourne Institute of Technology Phillip Institute of Technology	July 1992 July 1992	RMIT University
Swinburne Institute of Technology Prahran Institute of Tafe Eastern Institute of Tafe	 July 1992 July 1998	Swinburne University
Ballarat College of Advanced Education Ballarat School of Mines and Industries	Jan 1994 Jan 1998	University of Ballarat
University of Melbourne Melbourne College of Advanced Education Victorian College of the Arts Victorian College of Agriculture & Horticulture	 Jan 1989 July 1992 July 1991	University of Melbourne
Footscray Institute of Technology Western Institute	July 1990 July 1990	Victoria University
Note: This table shows only the largest of the institutions which were involved in the mergers; some smaller institutions were also involved at some universities		

Table 2.2: The main mergers of Victoria institutions which followed from the Dawkins reforms to the tertiary education system

There are three other universities which established campuses in Victoria after the Dawkins reforms, but which have been excluded from this study; these are the Australian Catholic University, Central Queensland University and Charles Sturt University. The main reason for their omission is that much of their operations take place on campuses outside Victoria. This makes it difficult to analyse their structures and academic programs in Victoria without extending the study to include consideration of their place in the educational systems in the other Australian states in which they are based. Their Victorian campuses are all small in comparison to the other Victorian universities, and their IT operations and share of the student market in Victoria are also relatively small; therefore, their omission is considered to be unlikely to have a significant effect on the overall picture of computing and IS education in the State.

The basic structure of the higher education system has remained much the same since the Dawkins reforms, and Victoria has retained the eight universities shown in Table 2.2. All eight universities ostensibly have similar overall objectives in terms of their stated goals in research and teaching, but the effects of their histories can still be seen in the variations in their characteristics - their size, number and distribution of campuses, number and range of degree programs, focus on vocational educational, research performance, market orientation and the like. Accounts of the individual histories of each of the universities demonstrate how the events shaping their formation and growth have contributed to the unique characteristics of each (see, for example, Hatton, 2002 and Harman, 2002)

The group represents a good cross-section of the main types of Australian university. In theory they are of equal educational status, but in practice there is still perceived to be a hierarchy, which reflects their origins and their relative prestige (see for example, Marginson (1997) and Moodie (2012)):

- The two largest and oldest universities, Monash and the University of Melbourne are inaugural members of the so-called ‘Group of Eight’, a group of the leading research-intensive Australian universities. This group traces its origins to 1994, when the vice-chancellors of these universities began to hold regular informal meetings to discuss higher education policy. This eventually led to the creation of the group as an official body, which became formally incorporated in 1999 (Go8, 2012). The ‘Group of Eight’ members have identified themselves as the most prestigious and influential universities in Australia, and aspire to compete with and achieve recognition among the best universities in the world. The members of the Group of Eight are usually rated in the top one hundred universities in the world in the best-known of the various international university ranking systems of rankings (Australian Education Network, 2012).
- La Trobe and Deakin are what Marginson (1997) described as the ‘Gum-tree universities’ – universities which were established in the 1960s-70s, usually in leafy suburban locations, to accommodate the surge in demand caused by the baby boomer generation. Although they aspired to be research-based universities, they made a point of trying to distinguish themselves from the older established universities in the Group of Eight. Moodie (2012) compared them to the University of Sussex in England, which most of them used as a model on which to base themselves. Moodie (2012) included Deakin as part of the ‘Gum-tree’ group, even though it was formed from a merger of CAEs; he suggested it had enough characteristics in common with the group to be considered as part of it.
- RMIT, Swinburne and Victoria Universities were all the product of mergers of institutions from the CAE sector. Their key institutions in the Dawkins mergers were technical colleges, and although they have sought to raise their profiles as research universities they are still strongly associated with vocational education, particularly in technology-based areas of study.

- The University of Ballarat is a small regional university, based in a provincial city. It was formed through the amalgamation of a number of vocational training institutions, and its operations are oriented strongly towards meeting the needs of its immediate local community.

Table 2.3 summarises the student enrolment profiles of these universities in 2011.

Institution	**Equivalent Full-time Student Load Type (EFTSL) by Type of Academic Program**				
	Doctorate	**Other post-graduate**	**Bachelor**	**Other***	**Total***
Deakin University	885	5069	22712	336	29002
La Trobe University	1015	3933	20465	619	26031
Monash University	2571	7495	38963	530	49591
RMIT University	1072	6125	30904	2321	40423
Swinburne University of Technology	637	2702	14985	225	18548
The University of Melbourne	2752	10093	23316	683	36843
University of Ballarat	112	2250	6234	193	8794
Victoria University	529	2336	15089	420	18373

* For some universities exact numbers are not available for some programs in the 'Other' category, so the number shown is an approximation. This also means the figure given in the Total EFTSL (Equivalent Full-time Student Load) column does not always exactly match the sum of the numbers in the other columns; however these differences are negligible.

Table 2.3: Student enrolment profiles for Victorian universities in 2011
(Source DIISRTE, 2011)

2.7 Conclusions and implications

This chapter has highlighted a number of important features of universities, disciplines and curricula as fundamental components of the higher education system. Firstly, it has shown that each is a complex areas of study in own right. Debate and discussion over the issues associated with them have existed since the origins of formal systems of education, and often involve irreconcilable differences of opinion on fundamental matters of educational philosophy. Secondly, it has shown their inter-connectedness. At an abstract level each of these topics can be studied independently of the others as a separate and distinct component of the education system; but in their implementation in practice they are linked together in a web of mutual interactions and inter-dependencies, so that strategies or actions addressing one of them will almost invariably affect and be affected by the other two. Thirdly, they are as much social as intellectual constructs, whose implementation in practice is strongly influenced by the social and organizational environment in which they are located. Both their intellectual and social dimensions must be addressed in order to gain a full and accurate understanding of the way they function; the decisions made about them in practice involve consideration of both educational philosophies and ideals, and the practical issues involved in their implementation.

The impact of the differences of opinion about these key components of higher education can be seen in the diversity of the institutions that constitute the higher education sector, as discussed in general terms in Section 2.5, and specifically in regard to the Australian higher education system in Section 2.6. The significance of this diversity of institutional types for this study, lies in the impact which it has had on each university's formulation of the IS discipline. By examining the implementation of IS across a range of types of educational institution, the study will show how differences between these institutions and their educational approaches have contributed to the differences in the way the discipline has evolved in each one. It will demonstrate that the impacts of these issues has been felt in the initial formation of the discipline, in its ongoing existence and identity within each institution, and in the nature of its intellectual content as expressed through its undergraduate curriculum.

This raises two problems for the study. The first is a practical one concerning the adequacy of the sample group of universities chosen for the study as a reflection of the variety of institutional types. Confining the study to the small group of universities listed in Section 2.6 has two advantages: first, it makes the task of gathering historical data about the universities more manageable; Gable's (2006) study of a much larger group of universities noted the problems in data gathering and analysis which a larger sample size creates. Secondly, the fact that the group included all the major higher education institutions within the State of Victoria ensured that it comprised a reasonably representative sample of the types of universities in the Australian higher education system, catering for a broad cross-section of the educational needs of single community. On the other hand, the fact that the characteristics of the institutions are reflective of the peculiarities of that higher education systems and the educational needs of that community, may limit the generalisability of the study findings to other regional and institutional settings. However, problems of this sort would apply, no matter what sample group of universities was used. Further issues relating to the choice of institutions for the study are addressed in the discussion of research method in Chapter 4, while their impact in the study findings are considered in the study conclusions in Chapter 9.

The second problem has less impact on the mechanics of the conduct of the study, but, is arguably both more important and more contentious. It concerns the issue as to whether the study should treat the universities as being equivalent in importance in terms of the significance of the development of their IS program(s). That is, should more attention be paid to events in the universities which are deemed to be more important according to some educational criteria? There are many possible criteria which could be used as the basis for such a weighting. Examples of obvious candidates include criteria based on the characteristics of the university, such as its size, history or performance in international rankings; on the characteristics of its IS department, such as its size, organizational status, reputation and research performance; or on the extent of its influence in the market place, as shown by measures such as levels of student intake and rate of production of IS graduates. It could be argued in support of such an approach that it reflects the reality of differences in prestige and educational standing of each institution.

The problem with such an approach is the level of subjectivity inherent in both the choice of the criteria which are used for any such weighting and in the methods for measuring them. This means that the adoption of any such method of weighting must inevitably involve the researcher's own biases on educational and disciplinary issues. In order to eliminate such biases, the approach which has been taken is to disregard the differences between institutions and to treat them all in the same way.

The final point of significance to note on these issues of educational philosophy is that although they have long been topics of intense discussion and disputation in educational circles, they have been given relatively little direct attention in the debates over IS. The protagonists in these debates have rarely set out the assumptions or beliefs about the higher educational system on which their views are founded, nor have they given any explicit recognition or acknowledgement of the existence of alternative educational approaches which might generate different outcomes. The study in no way aims to denigrate the importance of theoretically-based approaches to the definition of the discipline and its curriculum, which have played a vital role in shaping perceptions of the discipline and have often provided the framework upon which institutional implementations of IS have been based. However, the study aims to demonstrate that its approach, based on the analysis of the nature of the discipline in practice, offers important insights which are absent from theoretical approaches.

The following chapter highlights the shortcomings of theoretically-based approaches to defining the discipline, by briefly reviewing aspects of the history of the discipline as it has been conceived in its academic literature, its professional institutions and its model curricula. The picture of the discipline which emerges from this chapter will provide an important reference point for the analysis of the discipline in practice which comprises the core of the study.

Chapter 3: Information Systems as an academic discipline: Its origins and evolution

3.1 Introduction to IS as a discipline

This chapter presents a broad history of key aspects of the origins and evolutionary path of development of the IS discipline. In doing so it aims to present a number of perspectives of the discipline, which provide an essential background to the investigation of the development of the discipline in practice, which constitutes the main body of the study.

The chapter focuses on the origins and development of IS in the United States, and treats events in that country as the primary source for the conceptual foundations of the discipline. Other historical studies have shown that the development of IS in other countries did not necessarily follow the US pattern (see for example, Avgerou et al's (1999) discussion of its origins in Europe, Bubenko et al (2003) and Iivari & Lyytinen (1999) on its development in Scandinavia, and Clarke (2006) on its history in Australia). However, the US was clearly the main influence on the establishment and evolution of the discipline; it has grown faster and on the larger scale in the US than elsewhere, its best-known and most influential efforts at creating model IS curricula have come from there, as also have most of its textbooks, journals and leading scholars (see for example, Huang & Hsu (2005), and Gallivan & Benbunan-Fich (2007)).

In keeping with the discussion in the previous chapter of the multiple perspectives which can be taken to the analysis of an academic discipline, the chapter considers the evolution of IS from three perspectives: the first of these is based on the intellectual content of the discipline as it has been expressed in a selection of its academic literature; the second briefly considers the social dimensions of the discipline's initial formation and early growth as expressed through the influence exerted on IS by two key professional bodies; and the third presents an educational perspective on the discipline, by analysis the evolution of its core concepts as they have been specified in an influential model undergraduate curriculum.

As with the discussion in Chapter 2, these outlines are not intended as complete or definitive statements of the history of IS or of the nature of its characteristics as they have been defined during that history. On the contrary, the intention of the chapter is to highlight the fact that the differences between the ways of perceiving the discipline, and the diversity of the views of it which have been expressed within each, are such as to make it virtually impossible to generate any such definitive account.

The chapter is structured as follows:

- Section 3.2 sets the rest of the chapter in its historical context, by outlining briefly the development and use of information systems in the years before the invention of the digital electronic computer.
- Sections 3.3 examines the evolution of the IS discipline as an intellectual construct, as defined in its academic literature. It divides the history of the discipline into three time periods, with the reasons for the selection of the beginning and end points for each section being explained in each section:

    - Section 3.3.1 examines the origins and early development of the discipline from the late 1950s to about 1980;
    - Section 3.3.2 deals with a period of disciplinary diversification and growth from 1980 to 1996; and
    - Section 3.3.3 covers the period from 1996 to the present day, when the debates over disciplinary identity, core elements and academic legitimacy broadened and intensified.
- Section 3.4 highlights aspects of the social dimension of the discipline, by giving a brief overview of the roles played in its formation and early growth by two influential professional organizations, the Association of Computing machinery (ACM) and the Data Processing Management Association (DPMA).
- Section 3.5 gives an educational perspective on the development of IS, by describing the evolution of the ACM's IS Model Curriculum, which has been one of best-known, longest-running and most influential curriculum models for the discipline.
- Section 3.6 briefly outlines the implications of these perspectives of IS for the conduct of the study

3.2 Pre-history – IS before computers?

The conventional view of the evolution of IS as an academic discipline associates its origins with the growth and diversification of the use of computers in the late 1950s and early 1960s. In this respect IS is linked with the other IT disciplines of Computer Science (CS) and Computer Engineering (CE) which developed around the sciences of computation and computer design and construction in the early 1950s. The history set out in this chapter will generally follow this conventional approach: this is undoubtedly the time period in which a distinctive body of knowledge going by the name of 'information systems' was identified, and also when scholars began to associate themselves with the study of IS in academic institutions. However, a disciplinary history which ties the origins of IS to the invention of the digital electronic computer runs the risk of understating the significance of what might be called the 'pre-history' of the discipline, relating to the development and use of information systems before that time.

The use of formal technology-based systems for the recording, storing, processing and communication of information dates back to at least the Babylonian empire in about 3000 BC (Gleick, 2011). Historians of information and information technologies have highlighted the importance of the role which such systems played, long before the advent of the computer. For example, Chandler & Cortada (2000) examined the role of information and its associated systems and technologies in the development of the United States as a world power from the time of its independence in the late 18th century; Yates (1993) and Campbell-Kelly (1994) gave detailed accounts of specific examples of the use of information systems by large organizations in both the US and Britain during the mid-nineteenth century; Essinger (2004) described how the development of punched card technology by Herman Hollerith in the late 19th century provided a further major impetus to the use of large-scale systems for managing and processing information; and the discussion by Black et al (2007) of the evolution of information management practices in the period from 1900-1960 demonstrated that the supposedly modern-day emphasis on the importance of information pre-dated the digital computer.

It is commonplace for information systems and technologies from the pre-computer era to be dismissed as having been rendered largely irrelevant by its invention, and to rate as little more than historical curiosities. The contributions of a few pioneering figures such as Charles Babbage, Ada Lovelace and Hollerith are generally acknowledged, but even their work is often dismissed as being of little or no direct relevance to the modern computing age. Campbell-Kelly & Aspray (2004) quoted the British mathematician LJ Comrie as describing the period from Babbage's work in the early 18th century to the development of the digital electronic computer in the mid-20th century as the 'dark ages' for computation.

This attitude can be attributed largely to the fact that comparisons between the pre-computing and computing eras usually focus on the technology itself. Such comparisons tend to highlight the extent to which the fundamental technological characteristics of the digital computer differ from its predecessors. Although historians of technology such as Aspray (1990) have tried to show how the information technologies which were developed in the first half of the 20th century influenced the form of the modern computer, there are clearly significant discontinuities between them. Therefore, for disciplines like CS and CE which focus on the technology itself, it is easy to see these historical aspects as largely irrelevant to their evolution.

This is not the case for the study of information systems, as distinct from information technologies. In particular, there is a very direct connection between modern-day computer-based systems and the systems which were developed around the punched card technology invented by Hollerith. Originally designed for the recording and analysis of census information, this technology was quickly adapted and applied in business organizations to assist with a variety of information needs. Throughout the first half of the 20th century, companies such as IBM, Remington Rand, NCR and Burroughs built their businesses around the manufacture of machines which used punched card technology to support automated information systems for carrying out a wide variety of data processing tasks for businesses, particularly in areas such as accounting and business administration (Campbell-Kelly & Aspray, 2004). In terms of their scope, complexity, functionality and the nature of their fundamental data and information components, there is little to distinguish the large pre-computing information systems from the first generation of their computing era successors. In many cases the technology which they used was virtually the only significant point of difference between them. For example, Land (1999) claimed that in the British company, J Lyons, "… MIS was a matter of common practice a decade before the arrival of the electronic computer" (p313).

The prevalence of these systems meant that many of the non-technological aspects of information, systems, information systems, and information systems development were already topics of interest in a number of disciplines long before the invention of the computer. For example: methods and techniques for carrying out data processing tasks were studied in business-related disciplines such as Accounting and Business Administration; systems theory and the principles of systems analysis and design had been developed and applied both in business and in science through studies in Organization and Methods, Operations Research and Cybernetics; and the study of concepts in information was central to the established field of Library Science, Records Management and Archival Science, and the emerging field of Information Science. Although the nascent IS academic discipline of the late 1950s may have associated the study of information systems with the arrival of the computer, from the point of view of these other disciplines the computer was simply a new enabling technology. Its impact on their usage of information systems was clearly a matter of importance and interest to them, but it represented an evolutionary change in their area of study, rather than the basis for the formation of a new discipline.

Thus, from the time of its conception, IS had to deal with a choice between possible academic territories, based around what Haigh (2001b) characterised as ‘revolutionary’ and ‘evolutionary’ perceptions of the tasks which computing applications could perform. In establishing the validity of its claims to the status of a new specialist discipline, IS needed to be able to define a knowledge ‘territory’ which could be clearly distinguished from territories already occupied by other disciplines which saw computing as simply an enabling technology, and by the other emerging IT disciplines such as Computer Science and Computer Engineering, which focused on the nature of the technology itself.

3.3 The information systems discipline as an intellectual construct

As indicated in Chapter 1, issues relating to the issues relating to the disciplinary identity, legitimacy and cognitive content of IS have been a popular topic in the academic literature since the time it first began to be spoken of as a specialist discipline. Most of the discipline’s leading scholars have contributed to the debates about what should be regarded as constituting its core concepts, its reference disciplines, and its disciplinary boundaries.

The following discussion aims to highlight some of the key themes which have achieved prominence in this literature. It divides the history of IS into three time periods, and uses a small set of key papers from each period as the basis for identifying the main issues and points of controversy which they raised about the nature of the discipline.

3.3.1 In the Beginning … : Computers, Data Processing and MIS

The invention of the digital electronic computer had been driven by scientific and military applications, and initially there was little appreciation of the new machine’s potential for use for other purposes. Campbell-Kelly & Aspray (2004) credited Eckert and Mauchly, two of the key figures in the invention of ENIAC, the first digital electronic computer, as being “… almost unique in seeing the potential for computers in business data processing, as opposed to science and engineering calculations” (p95). The lack of appreciation of the possibilities for computer usage at the time is epitomised by the famous, (but almost certainly apocryphal) story about the estimate of the miniscule size of the potential future market for them made by Thomas Watson, the head of IBM - cited as five in many sources, but as “about a dozen” in Campbell-Kelly & Aspray (2004, p93). Estimates like this were based on the premise that computers were useful only for carrying out complex mathematical calculations, and there were very few organizations whose needs for such calculating capabilities were on a scale that could justify the use of such a machine. It was only after demonstrations of the broader data processing capabilities of the UNIVAC computer developed by Eckert and Mauchly for Remington Rand that the machine’s potential for a wide range of commercial uses was generally recognised (Campbell-Kelly and Aspray, 2004).

Even when this recognition came, the long history of business usage of machines for data processing discussed in the previous section meant that the adoption of computers as business machines was commonly treated in practice as an evolutionary change, rather than a revolutionary one (Haigh 2001b). Companies such as IBM and Remington Rand, which led the development of business computers, had originally been major manufacturers of punched card data processing machines; consequently, their attitude towards the computer was initially "… similar to that of aircraft manufacturers towards the jet engine: The new technology would make their products faster but would not change their function" (Campbell-Kelly & Aspray, 2004, p101). These attitudes were reflected in the widespread adoption of the term 'electronic data processing' (EDP), which IBM originally coined to describe the function of its new range of business-oriented computers.

Until well into the 1960s electronic versions of the punched card machines continued to be seen as an effective competitor with the computer. As late as 1959, IBM as the leading computer manufacturer still derived more than two-thirds of its income from its punched card machines (Campbell-Kelly & Aspray, 2004). Much of the application of computers to data processing systems represented an evolutionary progression from earlier systems, to the extent that from a business point of view computers were commonly viewed as "… glorified accounting machines ... which were simply absorbed into old-fashioned accounting systems" (Aspray, 1990, p146).

But while the initial applications of computers in practice were generally a continuation of previous data processing systems, the rapid advances in computer technology also promoted more ambitious ideas of how it might be used. One of the most influential of the visions for computer-based change in organizations was set out in a paper by Leavitt & Whisler (1958). It is this paper which is widely credited with having inspired the concept of a new business discipline of managerial computing to be known as Management Information Systems (MIS) (see, for example, Dickson (1981), Applegate et al, (1998), Haigh (2001a)).

The paper, published in the Harvard Business Review, was entitled 'Management in the 1980s'. It speculated that new technology (which it labelled with what was then a new generic term of 'information technology') was about to have rapid and far-reaching effects on managerial work. It identified three related parts to this new technology:

- Computer-based techniques for high-speed data processing;
- Statistical and mathematically-based techniques for problem-solving; and
- Computer-based techniques for simulating higher-order thinking.

The paper admitted that the use of the new technology in organizations had so far only been limited and partial; business managers had resisted attempts to apply it to traditional management tasks. However, it argued that the potential benefits of the technology were so great that it was inevitable that this resistance would soon be overcome. In order to bring about this change, organizations would need specialists with skills in systems and computers. Computer programmers, operations researchers and systems analysts would become the 'new information engineers', and should soon move to the upper echelons of organizational management.

Leavitt & Whisler (1958) suggested that the effects of computerization on organizations and management would be 'revolutionary'. It would enable a high proportion of organizational management decisions to be programmed into computer systems, removing organizational reliance on the skills and experience of middle managers. This would lead to a significant reduction in the number of middle managers, with those remaining being "routine technicians rather than thinkers". Organizational control would be centralized into the hands of a small group of senior managers, who could safely leave all routine decision-making to the machine-based systems, and focus more on strategic issues requiring creativity and innovation. But even for the top levels of management the longer-tem future was uncertain: "… Current research on the machine simulation of higher mental processes suggests that we will be able to program much of the top job before too many decades have passed." (Leavitt & Whisler, 1958, p46).

The ideas in the Leavitt & Whisler (1958) paper became the focus of two significant conferences conducted in 1959 - a seminar on Management, Organization and Computers, and a symposium on Management Information and Control Systems (Haigh, 2001a). This work was quickly followed by the commissioning of a book on MIS (Gallagher, 1961) sponsored by the American Management Association. From these works emerged the name and the first definition of the concept of a discipline called Management Information System focussed on the development and implementation of information systems to support managerial decision-making.

Supporters of MIS as a new discipline used its focus on management information to differentiate it from data processing. In the view of MIS proponents, data processing systems were clearly necessary to provide the data needed for an MIS, but they were only one relatively straightforward component. For example, Gallagher (1961) observed that many organizations had developed effective data processing systems, but very few had mastered what he identified as the most important component of an MIS

> "… the proper selection and arrangement of information for planning and control so as to form a system of reports which will give each manager the key facts he needs for decisions" (Gallagher, 1961, p11).

Gallagher lamented that too much emphasis had been placed in organizations on the benefits of what he saw as the relatively straightforward task of automating individual business processes, and too little attention had been given to the more important need to create an integrated MIS to serve the information needs of managers. A new breed of MIS specialists was needed with the specialised knowledge, skills, understanding and attitudes needed for the task.

Gallagher was writing from a business orientation, but similar sentiments were also in evidence in the early definitions of MIS used in the academic world. For example, Dickson (1968) differentiated managerially-oriented systems from 'clerical systems' which automated operational business functions:

> "When the orientation is towards providing information to be used in managerial decisions, the transition has been made from a clerical to an information system …. When a system provides information to be used in a managerial decision process, then it is a true information system". (Dickson, 1968, p19).

Similarly, in the first edition of his classic MIS textbook, Davis (1974) differentiated MIS from the 'easy' task of building data processing systems:

> "To use the computer to do clerical processing is a fairly simple matter; to apply the computer to provide support for management functions is more complex. Indeed the latter application is so challenging that it has been identified by the Association for Computing Machinery as a new academic discipline … known as MIS" (Preface to Davis, 1974, pvii)

Davis acknowledged that it was difficult to answer the question of how much management support functionality needed to be added to a "rather mundane" data processing system for it to earn the label MIS. He dealt with the problem by arguing that:

> "… This is not a useful question. MIS is a concept and an orientation towards which an information system design moves, rather than being an absolute

> state. What is most significant is the extent to which an information system adopts the MIS orientation or an information system supports the management functions of an organization. The answer is usually a matter of degree rather than a simple 'yes' or 'no'" (pviii)

It is not surprising, in the light of the vagueness of this answer, that the literature of the day reveals a widespread tendency to use the term indiscriminately in a way which made debates about MIS difficult. Glaser (1972) highlighted the levels of frustration caused by the uncertainty of precisely what was meant by the MIS concept:

> "Unconscionable amounts of time have been wasted in attempting to define MIS. Articles, conferences, seminars and colloquia are all given to this futile exercise; and many panel discussions have been bravely launched in this fashion, only to end 3 hours later on the same theme, with both the audience and panels participants exhausted and unenlightened. Searching for a universally acceptable definition may occasionally be therapeutic, but it isn't particularly rewarding. The same can be said for lengthy disquisitions on why MIS *cannot* be defined. [emphasis as in original]"

Despite these definitional problems, the MIS concept was quickly embraced in the corporate world in the US, and throughout the 1960s many organizations initiated large-scale MIS projects (Haigh, 2001a). In the academic world, things moved a little slower. Dickson (1981) suggested that for the academic discipline, the period up to 1966-67 was "… preliminary and of a stage-setting nature" (p4). But from that point on MIS began to flourish, attracting people and ideas from a variety of existing fields, including Management/Organization Behaviour; Management Science/Operations Research; Systems Theory/Cybernetics; and Computer Science/computer technology (Davis (1974). Dickson (1981) identified various landmarks in its growth and consolidation in the academic world, including the establishment of specialist academic programs, curricula, textbooks, conferences and journals.

But experiences with MIS in practice failed to live up to the hopes and expectations of its supporters. Problems with MIS development and implementation in practice were becoming apparent by the mid-1960s, and as time went on the voices of doubt and scepticism about the concept steadily grew louder and more numerous. As early as 1964, John Dearden - identified by Haigh (2001a) as the most constant and vociferous critic of MIS – wrote that "… systems specialists have been developing an approach to management information systems which, if left unchecked, could cause serious problems to the companies that adopt it". (Dearden, 1964, p128). Similar concerns about the performance of MIS in practice were soon being expressed even by supporters of the concept. (For examples of critiques, see Ackoff (1967), McKinsey (1968), Rhind (1968), Zani (1970), Bauer (1972) (in Gruenberger (1972)) Mintzberg (1972, and de Marco (1972)). By the end of the 1960s, an anti-MIS backlash was in full swing. Although MIS continued to be a major focus of corporate computing efforts throughout the 1970s, its days were numbered. By the 1980s, Haigh suggested, MIS had become "… so tainted by failure, reflecting the persistent reality of computer work's low status in the eyes of management, that academics and management writers flocked to alternatives rather than re-definition" (Haigh, 2001a, p57).

Of all the attacks which were made on MIS, the most often-cited is that by Dearden (1972) in an article entitled 'MIS is a Mirage' which was published in the Harvard

Business Review. Weber (2003) noted that "… Dearden's comments sparked substantial controversy, and among some scholars they were roundly condemned as destructive and unhelpful to a nascent discipline." (piii) Dearden was in fact a strong advocate of computerised information systems, and even co-authored a textbook entitled Management Information Systems (Dearden & McFarlan, 1966), which described the wide variety of application areas in which organizations could benefit from computer systems. However, he believed that many aspects of managerial decision-making were not amenable to computerization, and was a pronounced sceptic of the concept of the 'total' MIS.

Dearden summarised the main substance of his argument as follows:

> "I certainly do not mean to suggest that a company does not need good management information systems [note Dearden's deliberate use of lower case] - nothing could be further from the truth. But the notion that a company can and ought to have an expert (or a group of experts) create for it a single, completely integrated super-system - an 'MIS' - to help govern every aspect of its activity is absurd." (p90)

He further went on to say:

> "To the extent that MIS refers only to company information systems that use a computer base, and to the extent that everyone understands this limitation, I have no serious quarrel with the trend to MIS; it is vital that management tightly control its computer-based information systems, and in general the so-called MIS groups seem designed to guarantee a tight rein to management. In my experience, however, such a limited definition of MIS is *not* what advocates of this approach to information systems mean when they use the term. They intend something novel and far more global, some entity that can provide revolutionary benefits we cannot derive from the traditional approach." (p91).

From the standpoint of the current position of the IS discipline, it is hard to see why an article based around these statements could be seen as being so controversial and destructive. Even at the time, the comments about the non-viability of the 'total system' concept were conceded as accurate by many in the MIS community (see, for example Emery & Sprague, 1972). In fact the most common element of the published responses to Dearden (HBR, 1972) was the accusation that he had set up a 'straw man' in representing MIS as a 'total systems' concept, which his respondents claimed was an inaccurate and out-dated picture.

However, in its historical context, the anger of MIS adherents to Dearden's critique is more understandable. If his argument was accepted, the discipline's base in managerial computing would disappear, and it could not claim to represent anything more than the technically-based data processing systems from which it had consistently sought to distinguish itself. This would potentially place in jeopardy its claims to the special status of an academic discipline. According to Benbasat & Weber (1996), Dearden's critique of MIS did have an immediate adverse effect on the discipline's claims to academic legitimacy:

> "A ground swell of scepticism arose within academe about the discipline that threatened to undermine its already-fragile beginnings. In this light, pressures arose on MIS academics to prove to their colleagues in other disciplines that their contributions and their discipline were valuable." (p390).

This in turn made it difficult for MIS academics to get promotion, and created pressures for them to develop research programmes to improve the discipline's academic credibility.

For some time, many MIS supporters resisted their critics and continued to downplay the reality of practical experience with MIS. Dickson's (1981) history of MIS 'from the inside' is a good example of the selectivity of some of the MIS literature, providing a thorough account of the key influences in the discipline's evolution, but barely mentioning any of its problems. Critics of the MIS concept were dismissed with a brief passing reference to the existence of "… pessimistic writers [who] suggest that some of the proponents of computer support to management are overly optimistic" (p9). The paper labelled this group as 'the caveats' (p27). The only mention of the failings of MIS in practice came in the conclusion to the paper, which briefly referred to the existence of "persons who suggest … that MIS failed. The claims are that MIS has not been effective." (p27). Dickson responded to this in the same terms as were used in response to Dearden, by accusing critics of not understanding and mis-representing what MIS was really trying to achieve.

When MIS's problems were admitted in the academic literature, they were commonly presented as the 'teething problems' which were to be expected in a new discipline. For example, in the first edition of his classic MIS textbook, Davis (1974) noted that MIS had provoked some controversy because of its expensive failures. He attributed these failures to "… inadequate hardware/software (application attempted too much), inadequate MIS development personnel and procedures, or the lack of readiness of the user personnel and user functions for the system." (p21). Davis concluded his remarks on this issue by commenting that problems with the implementation of MIS in practice were to be expected, because MIS as a concept was still in the early stages of its evolution:

> "A useful historical analogy is the experience with the first application of the computer to data processing - the processing of a factory payroll. The application had severe problems … but in a short time payroll processing became an 'easy' application. The MIS for managerial planning and decision-making support is having a similar (although lengthier) experience, and there is reason to expect a similar result, which would mean that a rather complete MIS could be implemented in almost any organization." (p23)

Both the reference to controversy and the parallel with the 'ease' of data processing application development were removed in the second edition in 1985 (Davis & Olson, 1985).

Despite the attempts of its supporters to defend it, MIS continued to decline in popularity. According to Haigh (2001a), the basic problem was simply that it proved impossible to convert the concept into an operational reality:

> "There is no record of any major company managing to produce a fully integrated firmwide MIS during the 1960s, or even the 1970s - still less one that included elaborate economic forecasts or linked suppliers and producers".
> (Haigh, 2001a, p50)

In the face of the ongoing problems of MIS in practice, the academic discipline found it necessary to reduce its emphasis on managerial computing as its sole focus, and broaden the scope of the discipline to include all types of information system, including the 'easy' transaction-based data processing applications.

Over time the term ‘MIS’ ceased to have any meaning as a distinction between managerial computing and other forms of IS. For example, the preface to the second edition of Davis’s textbook (Davis & Olson, 1985) introduced and defined the discipline as follows:

> “… Although there are several terms to describe the content of the book, the term ‘management information systems’ is used because it is well accepted. Alternative terminology such as information systems or organizational information systems would have been acceptable. The conceptual structure implied by the terms is the same - a computer-based information system to support organizational processes. In other words, the information system is a support system for an organization. That part of the information system designed to support organizational operations is an operational support system, the part designed to support decision making is a decision support system, and the part that supports knowledge work is a knowledge work system.” (Davis & Olson, 1985, pvii)

Hence, the term ‘MIS’ had turned into little more than a convenient label, equivalent to various other general terms for any type of computer-based organizational information system.

With the loss of the MIS concept as the basis for defining the cognitive content of the discipline, and the consequent declining status of ‘MIS’ as a distinctive disciplinary name, it became difficult to specify what constituted the discipline of IS. In the late 1970s, a survey of American university departments (Nunamaker et al, 1981) identified 70 undergraduate and 54 postgraduate academic programs in information systems, which were known by a total of 37 different names; although ‘MIS’ was the most commonly-used name, it accounted for only just over 20% of the programs. Nunamaker et al (1981) acknowledged that few of these programs met even the minimum requirements of the IS model curriculum as it was defined at the time (discussed in the next chapter), but the paper did not address the obvious question as to the criteria which were used to determine that these programs could be categorised under the single general classification of Information Systems.

Various attempts were made throughout the 1970s to develop a disciplinary model which encompassed the increasingly diverse range of the areas of knowledge seen as relevant to the development, implementation and management of computer-based information systems. Many of these still used MIS as their central focus, and tried to develop more elaborate models which could explain the causes of MIS development/implementation problems, and establish a broader theoretical foundation for these systems. The outcome of these efforts is best seen in the development in the academic literature of theoretical ‘frameworks’ for MIS, which sought to provide a basis for the research which was needed to fix them. Examples of such frameworks include Chervany, Dickson & Kozar (1971), Gorry & Scott Morton (1971), Lucas (1973), Mason & Mitroff (1973), Mock (1973), Ein-Dor & Segev (1978), Ives, Hamilton & Davis (1980), and Nolan & Wetherbe (1980). Each of these frameworks highlighted particular areas of organizations, information, technology, human behaviour and the inter-relationships between them, which were held to be the key to successful MIS. Some of them became the basis of research programs designed to solve the MIS problem; for example, the well-known Minnesota Experiments on decision-making were conducted as part of research program based on aspects of the Mason & Mitroff (1973) and Chervany, Dickson & Kozar (1971) frameworks (Dickson, Senn & Chervany, 1977).

The frameworks also served to extend the scope of the MIS discipline into other disciplinary areas, and their emphasis on the importance of these 'reference disciplines' to MIS further blurred the boundaries between them and MIS. Davis (1983) admitted that the discipline now had "… an unusually high number of disciplines with which it intersects. The intersection occurs because the information systems area uses knowledge from another discipline as a fundamental part of its body of knowledge" (p6). He listed these intersecting fields of knowledge as Computer Science, Behavioural Science, Decision Sciences, Organization and Management, Management Accounting, Microeconomics and Organizational Functions.

The frameworks and Dickson's (1981) history demonstrate that some disciplinary leaders still retained their faith in the MIS concept until the 1980s, and would presumably have been happy to continue with their attempts to base the discipline around it. However, the failures of MIS in practice, combined with pressures from other groups to broaden the discipline's coverage to all forms of computer-based information system made this impossible. Work on managerial computing continued, but as a specialist sub-discipline, initially under the umbrella term Decision Support Systems, and then also under various other labels such as Executive Information Systems, On-line Analytical Processing and Business Intelligence (Power 2007).

The passage of time has served to diminish the extent of the failure of the MIS concept and its impact on the early years of the development of the discipline. In some computing texts the 'MIS era', is spoken of as simply a successful historical stage in the development of computing applications and the IS discipline. The well-known '3-era' model of the evolution of IS represented it as a product of the 1970s, which succeeded the initial 'DP era' of the 1960s, and was a pre-cursor to the 'strategic systems era' which moved the focus from managerial decision-making to 'strategic systems' and 'IT for competitive advantage' (see for example, Wiseman (1985), Somogyi & Galliers (1987), Ward & Peppard (2002)). The discussion in this section has tried to demonstrate that although this might be an attractive conceptual picture of an evolving discipline basing itself on increasingly sophisticated forms of computer usage, it is in fact historically inaccurate.

The MIS concept played an important role in earning recognition for the study of information systems as a new academic discipline, distinct from the more 'mundane' tasks of data processing. This was particularly the case in the US as illustrated by the fact that it became the original name for the discipline. However, the failure of MIS in practice meant it could no longer continue to serve as the key defining central focus for the field of study. IS was left in a state of uncertainty about whether it had some central core concepts and body of knowledge, and if so, what they comprised. This set the scene for the next stage in its evolution.

3.3.2 Beyond MIS: 1980-1996

Any starting point for an analysis of the evolution of the discipline after MIS is somewhat arbitrary, because there is no clear marker for the concept's demise. For the purposes of this history, 1980 has been chosen, because it was the year in which Peter Keen delivered an address at the first ICIS conference which has often been referred to as a landmark in the discipline's growth (Keen, 1980). This paper is significant because it clearly set out the need for MIS to find a new focus. Much of the subsequent research on the nature of IS published during this period acknowledged its influence.

Keen's paper made no reference to the prior history of MIS described above - a curious omission, given that he referred to his own background as being in history and commented on the importance of the role of history in the development of a discipline: "There is a need for reflection on the field, its roots, relations with other disciplines and historical context" (Keen, 1980, p18). One of the key messages spelled out in the paper was the need for the discipline to establish a 'cumulative research tradition'; one can only assume that he did not believe that what had happened to that point could constitute a useful part of any such tradition. Certainly in his earlier writings he had been dismissive of the MIS supporters:

> "The whole history of information systems has been dominated by evangelical aims and assertions. This was the cause of such recurrent fads of the 1960s as 'The Total System', 'Real-time, Online Planning Systems' and 'Global Corporate Data Base' True believers make vast claims for a new technology or methodology and build expectations that are too often unreachable….. The dominant evangelical aim has long been to bring the computer to top-level decision-making. This aim has not been met." (Keen, 1976, p3)

However, he was equally contemptuous of John Dearden's 'MIS is a Mirage' critique, describing it as 'an anti-intellectual piece of journalism', and citing it as an example of the 'real rubbish' which was too often accorded inappropriate levels of respect in the IS literature.

Keen was blunt is his assessment of the state of the IS field and its inability to identify and clearly define the body of knowledge around which it could claim its legitimacy as an academic discipline:

> "At present, MIS research is a theme, rather than a substantive field. Luckily, since computers are important and knowledge of how to use them limited, academics have been given a line of credit to draw on, and can expect that universities will eagerly continue to hire assistant professors in MIS even while they bemoan the poverty of their seniors' research". (Keen, 1980, p9)

The discipline's lack of clarity about itself, its focus, and its relationship meant that to other disciplines "… we look muddled, messy and fraudulent" (p10) and " … as an academic field, we look mediocre at best" (p16). Keen conceded the possibility that this would never change, and noted the risks :

> "Perhaps MIS is only a theme. Perhaps, like Organizational Behaviour and Business Policy, it is a convenient umbrella term for a hybrid applied field which is more easily defined in terms of the MBA curriculum than research. Perhaps MIS will eventually be absorbed into other more clearly defined disciplines, such as accounting." (Keen, 1980, p9)

Keen identified several key areas which the discipline had to address if it were to have a chance of avoiding this fate. These included: the identification of the most suitable reference disciplines for IS to use as the basis for developing its research approaches and techniques; the determination of key research themes and variables; the clarification of the nature of the discipline's links with technology and with business practice, and the establishment of suitable specialist outlets for publishing IS research. Associated with all of these was the need to establish a cumulative research tradition, based around a "… core set of issues, ideas and methods" (p13). Without this, MIS would remain a mystery to those outside the discipline and would struggle to establish and maintain its academic legitimacy.

Keen's critique of the discipline expressed concerns not only about the cognitive aspects of disciplinary definition, but also about the social dimensions of disciplinary legitimacy. As part of his warning that earning a secure place in academia would not be an easy task for IS, he noted that:

> "We have to recognise that it will be hard to make MIS 'respectable'. The current climate in academia is not receptive to the hybrid fields (eg, Business Policy, Organizational Behaviour) and political power is in the hands of the tough guys in many universities". (Keen, 1980, p14)

In particular, Keen noted that the fundamental aim of MIS to affect business management practice was currently unfashionable in universities. He acknowledged that some other business disciplines had yielded to these pressures by isolating themselves from practice, but argued that MIS must not be willing to pay such a price to gain its academic respectability.

The Keen paper came at the beginning of a time of rapid expansion in MIS research activity. The growth in MIS schools meant that a large and increasing number of MIS scholars were publishing research under the banner of MIS. This trend was further strengthened by the increasing capabilities of computer technology and the associated increase in the variety of computer-based applications. Scholars from many disciplines which had begun to use computing technology found the MIS literature to be a useful publishing outlet. Inspired in part by Keen's call for a cumulative research tradition, a steady stream of research papers appeared examining and analysing this published research in the hope that the real nature of the MIS discipline would be revealed. Table A1 in Appendix A lists the most significant of these studies and summarises the key parameters of the way in which they were carried out.

The most striking initial feature of these studies is simply their prevalence: doing research into its own nature became one of the central pre-occupations of the discipline. For example, one of the studies by Swanson & Ramiller (1993), which was conducted towards the end of this period, found that the study of the characteristics of IS and IS research ranked as one of the nine leading topics of interest for IS research. A second notable feature is that the studies were generally inductivist in nature. Earlier efforts to define the discipline had usually been deductivist, starting with some theory or belief about the nature of MIS, and using it as a basis for deducing what its disciplinary content should be. By contrast, these studies gathered together large numbers of research papers which identified themselves as being about MIS, and used analyses of the content of these papers to derive conclusions about the nature of the discipline. Thirdly, the studies showed the diversity in viewpoints which could be observed in the work of IS academic practitioners about the nature of the discipline, its key themes, its reference disciplines, its research methods, and its key journals.

The analysis conducted within each of these studies, and comparisons of the results of the analyses across the studies overall, showed significant broadening and increasing divergence in researchers' perceptions of the discipline. Traces of the original MIS focus on managerial computing remained in research work on topics such as Decision Support Systems and studies of management behaviour, but managerial computing was now just one of many themes addressed in IS research. There were no signs of an emerging dominant theme to replace managerial computing, and little evidence of the development of the sort of cumulative research tradition for which Keen had called. Instead, the discipline appeared to have become even more diversified and fragmented.

Reactions to these trends were mixed among IS academics. Some welcomed the discipline's expansion and increasing diversity, while others echoed Keen's concerns and called for greater unity. In one of the most often-cited papers from the period, Banville & Landry (1989) used disciplinary theory as a basis for analysing and resolving the growing tension between these opposing points of view They suggested that the advocates of greater unity in the discipline seemed to be adopting, either explicitly or implicitly, a Kuhnian model of science which claimed that disciplinary progress should follow a pattern of growth which alternates between periods of crisis or revolution, and periods of stability and 'normal science'. The initial formation of a discipline and its progression into its normal science phases were characterised by the identification of shared paradigms which brought disciplinary unity and cohesion. According to this model, the failure of IS to identify unifying paradigms was a sign of immaturity which brought into question its claims for disciplinary legitimacy.

Banville & Landry (1989) argued that it was inappropriate to apply the Kuhnian model to MIS. They suggested that although Kuhn's work had achieved widespread popularity and influence, his model of disciplines and disciplinary progress had many flaws, to the point where it was accorded greater respect outside the philosophy of science than within it. In particular, his explanation of what constituted a paradigm was ambiguous and confusing, and his association of scientific progress with the establishment of paradigms was dubious. Applying the Kuhnian model to MIS was "…too restrictive to help understand the present state of MIS" (p49).

Instead of following Kuhn, Banville & Landry (1989) adopted Whiteley's (1984) sociological framework for disciplines as the basis for their analysis of the status of MIS. Whiteley (1984) had argued that the inherent differences in the cognitive and social dimensions of disciplines meant that there were many different models of scientific disciplines, rather than the single model proposed by Kuhn. He had developed a framework which used a combination of the cognitive and social dimensions of disciplines to classify them into seven different categories, only one of which conformed to Kuhn's paradigm-based disciplinary model. Banville & Landry argued that MIS as it was practised at the time fitted into the 'fragmented adhocracy' category of Whiteley's (1984) framework. Disciplines in this category are open and very loosely controlled with minimal barriers to entry from other fields; research interests are weakly co-ordinated across the field as a whole with many small groups coalescing around different themes. Under this model, the pluralism and diversity of MIS and its propensity to identity crises were not flaws, but simply characteristic of its status as a discipline of that type.

Banville & Landry (1989) suggested that it was not possible to predict with certainty how a young and still evolving discipline like MIS would develop in future. It might stay as a fragmented adhocracy or it might morph into another of the disciplinary categories in Whiteley's (1984) framework. For example, the strong vocational orientation of MIS had had a significant influence on the character of the discipline; if this link were broken it might take on a more 'academic' flavour and change its disciplinary characteristics accordingly. However any such change could not be imposed on the discipline, but would have to come from the "convergent actions of a large segment of its members" (p58). For Banville & Landry the key point was that MIS "should be accepted for what it is" (p58), and not be subject to attempts to force it into some other state.

The Banville & Landry article has been often-cited in the IS disciplinary literature, and has been rated as a landmark paper because of the significance of its influence on the directions of the discipline. For many IS scholars, it provided an intellectual justification for the discipline itself and for the ongoing diversity of its literature. In the eyes of some of these researchers this diversity was a cause not for concern, but for celebration. For example, Cheon et al (1992) used diversity as a measure of maturity and marked the discipline's willingness to spread itself into many areas as a sign of growth; likewise King (1993) noted with approval the plethora of reference disciplines for IS, and suggested that "… diversity means we are doing something right" (p294). But for many other scholars there was a growing level of disquiet over the ever-increasingly fragmented nature of the discipline. The conflict between these opposing viewpoints became the centre point of the next stage in the discipline's evolution.

3.3.3 The 'anxiety discourse' and the search for identity: 1996 - present day

The year 1996 has been selected as the next transition point between stages in the evolution of IS, for the same reason that 1980 was chosen as the previous one - that is, it saw the publication of a landmark article, Benbasat & Weber (1996), which inspired a chain of successors. This article examined only one specific issue, but the debate which it sparked rapidly intensified and spread. As other writers responded and engaged with the debate, a number of other related issues were raised, forming what Lyytinen & King (2004) labelled an 'anxiety discourse' among practitioners concerned about the identity and academic legitimacy of the IS discipline. This section will explain in detail the key ideas as presented in the some of the early contributions to the debate, and will cover the subsequent discussions in summary form.

The Benbasat & Weber (1996) article proposed that the quest for disciplinary identity should change its current course and proceed in the opposite direction - stopping the expansion and spread of the discipline, and contracting its borders around a much smaller base of knowledge than that which had been explored to date. The paper stated its central concern as being the following question: "Is diversity beneficial or harmful for the long-term viability of IS as a discipline?" (p389). It acknowledged that "…Diversity in research has been both the reality and the accepted norm by many in the Information Systems discipline for over a decade" (p389). This diversity was an understandable product of the discipline's history, but it posed a problem which must be addressed if the discipline were to survive and prosper in the future.

The paper traced the origins of the discipline's over-emphasis on diversity to the first ICIS conference in 1980, and particularly to the presentation by Keen (1980) described in the previous section. It suggested that IS researchers had taken to heart Keen's strictures about the need to use reference disciplines to seek a new research tradition, and that IS research throughout the 1980s and 1990s had been dominated by a trend to pluralism - "… accommodating of diverse research problems, research methods, theoretical foundations, and paradigms" (p391). As a consequence, IS research had developed an unhealthy reliance on other disciplines for its theoretical foundations, and neglected the task of developing its own fundamental theories from within the discipline.

The paper argued that the survival of an academic discipline is dependent on its capacity to create these fundamental theories to act as a core to give it an identity:

> "… disciplines attain a relatively stable place and identity among other disciplines only when (a) they have developed at least one powerful, general theory (paradigm), and (b) the theory (paradigm) is widely accepted as their own, and *not* the property of some other discipline [emphasis in original]" (p393)

The paper noted that some IS academics (exemplified by King (1993) and Keen (1991)) were not concerned about IS's ability to attain disciplinary status, but were happy for IS to continue as a broad community of scholars, retaining strong allegiances to other disciplines. However, it argued that this view failed to recognise the importance of unity and consensus about the discipline's fundamental features. Failure to establish a disciplinary identity based on an agreed set of theoretical foundations would jeopardise the discipline's long-term future.

In support of this position, the paper relied heavily on the work of Pfeffer (1993 and 1995) who had addressed the same problem in the field of Organization Science. It argued that Pfeffer's comments in regard to the condition of that field and the risks which it ran due to its lack of agreed foundations applied equally to IS. In particular, it quoted Pfeffer's (1993) words on the consequences of this lack of foundations: "… the field …. will remain ripe for either a *hostile takeover* from *within* or *from outside*. In either case much of what is distinctive, and much of the pluralism which is so valued, will be *irretrievably* lost [emphasis supplied by Benbasat & Weber]" (p394). Already, the paper claimed, there were signs of both forms of breakup in IS:

- From within, as evidenced by the proliferation of specialist conferences, the suggestion that many IS academics no longer accorded an appropriate level of respect to mainstream conferences and journals, and the departure of some senior IS academics to other disciplines;
- From 'hostile' activities from outside, as evidenced by the interest allegedly being taken by some other (unspecified) disciplines in topics regarded to be in the IS domain, and by claims of anecdotal evidence of some schools "… where colleagues from other disciplines have indicated their readiness to step in and teach courses that we consider to be in our pedagogic domain" (p394).

The Benbasat & Weber paper provoked a strong and immediate response from Robey (1996). Robey concurred with most of the points made by the paper up to the point where it drew its conclusions. He agreed with their assessment of the high level of diversity in the discipline, its historical causes and its effects in hindering the development of any dominant disciplinary paradigm. However, he suggested that rather than being an accident of history, the growth of this disciplinary diversity had in fact been a deliberate strategy fostered by many in the IS community:

> "…diversity in IS research is being promoted through the conscious policies enacted by leaders in the IS field. We have not failed in some mission to converge towards a unified paradigm; we have wilfully pursued an opposing aim" (Robey, 1996, p402).

Robey also agreed with Benbasat & Weber's (1996) assessment of the risks inherent in disciplinary diversity, acknowledging that fragmentation, lack of a cumulative research tradition, poor communication within the discipline and a weakened institutional position were all possible adverse outcomes. He further agreed with Pfeffer's (1993) view, as quoted by Benbasat &Weber (1996), that there could be significant benefits if IS academics were prepared to adopt a shared disciplinary paradigm:

> "Those who conform to the dominant paradigm are likely to be rewarded; individuals excelling in mainstream research are granted promotion and tenure; institutions supporting mainstream research enjoy greater prestige and financial stability. In Pfeffer's view, conformity and control are the price a field must be willing to pay in order to receive the prize of political power and institutional legitimacy" (p403).

But this price, Robey argued, is one which IS should not be willing to pay. He pointed out that Pfeffer's arguments in favour of greater disciplinary unity and control had not been uniformly well-received within Organization Science, citing the following reactions as examples:

> "Pfeffer's vision would lead to a tyranny of the elites, who would protect their positions by denying the existence of evidence that challenges their views and by undermining the credibility of those whom they cannot control" (Canella & Paetzold, 1994, p338)
>
> "I want to suggest here that [Pfeffer's] sour view of our field is - to be gentle - insufferably smug; pious and orthodox; philosophically indefensible; extraordinarily naïve as to how science actually works; theoretically foolish, vain and autocratic; and - still being gentle - reflective of a most out-of-date and discredited father-knows-best version of knowledge, rhetoric and the role theory plays in the life of any intellectual community" (van Maanen, 1995a, p133)

While acknowledging that the latter quote in particular appeared to be inspired by personal animosity as well as differences of academic opinion, Robey suggested that any attempt to impose uniformity and control diversity in IS research would probably provoke a similarly hostile response.

More positively, Robey (1996) argued that diversity brought many advantages - a constantly expanding knowledge base, openness to the engagement of scholars from other disciplines, the encouragement of creativity and support for the principle of academic freedom. He made a telling observation that if the diversity of IS research had been halted at some arbitrary point in the discipline's evolution, then the dominant theme at that time would presumably have become the basis for the discipline, thereby potentially excluding many of the interesting and productive themes which had emerged in subsequent years. He cited the field of Operations Research/Management Science as an example of a field which had adopted a narrow perspective of itself to its long-term detriment. Robey concluded by agreeing that some level of control over disciplinary diversity was needed to avoid 'methodological anarchy', but that the imposition of a dominant paradigm was not the correct path to follow. Rather, the path which the discipline should seek to follow was one of disciplined methodological pluralism, as described by Landry & Banville (1992).

After this exchange, the argument over disciplinary diversity and identity simmered for several years, until it was brought to the boil again by the publication in MIS Quarterly of a further paper by Benbasat & Zmud (2003), in association with an editorial comment by Weber (2003). Although clearly motivated by the same concerns which drove Benbasat & Weber (1996), these articles took a different tack, setting aside the question of diversity and unifying paradigms, and focusing instead on the need for an IS disciplinary core.

Benbasat & Zmud (2003) repeated the concerns expressed in Benbasat & Weber (1996) about the ability of the discipline to survive if it could not establish a clear disciplinary identity. The paper went further in specifying the details of this concern, citing institutional theory (specifically, Aldrich 1999) as a basis for analysing the state of the discipline and the threats to its future. According to this theory, perceived legitimacy is an important contributory factor to an organization's ability to survive and flourish; this legitimacy can be based either on cognitive or socio-political considerations. Taking the IS discipline as a form of organization within the academic world, Benbasat & Zmud suggested that it had made significant progress in establishing its socio-political legitimacy; as examples of this they cited achievements such as the setting up professional bodies, the creation of academic programs and the conferral of accreditation on them, and the recognition which had been earned from other disciplines. However, the discipline still suffered from a significant weakness in the area of cognitive legitimacy, a weakness which they defined as being "… the absence of a set of core properties, or central character, that connotes, in a distinctive manner, the essence of the IS discipline" (p185). Without this disciplinary core, they suggested, IS would be unable to establish and articulate its identity in the way needed to maintain legitimacy in the eyes of the rest of its organizational field:

> "If influential stakeholders are unable to comprehend the nature, importance and distinctiveness of the role being served by the IS discipline, these stakeholders are unlikely to acknowledge its legitimacy within the organizational field' (p185)

As examples of such key stakeholders, the paper listed "… governing bodies, executives from public and private organizations, university and college administrators, and, most importantly, scholars from other disciplines" (p185).

The paper took a somewhat softer line on the issue of diversity than that which had been taken in Benbasat & Weber (1996). It noted once more the range of backgrounds from which IS had come and noted that "…like Robey (1996), we accept this breadth in intellectual background. However, much as IS needed interdisciplinary approaches, the lack of a clearly articulated core meant that "topical diversity can, *and has*, become problematic [their emphasis]" (p185). Such diversity was sustainable, but only when it was built on a solid foundation of clearly-defined core properties for the discipline.

The paper asserted that IS does have a clear core, which it identified as the IT artefact and its inter-relationship with key related constructs (described in the article as its 'immediate nomological net'). These were described as being issues relating to the development and implementation of IT artefacts, behavioural issues associated with the development and usage of these artefacts, and the impacts of their usage on people and organizations. The paper asserted that much of the research being published under the banner of IS either failed to include these core elements, or focussed too heavily on other elements which were not part of the net. Progress in clarifying the nature of IS and establishing its disciplinary identity could only be achieved when IS practitioners focussed their research around these core properties.

Weber's (2003) editorial comments concurred with the general thrust of the Benbasat & Zmud paper. He noted that some parts of it would be regarded as controversial within the discipline, and that some leading scholars believed that the discipline neither wanted nor needed a stronger sense of unity or identity. However, Weber argued that some sense of a disciplinary core was essential for the progress of the discipline; without it there were no boundaries to define what constituted the limits of the discipline. He disagreed with

Benbasat & Zmud's (2003) contention that the IT artefact should be accepted as the disciplinary core, and put forward the case which he and Wand had previously made for placing IS representation in that position (for example, in Wand & Weber, 1995). However, he suggested that further discussion and debate on these matters was important for the future of the discipline.

These papers provoked an outpouring of articles relating to these issues, expressing a diverse range of points of view, based on a variety of philosophical positions and calling on an equally varied and diverse range of supporting evidence. A literature review by Teo & Srivastava (2007), which was far from exhaustive, identified 25 significant papers on the theme published between 2003 and 2007. King & Lyytinen (2006) provided an excellent compilation of twelve of these papers by some of the leading figures in the discipline, to which were added the authors' retrospective commentaries on their own papers and that of the other protagonists.

The following list gives a broad indication of some of the main issues upon which the debate has focussed. For the sake of simplicity the list shows these issues as separate topics, whereas, as the questions listed within each topic show, there are actually many points of intersection and overlap between them. The list is not comprehensive, and is intended only as a selection to give an idea of the general flavour of the debate:

- Disciplinary identity: Does IS have a clear disciplinary identity, and does it need to do anything further to establish or maintain its identity in order to consolidate its status and ensure its future survival as a distinct academic discipline? This has led to questions of what constitutes a disciplinary identity, whether IS is a discipline or whether it is actually inter-disciplinary or trans-disciplinary, how important identity is for disciplinary legitimacy and survival, how it should be pursued, and what consequences a failure to achieve an agreed identity might have for its academic legitimacy.

- Disciplinary diversity:How much diversity can IS accommodate, and should boundaries be set to limit the range and diversity of issues which are held to constitute the discipline? This has led to questions about how diversity is defined and measured, how its impacts can be assessed, how any such boundaries could be established and enforced and what long-term effects they might have on the discipline, its identity and its ability to accommodate change.

- Disciplinary core: Does IS have a clearly-defined and agreed set of core disciplinary concepts, and if so, what is it? If not, should it have a core and what should that core be? This has led to questions about the nature of such a core (disciplinary content, foundational theories, research methods, etc), how common such a concept is in other disciplines and what effect it (or its absence) would have on disciplinary identity and academic legitimacy. Aside from the theoretical merits or otherwise of a disciplinary core, questions have been raised about its implementation in practice - how could any such core be defined and agreed upon, and could it be successfully imposed upon a discipline; or rather, must it emerge naturally from the work within the discipline.

- Disciplinary legitimacy: To what extent has IS succeeded in establishing its academic legitimacy, and what is the basis of those claims? This has led to

> questions about what constitutes disciplinary legitimacy in the context of the role of the university, the nature of the relationship between disciplinary identity and academic legitimacy, what is needed in order to establish and maintain claims to academic legitimacy, and the nature of the stakeholder groups who have a say in determining academic legitimacy.

From the point of view of this study, there is no need to examine this voluminous literature in detail, or to discuss the details of the variety of points of view which have been expressed. However the list of topics highlights the extent to which the general directions which the debate has followed involve many of the fundamental issues which were identified as perennial problems in educational theory and philosophy in Chapter 2. Protagonists in the debate have employed both philosophical and pragmatic arguments to explain and justify their positions.

Philosophically-based arguments have justified their positions by reference to fundamental general principles, often drawn from philosophies of knowledge or of science; the status of IS has been analysed and assessed against some preferred theoretical model of disciplines. An early example of this form of argument is that of Landry & Banville (1992) described above, which advocated the use of Whiteley's (1984) sociological model of disciplines in preference to Kuhn's (1962) paradigm-based approach.

By contrast, pragmatic arguments have focused on issues relating to the success or survival of the discipline; problems and their solutions are identified and defined in terms of their consequences for its long-term future. Keen's (1980) assessment of the state of discipline described in the previous section was based largely on an analysis of this sort. The paper by Benbasat & Weber (1996) which was described above as the starting point for this period used both these forms of argument: on pragmatic grounds it argued that IS should aim to limit its diverse for fear that it would risk becoming fragmented and losing its academic credibility; but also on philosophical grounds it argued that there was a fundamental principle that a discipline should have a core.

Coming on top of the diversity in perceptions of the cognitive content of IS, it is not surprising that the diversity in these forms of argumentation has caused the debate at times to appear to become a 'dialogue of the deaf'. There has often been little common ground for comparison of the merits of competing points of view, because they have been based on different philosophical positions in relation to the division of knowledge and the nature of disciplines, differing levels of optimism about the prospects of the discipline, and differing views about the strategies most likely to secure its future. Weber (2006) noted with a touch of frustration, that in their commentaries on the nature of the discipline "... the protagonists ... pass each other like ships in the night. For the most part, they make no reference or only token reference to the views of other protagonists. Instead they focus on articulating their own views about the information systems discipline" (in King & Lyytinen, 2006, p295).

Consequently, there have been few signs in the IS literature of any resolution of the issues concerning IS disciplinary identity, diversity, core content, academic legitimacy or future prospects. The views about IS which can be seen in the literature display not only the same kind of differences in perceptions of the subject matter of the discipline which were seen in the previous inductivist approaches, but also new areas of difference based on issues of educational philosophy. That is, far from helping to provide the basis of a solution to the IS identity problem, these attempts to address the issues in terms of fundamental disciplinary principles has simply added to the confusion.

The discussion has become so confusing and potentially divisive as to cause leading scholars such as Hirschheim (2006) and Mason (2006) to suggest that there should be a temporary moratorium on further debate. They argued that most of what needed to be said had been said, and the prospects of reaching consensus appeared to be so low that there was little point in continuing the debate for the time being. However, although an interlude of this kind may be deemed necessary or useful in the short term to give pause for reflection on the mass of literature which the debate has generated, it leaves unresolved the central problem of establishing an agreed intellectual base to define the discipline's identity.

3.4 The social dimension: the role of the ACM and the DPMA

Discussion of the sociological dimensions of IS disciplinary formation and growth have been relatively scarce in the debates over the nature of the discipline in the IS academic literature. As shown by the previous section, the literature has usually approached the problem of defining of the discipline as an intellectual problem, with contributors to the debate framing their arguments around issues related to its cognitive content, and supporting their positions by references to the themes covered in its research theories of knowledge and the like.

The most detailed sociological analyses of IS and the other IT-related disciplines have come from outside the IS field in the work of historians such as Haigh (2001a, 2001b, 2006), Ensmenger (2010) and Hughes & Hughes (2000), who have investigated the growth of computing professions and the nature of computing work. For example, Haigh's (2001a) study of the history of MIS, which was used as a major reference in Section 3.3.1 for the discussion of that phase of the development of the IS discipline, explored a wide variety of the sociological and organizational origins of the MIS concept.

To illustrate the impact of sociological factors on developments in IS, this section will outline only one aspect, which is the role of the main professional institutions in its formation and early growth. The influence of these institutions on IT and IT education generally has been described in great depth by Haigh (2003) and Ensmenger (2010). The following summary draws largely on their accounts to highlight the contrasting attitudes which these organizations took to IS and the other emerging computing professions, and to illustrate their impact on perceptions of the IS discipline.

As computing began to emerge as the basis for professions in the United States, three main organizations formed to support it - the Association of Computing Machinery (ACM), the Data Processing Management Association (DPMA) and The Institute of Electrical and Electronics Engineers Computer Society (IEEE-CS). These organizations played major roles in encouraging the formation and growth of the computing disciplines, promoting the use of computing in organizations, representing the interests of its emerging workforce and fostering the development of its educational programs.

The ACM and DPMA in particular were primarily responsible for the early attempts to define an IS discipline and develop the cognitive content which would establish its knowledge territory at a theoretical level. The differences in the characteristics of these organizations and their approaches to computing epitomised the conflicts which emerged to affect the early attempts to establish IS as a new application-focussed computing discipline. (The interests of the IEEE-CS initially centred on Computer Engineering, which meant its work did not have any significant influence on the origins and early development of IS; its main impact, which came with the later emergence of Software Engineering as an approach to the management of the software development processes.)

The ACM was established in 1947 as "… an informal association ... of those interested in the new machinery for computing and reasoning" (Revens, 1972, p485). Its formation was driven by the invention of the computer, and its focus was on the characteristics of the computer as a machine and the associated science of computation. Its primary aims were to promote computing as a new academic field of study and to develop the theoretical foundations needed to support it. From the time of its foundation, the predominant culture of the ACM and its members was academic, theoretical and scientific (Ensmenger, 2010). It applied for membership of the American Association for the Advancement of Science in 1954, and was affiliated with the Mathematical Division of the National Academy of Sciences. As a consequence of its scientific emphasis, the ACM was often poorly-regarded by the business community. A participant in a 1959 RAND symposium characterised the organization as " … a sort of holier than thou academic intellectual sort of enterprise – not inclined to be messing around with the garbage which comptrollers worry about"; while its leaders were "… a bunch of guys with their heads in the clouds worrying about Tchebysheff polynomials and things like that" (Ensmenger, 2010, p172).

Despite its general lack of interest in business-related computing applications, the ACM formed a special interest group on business data processing (SIGBDP) in 1960. SIGBDP was the first such ACM special interest group, but it became the template for many subsequent groups of this kind which were formed to focus on specialist computing topics. The impetus for SIGBDP came from the participation of some ACM members in large-scale applications development projects which, in the words of one of the group's founders, "… convinced me that even though it did not involve complex mathematics … 'business data processing' was not the trivial exercise the academics who were then the leaders in the computing field deemed it to be" (Postley (1998) quoted in Haigh, 2003, p662). Many ACM members were initially reluctant to extend the organization's involvement into this area of computing because they were dubious about the relevance of data processing to the organization's primary focus on computing as a science. However, ACM feared that outright rejection would cause the members who were interested in the area to leave and establish their own organization; the establishment of SIGBDP was a compromise measure to ward off this possibility (Haigh, 2003).

As computing usage spread throughout the business world in the 1960s and 1970s, the ACM periodically considered the possibility of broadening its base and making itself more attractive to practitioners in business and industry (see, for example, Galler, 2006). The potential reward for doing so would be the consolidation of its position as the pre-eminent society for all computer professionals. But many in the organization resisted these moves, which they saw as a departure from their true role as advocates of the science of computing. The battles between these opposing viewpoints were a constant source of tension and conflict within the organization, with the status of SIGBDP being an obvious target for debate. (see, for example, Sammet's (1974) comments in her role as ACM president on the role and performance of SIGBDP within ACM).

The ACM's main competitor as a society for computing professionals was the Data Processing Management Association (DPMA). It had originated as a trade-based association called the National Machine Accountants Association (NMAA) in the early 1950s, and changed its name to the DPMA in 1962. In its first incarnation as the NMAA, the organization represented the interests of the office staff who were involved in the operation of the punched card based electro-mechanical machines of the pre-computing era. These staff occupied positions which were responsible for a range of work, from manual clerical tasks such as those carried out by key punch operators to management and supervision of staff who operated the tabulating machines. The organization aimed to help represent the interests of its members by providing educational programs, pooling and sharing knowledge and resources, and helping to get recognition for the importance of their work (Daniel, 1985). Thus, in contrast to the ACM's academic, theoretical and scientific focus, NMAA/DPMA was vocational, practical and business-focussed.

The introduction of computers to replace the punched card machines represented both an opportunity and a problem for the DPMA: an opportunity, because it provided openings for the organization's members to move into more lucrative higher status white collar jobs as computer professionals; but a problem, because its membership was traditionally from non-academic backgrounds as clerical workers or technicians, many of whom found the transition to more broadly-based computer work a challenging one. Provision of educational and training programs to members had always been an important function for DPMA, but the transition to computing made it even more so. In the 1960s and early 1970s, the organization became a leader in the development and implementation of industry-based certification programs for computing practitioners (Ensmenger, 2010).

Virtually from the time of its transformation to an organization representing computing, the DPMA became the largest association of computing personnel (Ensmenger, 2010). The strength of the organization's historical business and industry connections meant that it initially had great success in attracting workers with an interest in computing. Popular computing trade publications such as Datamation and Computerworld consistently favoured the business-focussed DPMA over the more abstract and theoretical ACM (Haigh, 2003). Like the ACM, DPMA periodically tried to broaden its base to attract a wider range of computing professionals and to accommodate the expansion of computing applications beyond the nitty-gritty of transaction-based data processing. But, like the ACM, the association found that many of its members opposed such a move. For them, the computer was, in the words of Canning & Sissons (1967) '...the old tabulating operation with chromium plating' (as quoted in Haigh, 2001b). Attitudes such as these meant that even the organizational name change from 'machine accounting' to 'data processing' took six years of consideration before being approved (Haigh, 2003). Not surprisingly, divisions broke out between the old guard who wanted to retain the organization's traditional role and focus, and the advocates of change who wanted to re-orient the association's interests away from traditional data processing tasks towards a stronger managerial focus (Haigh 2003).

A point of particular conflict in these internal squabbles was the standard of qualifications required for DPMA membership. The organization's roots in clerical and manual work meant that these standards had traditionally been set at a relatively low of formal educational qualifications. This contrasted with the ACM, which required a bachelor's degree of its members. The advocates of change in the DPMA wanted to set more rigorous academic standards as a requirement for membership, in keeping with their ambitions of achieving a higher professional standing for the organization. But plans to do this were opposed by many existing members within the organization, whose lack of a college education and backgrounds in relatively low-skilled clerical jobs meant that their membership would be put at risk by such a move. Consequently, the plans to require a college degree were dropped, and the levels of knowledge and expertise required to pass the DPMA training and certification programs were lowered. But although this meant that most existing members were retained, it also damaged the credibility of the programs and the professional standing of the DPMA.

By the late 1960s the ACM and the DPMA had grown to be of similar size with membership of levels of about 25-30,000. Many of the leaders in both organizations had aspirations to becoming the dominant body representing all computing professionals, but the narrow perspective which each organization had of the world of computing made it impossible for either to achieve that aim (Haigh, 2003). Throughout the 1960s and 1970s there were periodic discussions about the idea of some kind of organizational merger between the two bodies, but the differences between their cultures and their perceptions of computing were so great that this proved impossible. Not only was there little common ground between their approaches to computing, but often there was an active antipathy between them. The disdain which many DPMA members held for the perceived inability or unwillingness of the ACM to descend from the realms of abstract academic theory to the realities of organizational practice were matched and returned by many ACM members who saw the DPMA as a lower status organization which lacked the credibility of a professional scientific body.

The DPMA eventually made the transition to a fully professional association which was reflected in the re-naming of the organization in 1996 to the Association of Information Technology Professionals, but by this time its membership had declined substantially. As the following section will show, the rift with ACM was healed and the two bodies combined (with others) to develop a common curriculum model in the mid-1990s. At about the same time, a new professional body called the AIS was formed to take up the role which SIGBDP had originally performed as a specialist IS group, affiliated with ACM.

For the purposes of this study the crucial point to emerge from this brief outline of the histories of the ACM, the DPMA and the conflicts between them is the differences in the orientation which the two organizations brought to computing – one scientific, theoretical and academic, the other business-focussed, application-oriented and practical. This difference in orientation epitomised a conflict which lay at the heart of the early years of the development of the IS discipline. It is implicit in the outline of the intellectual foundations of the discipline discussed in the previous section, and became more explicit in the development of model curriculum for IS professionals which is be discussed in the next section.

3.5 IS curriculum and the ACM model curriculum

At the same time as academic studies such as those described in Section 3.3 tried to identify and define the fundamental concepts of the IS discipline by reference to its research literature, a second important line of work approached the same task from a purely educational perspective. From the early stages of the evolution of the discipline, organizations with interests in IS have tried to develop model undergraduate curricula which defined the core content of an IS program and the specialist knowledge and skills it aimed to instil in its graduates. Examples of significant curriculum development work of this kind of relevance to IS include curricula developed by:

- The International Federation for Information Processing (IFIP) (Brittan, 1974, Buckingham et al, 1987, and Mulder & van Weert, 2000);
- The Data Processing Manufacturers Association (DPMA) whose work is discuss later in this section;
- The Information Resource Management Association (IRMA) and the Data Administration Management Association (DAMA) (IRMA, 1996, Cohen, 2000, DAMAI, 2005);
- The Organizational Systems Research Association (OSRA), (O'Connor & Caouette, 1996, Hunt et al, 2004);
- The ISCC99 Task Force (Lidtke & Stokes, 1999).

All of the curricula produced by these projects had their own idiosyncrasies and features, which reflected the differences in the orientation and purpose of the organizations which sponsored them. Rather than trying to cover them all, this section focuses on the curriculum model which was developed under the auspices of the ACM. It has been chosen because throughout most of this period, the ACM was arguably the world's leading association for computing academics and professionals and the leading force in computing education. Although it tries to be global in its outlook, the ACM is an American-based organization, which means it gives a predominantly American perspective of the discipline. As will be seen, its perspective has not always been endorsed by all those involved in the IS discipline, even within the United States. However, for the purposes of this study, the ACM-sponsored models undoubtedly represent the closest thing which can be found to a mainstream view of the discipline's curriculum.

The following sections work chronologically through the key features of four versions of the ACM's IS model curriculum, the original model which was published in 1973, and the subsequent up-grades which were released in the early 1980s, the mid-1990s and in 2010. This review of the model curriculum aims to achieve three things: Firstly, it will identify the main areas of content which the curriculum has claimed to constitute the fundamental core of the IS discipline; secondly, by examining the way in which each version of the model curriculum was produced, and the rationale behind them, it will identify the main factors which have influenced the cognitive content of the disciplinary core; and thirdly, by observing how the model curriculum has changed over time, it will demonstrate how perceptions of the nature of IS have changed throughout the lifespan of the discipline.

3.5.1 1973 - the first IS model curriculum

The ACM took the first steps towards developing a curriculum model for the new MIS discipline in late 1965. Its aim in doing so was to follow and complement its earlier work on the development of a Computer Science curriculum (subsequently published as Atchison et al, 1968). An ad hoc committee was formed comprising eight academics and two industry representatives, with its initial stated purpose being to "… scan curricula related to Business and Management, and evaluate the extent to which Data Processing is involved" (CACM, 1965, p711). Ultimately this committee published its findings in four reports:

- a survey and analysis of the nature and extent of computing content in existing business school programs (McKenney & Tonge, 1971);
- a position paper on the nature of information systems and the need for degree programs (Teichroew, 1971);
- curriculum recommendations for educational programs in IS at postgraduate level (Ashenhurst, 1972);
- curriculum recommendations for educational programs in IS at undergraduate level (Couger, 1973).

All these documents included material relating both to the overall nature of IS as a discipline and its implications for curriculum, as outlined in the following summary.

The reports did not directly address the controversies over the relationship between MIS and DP which were discussed in Section 3.3.1, but the manner of their brief references to the subject seems to imply that it may have been a contentious issue for the committee. Initially the committee was called the Committee on Curricula in Business Data Processing, but at some point it changed its name to the Curriculum Committee on Computer Education for Management. The National Science Foundation grant which funded the study also specified 'Management Information Systems' as the topic for research. Teichrow (1971) noted that the name change was made "… after considerable discussion" (p585), which seems to imply a lack of unanimity among committee members, and may hint at tensions between supporters of the 'pure' MIS concept and those favouring a more generalist data processing orientation.

The description of the new field in Teichroew (1971) used the general term 'Administrative Information Systems' to describe the scope of IS, encompassing "… the functions commonly termed business data processing or commercial data processing, as well as the more exotic management information systems" (p574). It acknowledged the confusion which existed over terminology, and the differences in interpretation of concepts such as data processing and management information systems, and noted the misunderstandings which they had caused. It also observed that DP operations were seen by many as "necessary … but prosaic in character". By contrast, it suggested somewhat caustically, that descriptions of management information systems depicted "… a vision which has caused the term to assume some disrepute among those concerned with the world as it is" (p574). A further disapproving reference is made later in the paper to the "… extravagant claims being made for the capabilities of management information systems" (p580).

Despite these critical asides, the report nevertheless accepted that organizational information needs included consideration of both forms of information processing, and that an Information Systems program must therefore encompass them both. In fact it went on to note that although the introduction of computer systems had not yet affected management significantly, this would change in future as organizations adapted to take advantage of the benefits which management information systems could bring:

> "… some of the cynicism one hears these days about computers not being important to general management must be taken with a grain of salt. What has been said and is still the case for management today will not apply for management tomorrow." (Teichroew, 1971, p578).

The reports were strongly vocational in their orientation, defining the fundamental purpose of the IS field as being to provide the work force with practitioners who could combine technical skills in computing with an understanding of business processes in order to create complex computer-based systems (Teichroew, 1971). In particular, the primary tasks for which the curriculum would prepare its graduates were those carried out in information systems development. Ashenhurst (1972) outlined a basic life-cycle model for the development of an IS, and identified and described three specialist functional roles corresponding to its three key phases – information analysis, systems design, and implementation. The proposed curriculum would produce specialist practitioners capable of dealing with the first two of these roles, while also working cooperatively with the programmers and operations staff, who dealt with the more technical task of implementation.

McKenney & Tonge's (1971) survey showed that aspects of computing were now being taught in many general business programs in universities and in specialist programs in areas like Computer Science, Operations Research and Management Science, but they generally omitted the key elements of IS development. Consequently, according to Teichroew (1971), the absence of suitably skilled staff in these areas was already causing significant problems for the use of computers in organizations.

A common framework of units to address these topic areas was recommended for both the graduate and undergraduates programs in IS, but with modifications in structure and a general reduction in the level of content for the undergraduate curriculum. This framework categorised program content into four groups as follows:

- Group A: Analysis of organizational systems
- Group B: Background for system development:
- Group C: Computer and information technology
- Group D: Development process

The undergraduate student would do a basic set of 4 core units, and then choose one of two streams or 'concentrations':

- an organizational concentration of 3 additional units, which corresponded to the specialist tasks of information analysis; this concentration would also be suitable for combining with other application-related areas such as business or government;
- a technological concentration of 4 additional units, which corresponded to the tasks of information systems design; this concentration would prepare graduates to work in an information processing department, typically starting as a programmer and then moving into system design as the technical end of system development

Figure 3.1 shows the units and the basic structure of the undergraduate curriculum as set out in Couger (1973).

All the reports noted that the choice of institutional location in which the curriculum and the staff who taught it should reside was an important implementation issue for the IS program. The existing IS programs which McKenney & Tonge (1971) had found were generally located in business departments, and were run as joint collaborative programs, calling on the teaching expertise of several other specialist departments. All reports assumed that the proposed curriculum would also have to operate in this manner for at least the next few years; there was no suggestion that specialist IS departments could be readily established to run the program in the immediate future.

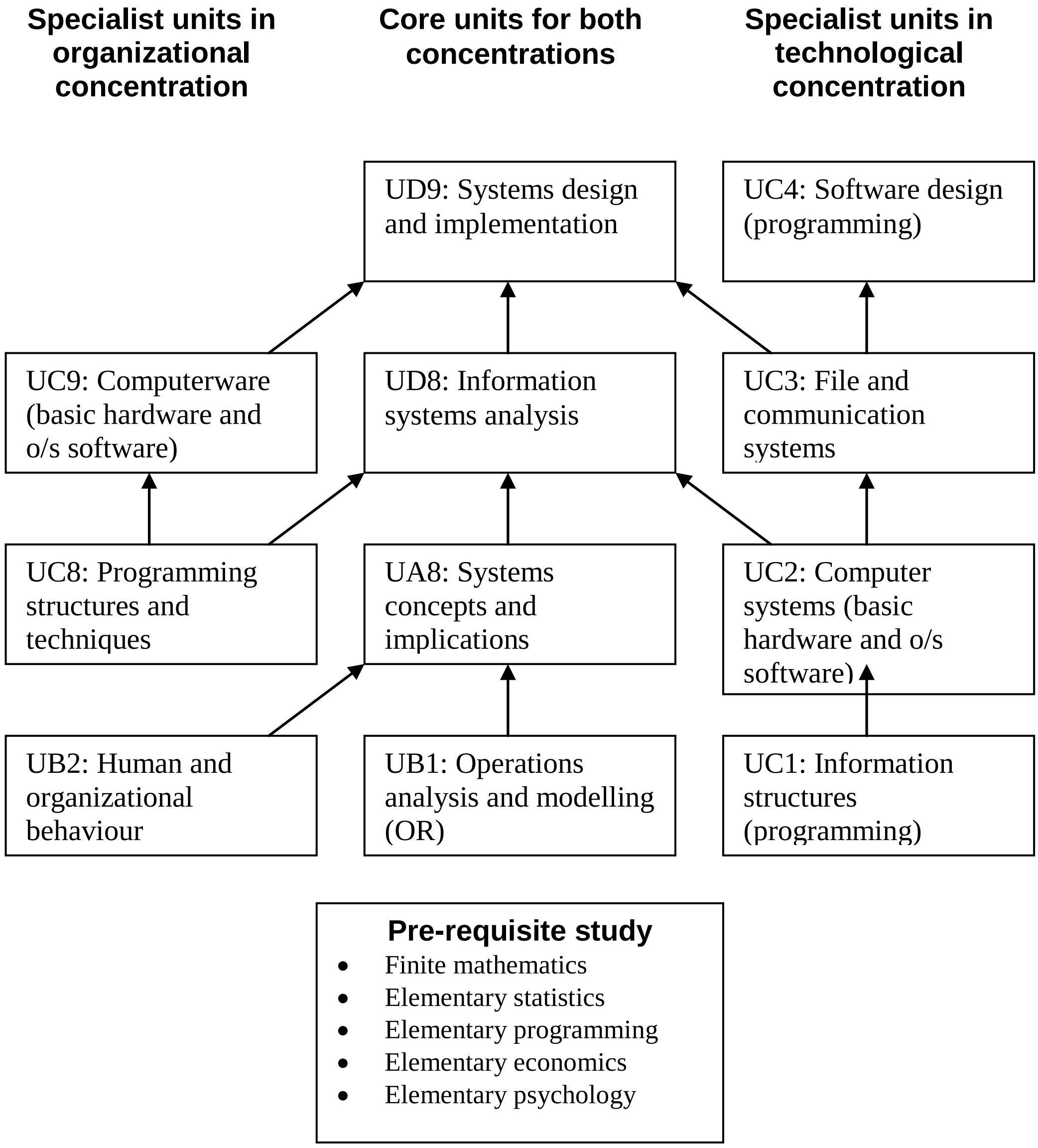


Figure 3.1 Units and unit sequence in undergraduate curriculum, 1973
(Source: Couger, 1973)

Couger (1973) suggested that the IS program could integrate with most of the disciplines and programs at a university, and that there was no point in recommending a preferred departmental location for it; rather it should be put wherever it fitted best and could best be resourced. This would be most likely to be in the institution’s computer centre, or in a department of business, computer science, electrical or industrial engineering: “Usually the stimulus for the creation of an IS program will come from one of the existing schools, and …. the program will be established there” (Couger, 1973, p737). The division in the undergraduate program meant that its organizational concentration fitted most naturally into a business school and the technological concentration into an engineering school. But dividing the concentrations and offering them separately in that way would require collaboration to eliminate the need for duplicate offerings of the core units. Couger suggested that “… a most desirable solution would be to make the combined program, with both concentration options available, in a school of arts or science or equivalent, thus removing the more narrow emphasis in ‘business’ or ‘engineering’” (p730). However, the practicality of such an approach would be affected by the fact that “ … an information systems speciality has an ultimate aim which is practical rather than intellectual” (Couger, 1973, p730); therefore it might not be compatible with the rest of the arts or science curricula.

3.5.2 1981 – The first ACM model up-grade and the DPMA alternative model curriculum

The first major upgrade to the ACM’s model curriculum was carried out by the Curriculum Committee on Information Systems, a re-named version of the committee which had done the original curriculum, now working as a sub-committee of the ACM Curriculum Committee on Computer Education. The new committee chaired by Jay Nunamaker comprised 6 academics and one industry representative and retained only two members from the previous committee. It began its work in the late 1970s, and completed and published its findings in two reports:

- Nunamaker (1981), which reported the results of a survey of the state of IS programs in American universities, and outlined an overview of the nature of IS which provided the rationale for the committee’s curriculum recommendations;
- Nunamaker et al, (1982), which described the details of the recommended IS undergraduate and graduate curricula

In its description of the nature of IS, Nunamaker (1981) followed much the same lines as the reports of the first committee. The need for specialist IS programs was again justified on the basis of labour market demands. The report used the diagram in Figure 3.2 to illustrate its perception of the spectrum of expertise associated with IS and the nature of work force demands. The shortage of people in the middle of the spectrum with a skill set combing technical and organizational knowledge meant that technical personnel were often being required to occupy positions whose key tasks they were ill-equipped to perform. IS programs were needed to provide graduates to alleviate this problem.

In assessing the availability and suitability of existing programs to meet this demand, the report noted that its survey showed that there were now many IS programs offered in American universities, but that there was a lot of variation in their content. The report suggested that many programs designated as IS were aimed at providing a general introduction to computing, rather than preparing students for careers in IS. It concluded that ‘very few’ of the programs met its desired standards for curriculum content.

The committee’s second report, Nunamaker et al (1982) took the same position as the first curriculum committee in identifying the central purpose of the IS curriculum as the preparation of graduates to carry out the tasks of systems development. However it expanded the scope somewhat to include broader IS management tasks such as needs identification, systems planning and the management of operations and development projects. In other areas such as the statements of curriculum objectives, the knowledge and skill expectations of IS graduates, and the general pre-requisite knowledge requirements, the curriculum description remained much the same as in the work of the first committee.

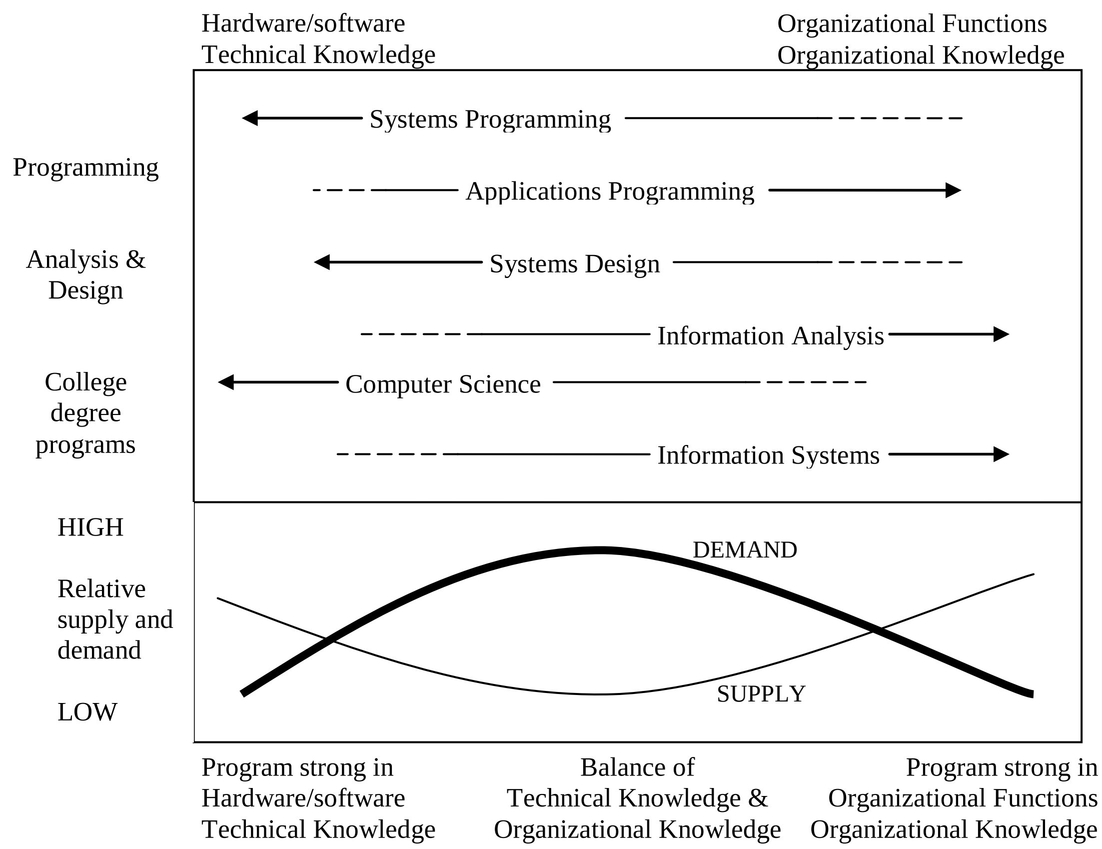


Fig 3.2 Comparison of activities, degree programs, and supply and demand with respect to technical and organizational knowledge dimensions *(Source: Nunamaker et al, 1981)*

The proposed new curriculum is shown in Fig 3.3. It proposed upgrades in unit content to cater for technological advances in key areas (most notably in programming, database and data communications), but its most significant changes to the previous model were structural. The first of these was the decision to do away with the previous model's division of units into compulsory core units plus a choice of an organizational or technological concentration. In keeping with the conceptual model shown in Fig 3.2, the committee argued that market demands now required people with both sets of skills, so there should be no ability for students to opt out of either. Secondly, the curriculum now required students to supplement their specialist IS units with business and management units sufficient to satisfy the accreditation requirements of the American Assembly of Collegiate Schools of Business (AACSB), the peak accrediting body for business programs in the US. This was justified on the basis of the importance of the need for IS practitioners to have a sound knowledge and understanding of organizations.

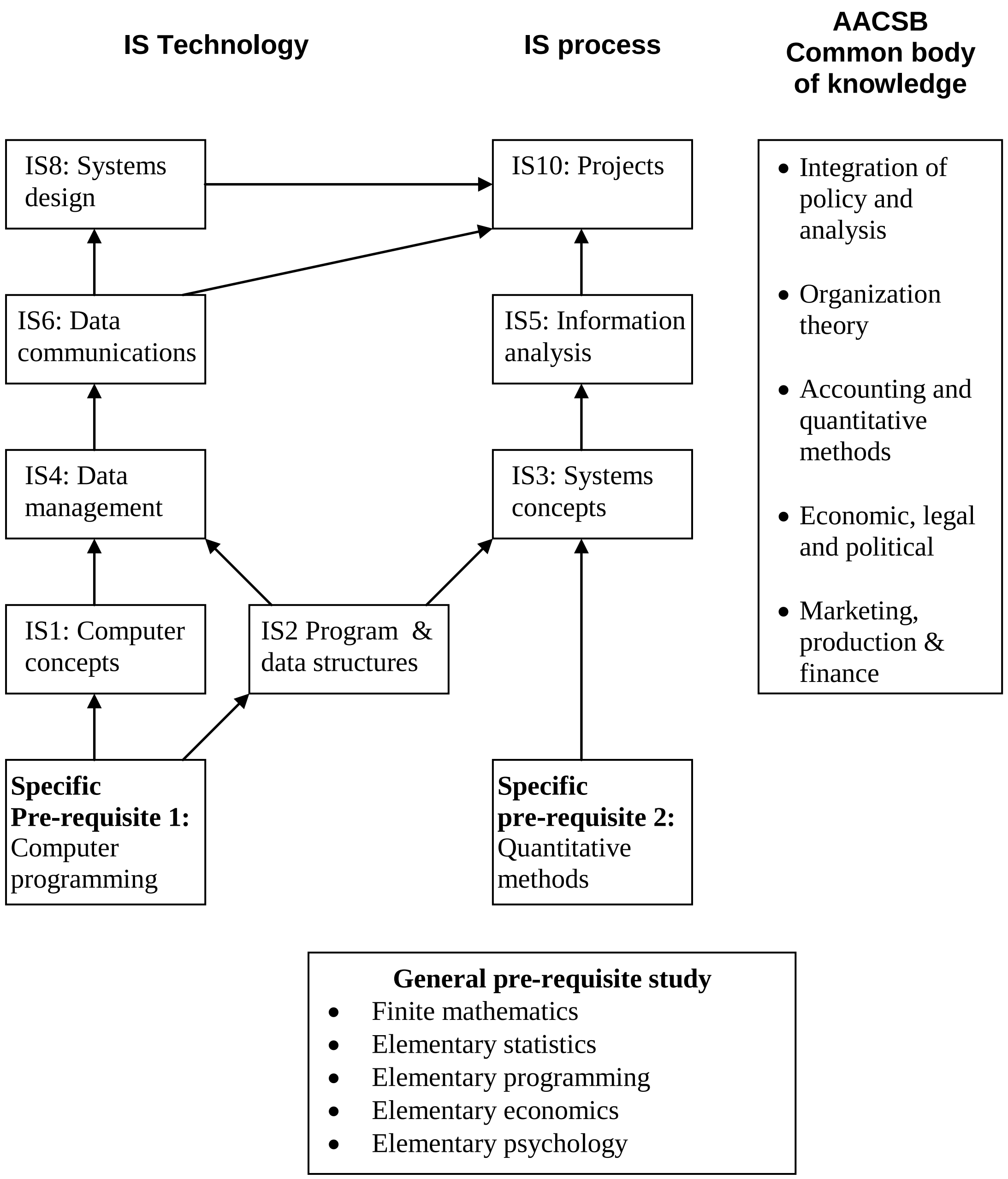


Figure 3.3: Units and unit sequence in 1982 revised undergraduate curriculum (Nunamaker, 1982)

The work of the ACM committee in preparing this curriculum upgrade also had the effect of prompting the ACM's main rival, the DPMA, to create its own version of an IS curriculum. The stated aim of the DPMA curriculum was similar to that of the ACM model – to deliver graduates who could work as business application programmer/analysts. Its supporters claimed that the 1973 version of the ACM model curriculum was too 'theoretical' in its approach, and feared that the revision being done by the Nunamaker committee would merely perpetuate that tendency. Therefore the DPMA sought to develop a curriculum which was more 'pragmatically oriented' (Mitchell & Westfall, 1981). According to Mitchell & Westfall (1981) the ACM committee tried to resolve the conflicting views which prompted the DPMA venture, but were unsuccessful. Nunamaker et al (1982) noted the existence of the DPMA's work as a 'major effort' in IS curriculum development, but made no further comment on it.

During the next decade, the DPMA curriculum continued to evolve (DPMA, 1986 and Longenecker & Feinstein, 1991), and attracted usage from institutions across the USA (see, for example, Bonnici & Warkentin,1995). It claimed to present an alternative view of the discipline to that represented in the ACM-based 'mainstream' model. Although no published data could be found to indicate the relative popularity of the two models, it seems clear that both attracted significant levels of support. The IS97 curriculum upgrade which finally merged the two together claimed that "… currently most information system programs use either the DPMA or ACM model or some combination of the two" (Davis et al, 1997, p35).

It is impossible to determine the extent to which the DPMA's decision to develop its alternative to the ACM model curriculum reflected significant differences between the two organizations' perception of the nature of IS, or whether it was simply a consequence of the rivalry between them. The two curricula covered similar themes, listed similar graduate outcomes, and covered similar topic areas, but the DPMA saw its model as more business-focussed and practical than its 'scientific' and theory-oriented ACM rival (Mitchell & Westfall, 1981). Comparative analyses of the two curricula, such as those by Cotterman (1983) and Discenza & McFadden (1986), indicated that their content was very similar, with the differences being mainly in matters of style rather than substance. Davis (1983) suggested that the practical emphasis of the DPMA model was more closely geared to satisfying the immediate needs of employers, while the ACM model was biased towards the theoretical understanding which underpins life-long learning. The eventual merger between the two curricula in IS97 seems to confirm that there was a high degree of similarity between them.

The DPMA curriculum may now look like little more than a relatively short-lived historical curiosity, but the fact of its existence illustrates the uncertainty which pervaded the IS discipline at that time, and the significance of the perceived conflict between the 'theoretical' ACM and 'practical' DPMA conceptions of the IS discipline. As Underwood (1997) noted, until this conflict was resolved with IS97, the independent curricula issued separately by the two organizations "… tended to confuse both academic and practitioner communities." (Underwood, 1997, p1).

3.5.3 Unification and the combined curriculum – IS95, IS97 and IS2002

The next upgrade of the IS model curriculum during the 1990s marked a major change in the way the IS curriculum was managed and presented. The first significant aspect of the upgrade was that it was carried out as a joint project by the main professional organizations with interests in IS – the ACM, the DPMA (re-named in 1996 to the Association of Information Technology Professionals) and the newly-formed Association of Information Systems (AIS). The stated aims of the project were: to end the problem of separate competing curricula published by individual organizations (specifically the ACM/DPMA split); to enable a wider range of participants to contribute to curriculum development; and to establish a stable basis for an ongoing programme to keep the curriculum up-to-date (Couger et al, 1995). The project was also endorsed by several other professional societies with IS connections – the International Association of Computer Information Systems (IACIS), the International Academy for Information

Management (IAIM), the Society for Information Management (SIM), the Decision Sciences Institute (DSI) and the Institute for Operations Research and Management Science (INFORMS).

Work on the project began in 1992, and its first main product was an interim curriculum published as IS95 (Couger et al, 1995). An edited version of this curriculum was released in its final form as IS97 (Davis et al, 1997). A new version with minor revisions was released as IS2002 (Gorgone et al, 2002). In their essentials, IS95, IS97 and IS2002 are much the same, and can be treated as slightly different versions of a single curriculum model.

The main feature of this curriculum upgrade was the way in which it used both the curriculum development project and the curriculum itself as vehicles for reinforcing the standing of IS as an academic discipline. Davis J (1996) claimed that the 'unprecedented co-operation' between the professional bodies involved was largely a reflection of the 'generally embattled state of several IS departments in business schools in the United States' (p97), which had come about as a consequence of university funding cuts. The revised curriculum was seen as one weapon for the discipline to defend itself and its claims to disciplinary credibility. Great pains were taken in the curriculum development process to demonstrate that this model curriculum could be presented as a product which had earned widespread endorsement from within the entire IS disciplinary community. Its development was portrayed in Couger et al, (1995) and Davis et al (1997) as a collaborative effort which had involved all the key organizations which had interests in IS, and had actively sought input from academics and other interest groups.

The rationale for the curriculum and its mode of presentation took on a much more strongly academic orientation than in previous versions. Where the 1973 and 1981 models had justified the curriculum content almost exclusively in terms of the skills needed by graduates to meet labour force demands, IS97 emphasised the role of the curriculum in establishing the academic legitimacy of IS as a field of study and sustaining the position and status of IS and IS programs within universities.

This change to a more academic emphasis was reflected in the way in which the curriculum was presented within a formal framework or 'architecture' as the embodiment of a 'Body of Information Systems Knowledge'. At the broadest level at the top of the architecture, the scope of the discipline was described as encompassing two areas:

- Systems development: similar to the 'traditional' focus of previous curricula, but described in somewhat broader terms as covering "… the development and evolution of infrastructure and systems for use in organizational processes" (IS97, p7)
- The information system function: similar to the management focus which Nunamaker (1982) had added, but now described in more detail as covering the "…acquisition, deployment and management of information technology resources and services" (Davis et al, 1997, p7).

The architecture then broke these functions into successive layers of increasingly more detailed and narrowly focussed sets of topics, until it reached the set of curriculum elements which comprised the 'body of knowledge' for IS. IS97 identified 506 such elements, and this number had grown to over a thousand elements by IS2002. The content of the units of study specified in the published curriculum was defined as combinations of these elements and the depth to which they were to be learned. Figure 3.4 shows the 10 curriculum units recommended by IS97

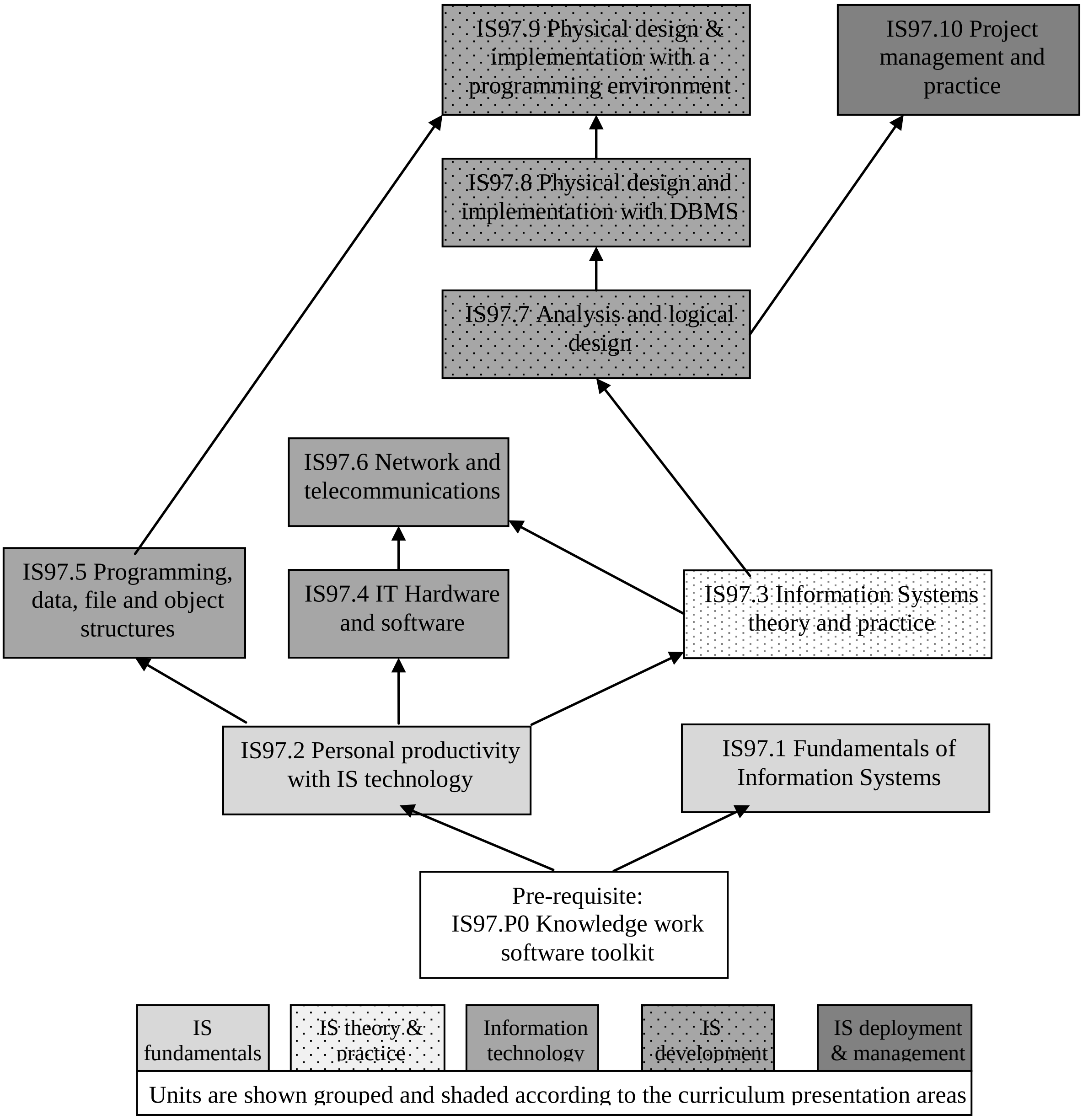


Fig 3.4: IS97 units and unit sequence
Source: (Davis et al, 1997)

The proposed units were described as covering 5 'curriculum presentation areas' as shown in the diagram. However, the report explained that the modular design of the architecture and the body of knowledge meant that institutions could develop their own sets of units by combining learning units to suit their needs and circumstances.

The IS2002 revision was identical in most respects to IS97, with the only significant difference being the addition of a new unit called 'electronic business strategy, architecture and design' which introduced e-business concepts, technologies and their application. In order to fit the new unit within the desired 10-unit curriculum structure, the personal productivity unit, IS97.2, was removed and combined with the pre-requisite unit IS97.0. The IS2002 report suggested that this change was also consistent with improvements in student computer literacy, which made the pre-requisite in its previous form less necessary.

IS97 made little reference to the nature of the changes in curriculum content from the ACM and DPMA models which they replaced, speaking only in very general terms about the need for updating the previous curricula. However, even a broad comparison of the lists of topics across the units shows that these changes were relatively minor in terms of the overall focus of the curriculum. That is, IS97 included consideration of new technologies and development techniques, and organized and linked the content in somewhat different ways, but the overall themes it covered – systems in organizations, technology and development process - were much the same as those of its predecessors.

3.5.4 Flexibility and a change in orientation - IS2010

The most recent revision of the model curriculum instituted the most significant changes to the model curriculum since its first release in 1973 (Topi et al, 2010). Whereas, both the 1981 revision and IS97 had retained much the same basic structure and content of the original, IS2010 implemented some significant changes to the structure, content and general orientation of the curriculum.

The project to carry out the curriculum up-grade began in 2007, but an important part of the context for it came several years earlier, with the establishment of the Computing Curricula project (CC2005) run jointly by the ACM, the AIS and the IEEE-CS (Shackelford, 2005). CC2005 established a framework for curriculum development, which defined and described five distinct computing disciplines and the bodies of knowledge upon which they were based (see Figure 3.5). It described IS as a discipline which "…spans the boundary between computing and business" (p23), and repeatedly emphasised its links with business, such as its typical positioning within business schools and its inclusion of business topics within its curriculum.

For IS curriculum, the most significant feature of this framework was the inclusion of a new discipline, called Information Technology to supplement the established disciplines of Computer Science, Computer Engineering, Software Engineering and IS. According to the CC2005 report, this new discipline had begun to appear in US universities in the late 1990s as a consequence of the increasing ubiquity of computers in organizations and the need for specialist IT practitioners to manage organizational IT infrastructure. Its emergence represented "… a grass-roots movement by computing educators to respond to the very real needs of both their local communities and their students" (Shackelford, 2005, p33). The report claimed that although such programs were known to have existed elsewhere, they had not previously been common in the US. About 70 American institutions were offering programs of this type in mid-2005 (compared with an unsourced estimate of about 1000 IS programs).

In CC2005's diagrammatic representation of the relative areas of interest of the computing disciplines, IT was shown as having very significant areas of overlap with IS. CC2005 acknowledged that IS programs (and CS programs) were now facing competition from IT programs, and noted that some IS academics feared the loss of some of their 'turf'.

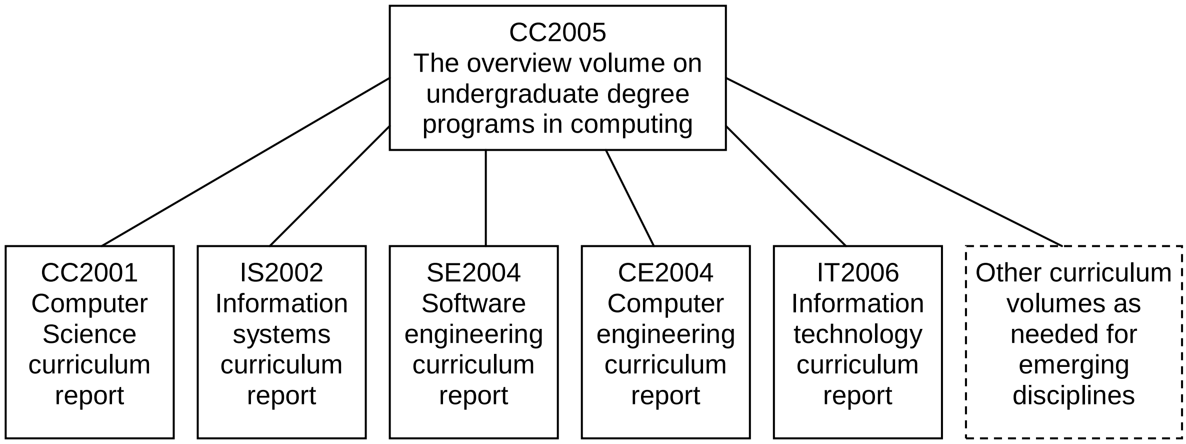


Fig 3.5: IS as a part of the CC2005 framework
(Source: Shackelford, 2005)

The extent of the apparent overlap between IS and IT was reinforced in the IT2005 curriculum, ACM (2005), which appeared shortly after the release of CC2005. It defined the focus of the Information Technology discipline very broadly as "… meeting the needs of users within an organizational and societal context through the selection, creation, application, integration and administration of computing technologies" (ACM, 2005, p5). IT was described as a complementary discipline to IS, in that it too deals with the application of IT in organizations, but where IS was said to focus on the 'information' part, the IT discipline focuses on the 'technology'. The curriculum included many topics which had previously appeared in IS curricula, such as the organizational aspects of computer usage, human-computer interaction, system architecture, systems integration, data management, data modelling and database design.

In its discussion of the rationale for its revisions to the IS curriculum, IS2010 acknowledged the possible threat to its academic territory posed by the emergence of the IT discipline. It noted the overlap of its content with that of the IT model curriculum, but emphasised that there were still many areas of difference. It concluded its remarks on this issue with the suggestion that "… It is very likely that the discussion regarding the identities of the IT and IS disciplines will continue actively during the next several years." (Topi et al, 2010, p14). The report also noted that the revised curriculum was needed to address concerns about the trend of declining student interest in the study of IS, and to help the discipline to address its crisis of identity by establishing and articulating a clear vision of itself - "… the IS discipline must address its core principles and values within and through the curriculum" (p14).

IS2010 suggested that the 'IS landscape' had changed in ways that necessitated a fundamental re-evaluation of the model curriculum's foundations. In particular, the domain of IS should be extended beyond its traditional focus on computer applications in business and management; business would undoubtedly still remain a primary domain for IS, but the discipline and its curricula should not be tied exclusively to it (the report did not comment in the apparent conflict between this proposal and CC2005's classification of IS as business-based discipline). The curriculum also needed to be more flexible to accommodate the diversity of interests and possible career paths of graduates, and to give institutions offering IS programs more choice in their range of unit offerings. However, the report stressed that increased flexibility of structure should not be extended to allowing omission of core topics; it noted that in specifying its core content it was "… making a strong statement regarding what defines Information Systems at the undergraduate level" (Topi et al, 2010, p9). That is, all topics in the core should be regarded as essential for a program to be categorised as IS.

Despite these imperatives for change, the report's description of IS as a field of academic study remained similar to that given in IS97, with the only significant difference being an added emphasis on the role of information systems and information technology as sources of innovation and industry change. The definition of the scope of the field also remained much the same as for IS97, but with the system development function now expanded to include packaged system acquisition.

The major drivers of the changes in curriculum content were identified as being changes in organizational information needs and the associated changes in the capabilities expected of IS graduates. Where IS97 had defined units almost exclusively in terms of the elements of the body of knowledge, IS2010 emphasised the influence of desired graduate capabilities on the way in which the curriculum was derived. As with IS97, the presentation of the curriculum content itself was set within the context of an overall 'curriculum architecture'. Although the report stressed that its architecture differed from that of IS97, its essential features remained much the same. The content of units was derived in the same way as with the IS97 architecture, with each unit presented as an assembly of material drawn from an underlying body of knowledge. However, the body of knowledge was a revised and much simplified version of the complex IS97 version, and categorised its content items into seven IS-specific knowledge areas. This general structure was designed to conform to the approach used in the other disciplinary curricula included in CC2005.

The curriculum specified seven core units covering the topics which every IS program must include, as set out in Fig 3.6, although the report noted that programs may differ in their depth of coverage of them. Aside from its structural differences, the report highlighted two major changes in content from IS2002: Programming was removed from the core for the first time, and specified as a desirable elective rather than a core unit; and the two previous units on IT hardware and operating systems and Networks and telecommunications were converted into an IT Infrastructure unit (IS2009.5) and an Enterprise Architecture unit (IS2009.3). The former focussed on the technical foundations of computer hardware and networks, while the latter dealt with the organizational issues involved in planning, designing and implementing IT-based solutions compatible with that basic infrastructure.

The report noted that institutions may wish to orient their programs towards specific graduate career paths, and included the following list of eleven elective units as examples of other content which might be included in an IS curriculum:

- Application Development
- Business Process Management
- Collaborative Computing
- Data Mining/Business Intelligence
- Enterprise Systems
- Human-computer Interaction
- Information Search and Retrieval
- IT Audit and Controls

- IT Security and Risk Management
- Knowledge Management
- Social Informatics

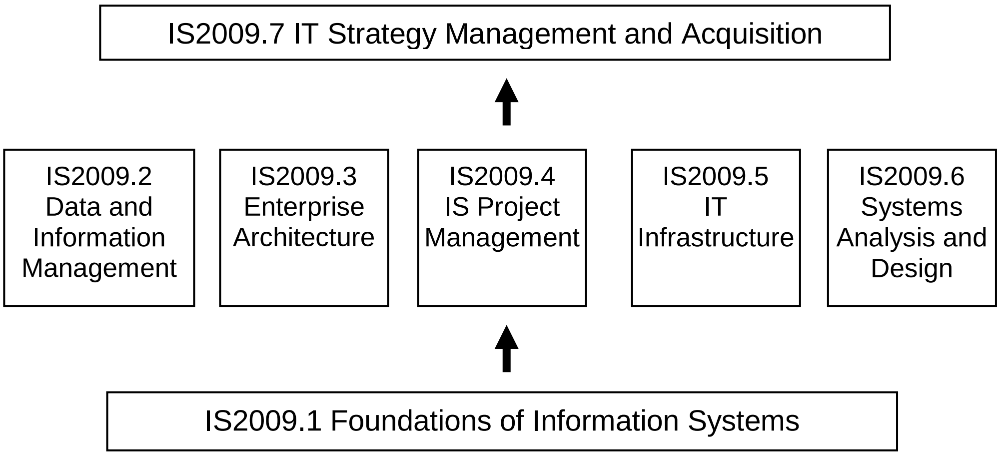


Fig 3.6: IS2009 core units

3.6 Conclusions

The three perspectives of the IS discipline outlined in this chapter have painted contrasting pictures of the state of the discipline and the nature of its content. From the point of view of its cognitive content as presented in the academic literature, the history of the discipline is one of constant uncertainty, instability and conflict. Each of the three periods into which the discussion divided the discipline's history was characterised by sharp divisions of opinion among IS scholars about the nature of the discipline's content, its orientation and its future directions. The areas of dispute have changed from time to time, but the essential elements of confusion and disagreement about the discipline have remained the same.

The sociological perspective presents a similar picture of conflict over disciplinary orientation between the two key disciplinary associations, until the mid-90s, when IS97 became the vehicle through which they resolved their differences to present a united view of the discipline. That agreement over IS97 was presented as signifying a new disciplinary consensus over the core content of IS, a sentiment which stands in stark contrast to the picture presented in the research literature. This was, however, in keeping with the picture of the discipline presented through the ACM's model curriculum, which has given the most stable and consistent view of IS. In that model the key elements of the curriculum have remained largely unchanged throughout most of the discipline's history, focusing on the knowledge and skills associated with system development. But in its most recent version, the model curriculum has also begun to acknowledge the discipline's internal conflicts, and has introduced some significant changes to broaden and diversify its content. At the same time it has stressed the importance of using the curriculum as a means of maintaining disciplinary cohesion and resolving its identity issues.

It is in light of the confused picture of the discipline presented by these perspectives that the decision was taken to conduct this study of the state of the discipline as it has been implemented in practice. In doing so, the study aims to evaluate both the extent to which the levels of uncertainty about the discipline at a theoretical level have influenced its implementation in practice, and conversely, the extent to which the characteristics of the discipline in practice may have helped contribute to the confused state of its theory.

Chapter 4: Historical research and the conduct of the study

4.1 The study and its research method

The decision to adopt an historical approach to the study created a problem, because historical research is not a well-established research method in IS. In a recent review of the academic literature about the history of the computing field, Haigh (2011) noted that most of the work on computing history has focussed on the technology itself and the computer pioneers who were responsible for it, and it has given little coverage to topics related to the discipline of Information Systems. Within his categorization of the historical computing literature, the only group of works with a close association to IS was that relating to computer applications in administrative work and business. Haigh concluded his assessment of the work on this aspect of computing history with the comment that: "To call this coverage in administrative computing patchy would be to greatly exaggerate its comprehensiveness" (Haigh, 2011, p49). The most recent significant published study of the history of IS (Hirschheim & Klein, 2012, which was released subsequent to Haigh's study, also noted the paucity of examples of historical studies of the discipline.

In the absence of suitable research models specific to IS, guidance was sought from the academic literature on the study of history and historical research method. This literature revealed deep divisions within the disciplines of history and historiography, and long-running controversies about many aspects of historical research. These divisions relate both to pragmatic issues such as the choice of sources of historical data and to broader philosophical questions about the nature of truth and the knowledge which can be derived from historical research. Debates on these contentious issues have been waged with particular intensity, and at times with a high level of vitriol over the last fifty years.

Consequently, the description of the research method, which is an essential element of any significant research project, is particularly important for this thesis, and its discussion in this chapter is longer and more detailed than might normally be expected. Rather than simply describing the chosen research method, the chapter describes the evolution of contemporary approaches to historical research, examines some of its fundamental philosophical issues and identifies the limitations of the outcomes it can achieve. This background is used as a basis for describing the key elements of the historical research method adopted for this study.

The structure of this discussion of the study's research method is as follows:

- Section 4.2 briefly outlines the evolution of philosophies and methods for conducting historical research; it identifies the main areas of controversy in historical research, and summarises the key differences in the way they are addressed by the main schools of thought;
- Section 4.3 discusses the approach taken by this study to each of the areas of controversy identified in the previous section;
- Section 4.4 summarises the impact of these issues in historical research method on the study and its findings.

4.2 Key problems and controversies in the study of history and historical research method

Although its origins as a scholarly field of study can be traced back to the ancient Greeks, history struggled to gain credibility and recognition as a formal academic discipline until relatively recent times (Evans, 2001). The main stumbling block to its acceptance in academic circles lay in the uncertainty of the claims to factual accuracy of most historical works. This was due partly to the inadequacies of source materials for such work, and partly to the biases of historians, many of whom were seen to be influenced by objectives other than that of providing an impartial and accurate record of the past. As a consequence of these doubts about its credibility, and in the absence of any established methods for doing historical research, historical writing was widely regarded as being more closely related to literature than it was to science.

The transformation of history into a formal discipline with well-established methods and widely-recognised claims to the status of a science occurred only in the late 18^{th} and early 19^{th} centuries. The bulk of the credit for this change is usually given to the German historian Leopold von Ranke, whose work was so influential that he is often called the 'father of modern history' (Evans, 2001). Von Ranke's approach to history was inspired by the successes which had been achieved by the application of positivist and empiricist approaches to research in the physical sciences. These had driven the development of the 'scientific method', which used empirical research founded on meticulous observation. Von Ranke believed that in their observation and description of historical events historians should aim to emulate the methods of science, focusing solely on gathering the facts and reporting on them in an objective and scientifically valid way. In the preface to one of his own works he highlighted this contrast between his motivation and that of previous historical writing:

> "To history has been assigned the office of judging the past, of instructing the present for the benefit of future ages. To such high offices this work does not aspire: it wants only to show what actually happened." (Ranke, "Preface to Histories of the Latin and Germanic Nations from 1494-1514", quoted in Stern,1973, p57)

This phrase, "to show what actually happened", became one of the defining hallmarks of the Rankean approach to history.

Von Ranke's ambitions for a science of history and his approach to creating a suitably scientific research method for the discipline were enthusiastically received and widely adopted by many historians. But for others, his belief that history could be treated as a science was subjected to fierce criticism. Critics of the scientific approach argued that the study of history must aim to be more than a simple process of observation and accumulation of facts. For example, George Trevelyan, a leading British historian of the early 20^{th} century, engaged in a long-running campaign, warning of the dangers of trying to treat history as a branch of science:

> "History cannot, like physical science, deduce causal laws of general application. All attempts have failed to discover laws of 'cause and effect' which are certain to repeat themselves in the institutions and affairs of men. The law of gravitation may be scientifically proved because it is universal and simple. But the historical law that starvation brings on revolt is not proved; indeed the opposite statement, that starvation leads to abject submission, is equally true in the light of past events." (Trevelyan, 1913, p190)

In the closing decades of the 20th century, the application of postmodernist ideas to the study of history confused matters still further. Postmodernism had been initially associated most strongly with disciplines such as literary theory and cultural studies, and had no immediate connection with the study of history. However a number of writers adopted postmodernist ideas as the basis for attacking the basic foundations of the study of history. These attacks created a sense of crisis among many historians. Evans (2001) cited a number of the expressions of alarm about their impact and concluded that "Such has been the power and influence of the postmodernist critique of history that growing numbers of historians themselves are abandoning the search for truth, the belief in objectivity, and the quest for a scientific approach to the past." (p4).

The debates over historical research method are difficult to summarise because they have attracted such a vast and wide-ranging literature. In addition to its sheer volume, this literature is made difficult by the diversity of points of view which it contains, the complexity of the philosophical issues which underlie them, and the obscurity of the language in which some of it has been written. Its debates have often also been heated and acrimonious, which at times makes it difficult to separate the substance of the issues from the accompanying *ad hominem* arguments.

Consequently this section can aim only to give a general overview of the key problem areas and the differences in the positions which have been argued in relation to each one. The issues it highlights constitute a selection of the main philosophical and methodological issues which have been discussed in the historical literature, and the discussion of each issue outlines only a few key points which illustrate the main areas of contention. For the sake of simplicity, each issue is discussed individually and, as far as is possible, in isolation from the others, although as will become clear, in practice they intersect and overlap with each other. Likewise, within each issue the explanations of the differing points of view are set out largely in isolation from one another, to eliminate the confusion of the arguments and counter-arguments which have been put by the supporters on each side in the debates in the literature. For a more extended discussion and coverage of the issues and the exchanges between the protagonists, Evans (2001) provides the best starting point; it gives not only extensive discussion of the issues, but also a very detailed review of the literature supporting the main points of view.

For the sake of simplicity, the discussion of the issues has been drawn largely from the works of four leading contributors to the debates over historical research methods. These four authors, their key works and the reasons for their selection are as follows:

- Sir Geoffrey Elton (Elton, 1967 and 1991): Elton was an eminent British historian whose approach in these works embodied the traditional empiricist and objectivist views of history pioneered by von Ranke. Elton (1967) was written as a direct response to the new wave of modernist approaches to history and took particular issue with the ideas of EH Carr (see next point below). Elton (1991) also defended the Rankean approach, but in doing so, devoted his attention largely to the postmodernist ideas which had become popular by that time; these Elton described variously as 'menacing', 'destructive', 'absurd' and 'meaningless', while describing their appeal to new historians as "… the intellectual equivalent of crack" (Elton, 1991, p41).

- EH Carr (Carr, 1961): Carr was also a leading British historian, whose approach to the study of history as outlined in this work achieved great prominence as the 'modernist' counterpoint to the traditionalist approaches of historians like Elton. At the time of its publication Carr's book was seen as a radical attack on the traditional approaches to historical research (Evans, 2001). In the years that followed, Carr's ideas earned widespread acceptance, to the point where Munslow (2006) described them as constituting the mainstream of historical thought in Britain. The contrasting views of Carr and Elton have been widely used to introduce history students to the fundamental issues of historical research (Evans (2001)).
- Keith Jenkins (Jenkins, 1991, 1995, 1999, 2003, 2009): Jenkins is a historical theorist rather than a practising historian. He is a self-proclaimed postmodernist, and is one of the most widely-published writers to have applied the ideas of postmodernist theorists to the study of history. Jenkins's work originally focussed on the use of postmodernist theory to rebut the mainstream approaches to historical research espoused by historians like Carr and Elton, but his critique of historical method was extended in later publications to a repudiation of historical writing of any kind.
- Richard Evans (Evans, 2001): Evans is a distinguished British historian, whose work in Evans (2001) is a controversial but influential reflection on the state of historical theory and practice. Evans's introduction to history as a student came largely through the works of Elton and Carr, and his review of the state of the discipline acknowledged the debt that it owed them. However, he suggested that their ideas now need updating in light of the new insights offered by postmodernist theories. Having said that, Evans was also strongly critical of what he saw as the more extremist aspects of postmodernism. He argued for the end of the 'dialogue of the deaf' between competing viewpoints, and the opening of a genuine debate in which theoreticians and practising historians could exchange views and seek a better understanding of the merits of each other's points of view.

4.2.1 The purpose of historical research

Issue: What can and should be the purposes which motivate the conduct of historical research and the writing of history?

At a superficial level, all historical research can be said to serve the same purpose – to gather facts in order to provide a reconstruction of the past which matches the reality of that past as precisely as possible. However, this answer begs the more fundamental question as to why such a reconstruction of the past is wanted or needed. Can (and should) the desire to know and describe what happened in the past be in itself a sufficient purpose for historical research, or must (and should) an interest in the past necessarily be driven by some further underlying motivation?

One of von Ranke's main concerns was the extent to which the accuracy of previous historical works had been adversely affected by their authors' intentions to use them in support of a particular outcome. For the classical historians like Elton who adopted the Rankean ideal of the historian as an objective observer "… the past must be studied in its own right, for its own sake and on its own terms" (Elton, 1967, p59). Elton noted two key implications of this approach: first, the collection of factual data should always take precedence over interpretation in the historian's work, particularly in the early stages of historical research; secondly, the historian must avoid the “insidious temptation” of trying to see history in terms of its relevance to the present day (Elton, 1991, p9). Any such attitude would invariably lead to the historical evidence being selected and presented to accord with present-day circumstances and interests, rather than to depict accurately the circumstances and events of the period being studied.

Carr disputed both these key elements of the classical approach, and labelled as a “nineteenth-century heresy” the idea “… that history consists of the compilation of a maximum number of irrefutable and objective facts” (Carr, 1961, p9). He argued that in any reconstruction of the past, the process by which facts are selected and gathered must be driven, at least in part, by the intentions and ideas of the historian. That is, in good historical writing, the collection of facts and their interpretation should go hand-in-hand. Historians start with a provisional interpretation, make a provisional selection of facts accordingly, and then engage in a process of continual re-interpretation and further selection and analysis. The underlying purpose(s) driving the historian’s work may not always be stated explicitly, but they are invariably present, and must affect the work. Carr recommended that before reading any historical work the reader should first investigate the historian to find out “…what bees he has in his bonnet. When you read a work of history, always listen out for the buzzing.” (Carr, 1961, p18). Carr also dissented from the classical historian’s emphasis on seeing and understanding the past on its own terms and not trying to relate it to the present day; rather, he believed that it was inevitable and appropriate that the historian should view and interpret the past ‘through the eyes of the present’ (Carr, 1961, p19). The purpose of historical research is “… to master and understand [the past] as a key to the understanding of the present” (Carr, 1961, p20).

Carr acknowledged that his approach could be incorrectly interpreted as giving a licence to historians to adopt a relativist position that held that all interpretations of historical events are equally valid; even worse, that historians may distort the facts of history to support their point of view. In refuting these approaches Carr made an analogy between the multiple perspectives of history and the multiple perspectives which one can get of a mountain by viewing it from different vantage points; the fact that the mountain takes on a different shape when viewed from different perspectives does not mean that the mountain has no shape, nor that it has an infinity of shapes. The historian must never let their personal beliefs and prejudices blind them to the facts which the historical evidence provides.

Postmodernists argue that the ‘dangers’ which Carr and Elton had warned about are in fact the very essence of historical writing. In their view, historians do not discover or interpret historical meaning as it is handed down in the traces of the past; rather they create meaning and seek evidence from history to support it. All histories are designed, whether implicitly or explicitly, to support or justify specific causes or ideological beliefs. In contrast to Elton’s view that history should be studied for its own sake, Jenkins asserted that: “History is never for itself; it is always for someone” Jenkins, 1991, p21) Hence, for the postmodernist, histories may serve an almost infinite variety of purposes, but simple reconstruction of the past can never be one of them.

Jenkins suggested that the most common purpose of historical writing in its reconstruction of the past was that of promotion of the interests of a specific group in society with whom the historian chose to associate themselves. He recalled the famous Orwellian phrase that those who control the present control the past and those who control the past control the future, and concluded that "… history is basically a contested discourse, an embattled terrain wherein people(s), classes and groups autobiographically construct interpretations of the past literally to please themselves". (Jenkins, 1991, p23)

4.2.2 Selection of themes for historical research

"What are the key themes which should be the main focus of an historical work?"
In any historical research, the historian is faced with a vast array of events and facts about these events for the time period being studied, of which only an infinitesimal proportion can be included in even the most thorough and detailed of historical works. The first element of any historian's task to decide which aspects of the historical period under consideration should become the major themes to be addressed in their research.

Until the beginning of the twentieth century, the history profession generally took a very narrow view of what constituted acceptable themes for historical research. These were typically seen to be the nation-state, the rich and powerful elites who governed them, and the political and military events which shaped them. Research into facts and events of the past which fell outside these conventionally acceptable themes risked being regarded as irrelevant and of no useful purpose to the study of history. Prejudices of this kind operated to exclude many aspects of the past from mainstream historical research. As late as 1963, the prominent British historian, Hugh Trevor-Roper famously decried the idea of studying African history on the grounds that the content of its past did not constitute history:

> "Perhaps in the future there will be some African history to teach. But at present there is none, or very little: …we cannot… afford to amuse ourselves with the unrewarding gyrations of barbarous tribes in picturesque but irrelevant corners of the globe" (cited in Evans, 2001).

Despite the prevalence among traditionalists of such narrow and elitist views of history, the twentieth century saw a significant broadening in the range of themes which were addressed by academic and professional historians. This was initially inspired in large part by the Annales school of French historians, who saw themes related to the broader long-term trends in social and economic conditions and their effects on the people as a whole as being ultimately more important than the activities of military and national leaders (Evans, 2001). This led in turn to the establishment of sub-branches of history devoted to these different themes.

Evans noted that Elton and, to a lesser extent, Carr tended to remain among those of the old school of historians who were cautious if not actually disapproving of history moving beyond its traditional themes. Elton in particular believed that in doing so historians risked moving into areas which were outside their areas of competence. Carr noted that historians and their perspectives on the world are themselves the product of their environment, which means that the historical and social circumstances of the day may affect the way in which themes gain or lose currency. He illustrated this remark with a number of examples of the way in which historians had changed their emphasis and approach to history as the circumstances around them changed. Therefore, Carr concluded, it was necessary to add a rider to his previous injunction that the reader of any historical work should first study the historian (as discussed in Section 4.2.1 above): "Now I would add: Before you study the historian, study his historical and social environment" (Carr, 1961, p44).

For postmodernists, the fact that historians judge some themes as being more acceptable or important than others as topics for historical research highlights the way in which the historian acts not as an objective observer reconstructing events, but as an arbiter in determining what aspects of the past constitute historical knowledge. Comments like that of Trevor-Roper quoted above are an extreme example of the prejudices which historians bring in their selection of themes deemed suitable for study, but prejudices of this sort are present implicitly in all historical works. In keeping with the common saying that history is written by the winners, stories of the past written from alternative viewpoints, such as those of oppressed or minority groups, are often seen to be of little interest to conventional historians. Jenkins (2009) argued that the narrowness of the range of themes covered in mainstream historical research illustrates how the study of history fundamentally aims to support and reinforce the current status quo.

4.2.3 Explanation, interpretation and the use and development of theory in historical research

"To what extent should theory be used as the basis for explanations of historical events?"

Many of the historians who adopted von Ranke's scientific methods for historical research also adopted the positivist philosophy that historians should aim to emulate the physical and natural sciences in developing 'laws' and predictive models for historical events. Historians should seek not just to record the events of the past, but to develop explanations and theories of how and why they occurred. Theories developed in this way could be used not only to explain the past, but to predict the likely future course of events and identify actions which could cause it to change. For the positivist historian, research of this sort was seen to be central to the status of history as a discipline; in fact some argued that studies of the past which aimed simply to record facts and events were merely chronicles of events, and did not constitute true historical research (Megill, 1989).

Although this theory-based approach to historical research developed as an extension of von Ranke's scientific methods, it was opposed by many historians from the classical school. Elton (1991) argued that the search for patterns in historical events was fundamentally unsound and led to bad history. The historian's interest should always lie with the particular – the people and events which were the subject of their research, and they must accept that their findings relate only to those people and the unique set of circumstances which applied at that time. In Elton's opinion, the apparent usefulness of theoretical frameworks as tools to help to bring order to seemingly chaotic masses of historical data made them particularly dangerous: "… the very fact that they offer a helpful instrument for clearing up the muddle of the past quickly turns into a conviction that the past must be reconstructed to coincide with the theory" (Elton (1991, p15). The historian might think that they are in control and are using the theory selectively to assist their work, but in practice they inevitably become a slave to the theory, framing their research questions to accord with it, and seeking only evidence which supports it.

Carr and Elton were in agreement that the 19th century dream of precise, comprehensive predictive laws was unachievable, but Carr argued that theory as a formalized statement of generalizations about the past is pivotal to the conduct of historical research. In contrast to Elton's focus on the particular, Carr believed that the historian's interest lies equally with the particular and the general, and the relationship between them. The historian's understanding of any particular set of events should always be guided by the generalizations they have derived from other events, and likewise all generalizations should be constantly re-assessed and modified in light of the particular. Historical theories may not have the precision or the reliability needed for use in making precise and specific predictions about the future, but they provide essential guidelines for aiding our understanding of both the present and the future.

Postmodernists hold two somewhat contrasting attitudes towards the use of theory and explanation in historical writing. On the one hand they support Carr's view that theory has a central place as an essential and unavoidable element of all historical work. In the postmodernist's eyes, it is not possible for any historian to approach the study of the past without adopting some theoretical stance(s) – whether implicit or explicit - upon which to base their work. Historians who claimed to be approaching history with no pre-conceived theoretical stance are simply glossing over or failing to accept the reality that their approach to history is theory-driven. Thus, Jenkins (2009) suggested, an overtly theory-based approach to history was preferable to one which claimed to be a-theoretical because at least it made its theoretical position explicit to the reader.

On the other hand, postmodernists are also dismissive of the validity of theories, which they see as being simply interpretations imposed on the past and supported by selective use of the traces which it has left. Any theory about the past is entirely the creation of the historian and has no inherent verifiable relationship to the reality of the past. An infinite variety of such theories is possible, and no one of them can ever claim greater validity or accuracy than any other as an explanation of the past. Thus, where modernists like Carr believed that history is about the quest for a theory which is objectively superior to the rest, Jenkins asserted that there is no such thing as a 'correct' theoretical basis for any historical account (Jenkins, 2009).

4.2.4 Knowing the past: facts and their sources

"*What source materials can we use to tell us about the past, and to what extent can we rely on them in a historical reconstruction of events?*"

One of von Ranke's most enduring legacies was his development of the basic principles and approaches for dealing with source materials for historical research. Prior to his work, historians had often been cavalier in their treatment of sources, frequently failing to examine systematically and thoroughly the available historical records, using material of dubious quality, and relying on second-hand sources of information without checking their reliability. Von Ranke emphasised that the key facts of any historical account should be derived from 'primary sources' such as eyewitness accounts or documents which could be shown to have originated at the time. Historians should avoid 'secondary sources', such as the work of other historians, second-hand reports, documents and memoirs written well after the events had occurred. Classical historians such as Elton who followed in the Rankean tradition emphasised the use of formal documentary sources as the basis for the historian's primary task of collecting factual data about the past.

Carr acknowledged that "facts and documents are essential to the historian", but emphasised that "they do not by themselves constitute history" (Carr, 1961, p13). He was critical of the position of pre-eminence which documented source materials occupied in the Rankean approach to historical research:

> "The nineteenth-century fetishism of facts was completed and justified by a fetishism of documents. The documents were the Ark of the Covenant in the temple of facts. The reverent historian approached them with bowed head and spoke of them in awed tones. If you find it in the documents, it is so." (Carr, 1961, p10).

Carr argued that documents from the past and the facts they contain must be treated with caution. They cannot be taken as absolute truth, because they represent only the knowledge and opinions of their authors:

> "No document can tell us more than what the author of the document thought – what he thought had happened, what he thought ought to happen or would happen, or perhaps only what he wanted others to think he thought or even only what he himself thought he thought". (Carr, 1961, p10).

Postmodern theorists have even less respect than Carr for the sanctity of source materials and the facts which can be derived from them. They argue firstly that the existence of documentary sources from the past is itself affected by the course of history. That is, the survival of traces of the past in source materials is uneven, with distinct differences in the rates of retention of different types of material. Jenkins (1991) argued that these biases in the processes of document creation and retention introduce unavoidable distortions in any historical research, because the views of some groups are not preserved in the standard historical source materials.

Postmodernists also reiterated and extended Carr's concerns about the interpretation of the meaning of source materials. As well as supporting Carr's comment cited above about the problems relating to the intentions of the author of a historical source document, they also disputed the historian's ability to interpret such a document correctly. Jenkins (1991) argued that the fact that all historical source materials are products of the social and cultural circumstances of the time makes it impossible for the historian to understand them fully. These problems serve to negate any assertion by the historian that their use of the facts and meanings which source materials provide ensures that their reconstructions of the past can claim to be accurate. In reality it is the other way around: the historian constructs their version of the past, and selects and interprets the sources to support this construction.

4.2.5 Historical writing and the use of narrative

"What form of writing should be used in the presentation of historical research, and what role does the form of presentation play in an historical account?"

Before von Ranke, the success of historical works was often due as much to their quality as works of literature as their factual content. The discipline's transition from a literary to a science-based discipline reduced the emphasis on literary merit, but the descriptive nature of historical writing meant that historians continued to face the problem of choosing the most suitable form of presentation for their work.

Elton (1967) identified three dominant approaches to historical writing, which he described as the narrative, descriptive and analytical modes. The narrative mode uses the passage of time as its primary reference point, and aims to integrate the facts into a story which replicates the sequence and flow of events as they occurred. Ideally this narrative would take the form of a single continuous linear storyline, but in reality almost any historical narrative involves a number of separate narrative threads. The narrative historian manages the description of each individual thread, while also weaving them together to form a single coherent account (Evans, 2001). By contrast, the descriptive and analytical modes omit the storyline, and base their descriptions of the facts and events around selected themes at a given point in time. Their focus is not on the passage of events, but on the overall context in which they took place. The descriptive mode focuses on a simple description, whereas the analytical mode tries to identify the motivations behind events, and studies the causal connections and inter-relationships between them.

Narrative, which was traditionally the dominant form of presentation of historical writing, began to fall out of favour in the early part of the 20th century, because it was perceived to be out of line with the ambitions of history to be treated as a scientific discipline. It was criticised on the grounds that it tended to be purely descriptive and to be focused on a specific set of events, whereas a science should go beyond the particular and descriptive and should seek to develop universal or generalisable explanatory statements about the world (see, for example, Furet, 1982).

Towards the end of the twentieth century, narrative history underwent something of a revival, in part as a reaction to the growing disillusionment with the failings of scientific historical approaches (see, for example, Stone, 1979). However, it then ran into a new set of controversies based around postmodernist critiques of its validity and accuracy as a form of historical representation (for example, Kellner, 1987). These critiques were part of the so-called 'linguistic turn' in historiography, which focussed on the impact of problems of language and meaning in historical writing. Postmodernists used these issues to question the extent to which any historical work can claim to be a neutral representation of facts and events about the past.

One aspect of this critique is the fact that the choice of words and phrasing which historians use as the basis of their descriptions of the past are subject to interpretation, which will inevitably affect the nature of the message which is conveyed to the reader. For example, a group of people opposing the government in power could be labelled as 'freedom fighters resisting tyranny' or 'terrorists subverting democracy'; the choice of words cannot be value-free and will have significant impacts on how the facts and events being described are perceived by the reader. No matter how much historians may aim to write in objective, neutral, factual terms, their use of language will inevitably cause their own biases and the biases of their readers to become a part of the historical account.

A second significant area of language-related criticism relates to the historical narrative itself. White (1987) argued that the storyline in any historical account is itself an important part of that account – that is, any historical writing comprises not just a compilation of facts, but also the particular narrative form in which those facts are presented. Although the specific facts and events from which the historian constructs the narrative may be found in the evidence of source materials, the story itself is not. In this sense, the historian's creation of a historical narrative is similar to that of a novelist writing a work of fiction – it is not the events themselves, but the historian who decides the way in which they will be assembled and represented. Like a writer of fiction, the historian chooses the storyline, and presents events as tragedy, drama, comedy or some other narrative form according to whatever suits their purpose. In this sense, according to Jenkins (2003), all history is as much the invention of the historian as it is the discovery of the past

4.2.6 Objectivity in historical research

To what extent can a historical work free itself from personal biases and claim to be an objective and accurate account of the past?

Von Ranke believed that historians should adopt the scientific ideal of objectivity as a central element of their approach to their work. Methods of historical research should aim to emulate the methods of science, by establishing a separation between the phenomena being studied and the researcher, so that the effects of observer bias are eliminated. Von Ranke's followers lamented the subjectivity of previous historical writing, and believed that historians could and should be able to look beyond their own interests and those of their audience(s), and be totally impartial in their accounts of the events of the past (Evans, 2001).

Although objectivity has long been one of the most sought-after ideals of scientific research, even within the physical sciences the ability of any research to be truly objective became a matter of great controversy during the twentieth century. Many philosophers of science have come to regard it as a theoretical ideal which can never be attained (Chalmers, 1999). For the historian, whose objects of study are no longer even in existence and can only be inferred from what they have left behind, the problems involved in achieving objectivity are particularly acute.

Elton (1991) acknowledged that critics were right in noting the difficulty of achieving complete objectivity, but argued that they had now gone too far in the other direction in their emphasis on the inherent subjectivity of historical research. Given that the past does have an objective reality independent of any historical enquiry, Elton (1991) suggested that objectivity is possible in the tasks of finding, gathering and recording its traces in order to establish an indisputably accurate body of knowledge about it. He acknowledged that such objectivity is harder to achieve when the historian moves beyond the accumulation of facts to the development of explanations and interpretations of historical events. But even in this area, he argued that the effects of subjectivity on a historian's interpretation of the past were severely constrained by the fact that that interpretation must conform to, and be supported by, the known body of historical evidence. There would always be some areas of doubt and dispute about the past, and it would always be impossible to reach a final and definitive resolution for all of them, but a good deal of progress towards an objective understanding of events was possible.

Carr (1961) and Elton (1991) were in agreement that objectivity should be a central aim of all historical research, but, in keeping with his views about the closeness of the inter-connection between facts and interpretation, Carr was more pessimistic about whether this was possible. He acknowledged that the nature of this inter-connection made it difficult to see how the concept of separation between the historian and his object of study could be achieved. Evans cited a comment by Carr written the year before his famous work appeared:

> "The awkward thing about history is that bias seems an essential element of it – even in the best of history. The fact is that the facts do not, as is sometimes said, 'speak for themselves', or if they do it is the historian who decides which facts shall speak – he cannot give the floor to them all. And the decision of the most conscientious historian – of the historian most conscious of what he is doing – will be determined by a point of view which others may call biased. It would not be altogether cynical to say that the best historian is the historian with the best bias – not the non-existent historian with no bias at all." (Evans, in Carr, 2001) pxiv)

In the eyes of postmodernists, the pursuit of objectivity is misguided and futile. In his earlier works, Jenkins's (1995) discussion of this issue focussed on the problem of source materials, as described in section 4.2.4; that is, since the choice of source material and our 'reading' of every source material is inherently subjective, there can be no objective truth in the knowledge it gives us of the past. In his later works, (Jenkins, 2003 and 2009) he changed this focus somewhat, and argued the issue mainly on the basis of the problem of narrative, as described in section 4.2.5; that is, he now acknowledged that it is possible to establish many statements of fact about the past, but argued that historians (and postmodernists) were not interested in history at the level of individual factual statements, but in the way these facts were put together in a historical narrative. Different historical accounts may agree on some of the historical facts, but the overall patterns of selection, interpretation and presentation of these facts will differ according to the interests of the group for which the historian is writing. It is at this narrative level, when the historian tries to explain what the facts of history mean, that subjectivity cannot be escaped.

Jenkins (2003) argued that the attempts by historians to seek 'objectivity' and 'truth' were in fact aimed at achieving what he called 'interpretive closure'; that is, they aimed to shut down possibilities for the emergence of new ways of seeing and interpreting the past. When historians use of the concepts of truth and objectivity in their work they are seeking to control interpretations of the past and to prevent the emergence of alternative historical accounts which might threaten their view.

4.3 The research approach adopted in this study

For the neophyte historian with no specialist training in history and no allegiances to any particular philosophical or ideological position about historical research, there are no easy answers to the problems of historical research method outlined above. As Evans (2001) concluded, for each of the issues described in the previous section there appear to be some merits in the arguments put by all three schools of historical thought - the classical, the modernist and the postmodernist. In line with Evans's recommendation, an eclectic blend of all three was used, in accordance with my own biases and with the way each approach seemed to fit with the needs of the study.

The remainder of this section outlines and justifies the main features of the method which was followed in the study. Section 4.3.1 describes the way in which the study was conducted and justifies its scope in regard to the institutions and academic programs which were included, and the time period over which they were analysed. Sections 4.3.2 -

4.3.7 briefly describe the approaches which were adopted to each of the key issues for historical research identified in the previous section, and explain the rationale for the method which was chosen in each case.

4.3.1 Conduct and scope of the study

The study focused on the development of IS in all tertiary institutions in the state of Victoria in Australia over the period from 1960 to 2011. The details of these institutions and the Victorian tertiary education system in which they operated were given in Section 2.6. Initially it was intended that only programs at universities would be included, but the structural changes in the Australian higher education system explained in that section made it necessary to extend the study to cover other types of tertiary institution in the period up to 1990. In addition to its coverage of the broad pattern of events across all institutions, the study was extended to include a detailed case study of the origins and evolution of IS at a single institution, Monash University.

The decision on institutional scope was dictated by a mixture of considerations, some of which related to issues of research method, and some of which related to pragmatic issues about what was achievable within the study constraints. From the point of view of research method, confining the study scope to institutions within a single geographical region had the advantage of ensuring a high degree of uniformity in their operating environments. All the institutions worked within the same educational system, faced the same external regulatory and financial environment, and dealt with similar marketplace conditions in terms of both student and workforce demands. The institutional scope also helped to meet a research aim of including a wide range of tertiary educational institutions. The fact that the institutions included in the study constituted virtually the entire tertiary education system for the region, meant that between them they covered a very broad cross-section of institutional types and circumstances.

At a pragmatic level, limiting the study to Victoria kept the number of institutions to a manageable size, and ensured that sufficient data were available to enable a suitable depth of analysis of events at all institutions throughout most of the study period. Even within this restricted scope, there were some data collection and analysis problems, as later chapters will show. The familiarity of the researcher with the institutional environment was also felt to be an important consideration to minimise the likelihood of important contextual issues being overlooked. The fact that I have worked in tertiary education in Victoria for more than 20 years gave me a good background knowledge and understanding of the educational system and of many of the institutions. This helped both with the establishment of the broader educational and institutional context of the study, and also with the collection, analysis and interpretation of the study data.

There were also some disadvantages to the choice of institutional scope in relation both to the conduct of the study and to the nature of its findings. Issues of the first type are addressed in general terms in Section 4.3.4 on study data and in Section 4.3.7 on objectivity, and specific problems of this kind, which need to be explained within the context of the study, are discussed in later chapters.

Although the study aimed to focus on the history of the discipline of IS, the vagueness and fluidity of ideas about what constitutes the discipline and the lack of precision in the way in which IS and IT programs have been named made it necessary to extend the research to include consideration of the wider context of the development of all forms of computing education in the institutions studied. This decision minimised the risk that significant IS-related programs might be omitted from the study purely as a consequence of the way in which they were named. However it greatly increased the amount of data collection required for the study, and in doing so increased the risk of key issues being obscured by the mass of extraneous detail.

Issues with data were a primary reasons for the extension of the study to include a detailed case study of the evolution of IS at Monash University. The initial analysis of events across the full sample group demonstrated that the data on which it was based were adequate only to give a very high-level picture of the patterns of development of IS as a discipline and the forces which influenced its formation and growth. A more detailed case study was felt to be necessary to supplement this overall picture and provide greater insight into the way in which these forces took effect within a particular institution.

The nominal starting point for the time period covered by the study was set at 1960, which, as discussed in Chapter 3, is the approximate time which most IS texts cite as marking the birth of the discipline. To simplify the presentation of the data, the study period was divided into three separate stages:

- Stage 1: from 1960 to 1990;
- Stage 2: from 1990 to 1996;
- Stage 3: from 1996 to 2011.

The basis for choosing this division of years is explained in the following chapters.

Consideration was given to extending the study back further into the 'pre-history' period, whose importance to the discipline was discussed in Section 3.2. However this idea was rejected, partly because of the difficulty of getting data before that time, but mainly because the extent of the changes to the tertiary education system in Victoria in the early 1960s (described in Section 2.6) were so drastic that trying to extend the study back further would be an extremely difficult and probably futile task.

4.3.2 The purposes of the study

What does this history aim to achieve?

As set out in Chapter 1, three distinct purposes were identified for the historical reconstruction carried out in the study: firstly, at a purely descriptive level, it aims to provide an outline of the events which led to the establishment and evolution of the IS discipline in each of the universities in Victoria, and the form of the IS undergraduate curriculum which resulted in each case; secondly, at an analytical level, it aims to explain how the course of events at each institution shaped the discipline and its curriculum, and to identify the key factors which determined the areas of similarity and difference between the different institutional implementations of the discipline; and thirdly, at a prescriptive or predictive level, it aims to use the history of these implementations of IS as a basis for reflecting on the issues of disciplinary identity and legitimacy with which the discipline has grappled, and for assessing the future prospects of the discipline.

In its pursuit of these objectives, the study aims to combine aspects of both Elton's classical approach to historical research and Carr's modernist approach. In serving its descriptive purpose, the study aims to conform to the precept underlying all of Elton's work that a historical account should simply provide an accurate factual reconstruction of events – in this case the events associated with the evolution of the IS discipline in the institutions being studied. In this aspect of the study, it can be seen as an attempt to follow von Ranke's objective "to show what actually happened", independent of any explanation or analysis of the causes of these events, and without making any claims about the relevance or significance of the events of the past to the present or future state of the discipline.

In the use of these factual foundations for analytical and prescriptive purposes I accept Carr's (1961) view that the study goes beyond the simple act of reconstruction. Rather, in these areas it is inspired by the 'bees in my bonnet' which have arisen as an inevitable consequence of the nature of my background interest and involvement in the IS discipline. I also accept Carr's view that, regardless of how much I may try to follow the Eltonian ideal of seeing the past on its own terms and understanding it for its own sake, it is inevitable that my interpretation and explanation of the past will be biased by my perceptions of the discipline and will be affected at least in part by its present needs and circumstances.

These biases limit how far the study can go in terms of claim to reach any absolute or definitive judgements in relation to these areas. Although most of the facts which are presented can be shown to be objectively true, the interpretations and conclusions drawn from them about the IS discipline are necessarily subjective, and represent just one particular point of view. To use Carr's (1961) analogy, it provides only one perspective of the 'IS mountain', and many other perspectives are possible. However, like both Elton and Carr, I believe that the facts which the study contains are a valid representation of one aspect of the objective reality of the discipline.

Although the purposes of the study as set out above can claim to be based on the philosophies espoused by Elton and Carr, some consideration must be given the postmodernist argument that all historical research is influenced by the motivations of the researcher. That is, whatever its stated intention, the real purpose of the study (either consciously or unconsciously) is to promote a particular view of the discipline. The prevalence of this purpose as the main motivation for historical research was emphasised in Graham et al's (1983) compilation of essays on disciplinary histories. In their foreword to this work, the editors asserted that the main function served by almost all such studies is that of legitimation. Under this broad banner they identified varied and contrasting types of legitimation - socialising disciplinary newcomers, gaining support for a particular perspective of the discipline, promoting the cause for change within the discipline, supporting the disciplinary status quo by resisting change, and so on. The authors argued that legitimation objectives like these are particularly prevalent in what they call 'amateur' historical works which are written by a member of the discipline, rather than by a professional historian who is external to the discipline. Since this thesis is a history of this type, it must therefore be regarded as particularly susceptible to this problem.

Clearly the conduct of the study cannot be freed completely from the biases which my long-standing involvement in the discipline has given me in relation to both the discipline's past and its future. However, the collection of the facts on which the study has been based, their presentation and interpretation have been organized to minimize the effects of these biases as much as possible. As both Elton and Carr argued, at some level these facts do speak for themselves, regardless of what either the reader or I may want them to show.

4.3.3 Study themes

What are the key themes on which the history focuses?

The normal approach to the study of disciplinary histories – what might be termed the 'classical' approach to this form of historical research - is to focus on issues related to the development of the discipline's intellectual foundations and cognitive content (Graham et al, 1983). The key themes covered usually include areas such as the identification and elaboration of fundamental disciplinary concepts, the establishment of the theoretical frameworks which underpin disciplinary research, the identification of specialist research topics, and the pioneering work of the key figures in the discipline's foundation and growth. The exploration of themes such as these provides the intellectual justification for a discipline, by identifying and defining the body of knowledge around which it is focussed. Within this conventional approach, the academic infrastructure associated with the implementation of the discipline – university departments, teaching programs, curricula and students – is usually not considered, or is regarded simply as a by-product generated by the processes of disciplinary formation and growth. These areas of disciplinary implementation may be used as indicators to demonstrate the rate of progress of this growth, but are otherwise usually treated as if they are of only minor importance to the discipline's intellectual development.

The approach followed in this study reverses this normal emphasis. It focuses on the processes by which IS academic programs were formed and implemented within the sample group of universities, and examines the way in which these formative processes have affected the nature of the discipline and its knowledge content in those institutions. That is, its key themes concern the institutional context for the discipline, and the way in which its implementation in each institution influenced the evolution of its cognitive content. In addition, the study focuses on the curriculum content of the discipline's academic programs in practice as a key indicator of the nature of the discipline, rather than focussing on the academic research literature or the theoretical conceptualisations of the discipline contained in model curricula.

In its choice of these themes, the study can be said to align with the postmodernist perspective which holds that classical approaches to historical research are innately conservative in reinforcing and perpetuating a traditional 'mainstream' view of the world - in this case the view that academic disciplines are intellectual constructs which are formed and evolve as part of an orderly and rational process of growth and division of knowledge. It is on this basis that the classical approach to disciplinary histories has focussed on developments in disciplinary research as outlined above.

Although the classical approach is satisfying from an intellectual point of view, and provides an important perspective on the cognitive content of the discipline, it does not take account of the other aspects of disciplinary formation and growth which were discussed in Chapter 2. This study's examination of these issues in the implementation of IS in practice provides an alternative perspective of the discipline. In doing so it aims to provide a new insight into the discipline's identity/legitimacy issues.

4.3.4 Use of theory

What use does the study make of theory for its explanations of the past?
The study adopted the view which is common to both the modernist and postmodernist approaches, that the use of theory in some form is a necessary and inevitable part of the historian's work. That is, no matter how much they may wish to adopt the neutral stance favoured by Elton, every historian's approach to the collection and interpretation of data will invariably be based around some sort of explanatory theory, which should be acknowledged and articulated.

According to Graham et al (1983) most disciplinary histories adopt some form of rational progressive model of development, in which the events of the discipline's past are arranged and presented as an orderly sequence, which demonstrates that the final outcome is the logical result of a natural and predictable evolutionary path. This study does not make any such assumptions. Rather it takes the view expressed by Light (1974) that chance and circumstance play major roles in the way in which a discipline evolves: "Most of the disciplines today are an accumulation of historical accidents and arbitrary turns made by the head of the academic procession as it blindly snaked its way through the city of knowledge" (Light, 1974, footnote to p13). Thus, the order and logic seen in the patterns of disciplinary development described in most disciplinary histories are the result of post-hoc rationalisations of the course of events.

Despite these elements of chance and arbitrariness, the study assumed that there are some patterns in the main factors which influence disciplinary formation and evolution, and which are common to all universities. Figure 4.1 shows these factors in the form of a theoretical framework, which was developed and adopted as the basis for the conduct of the study.

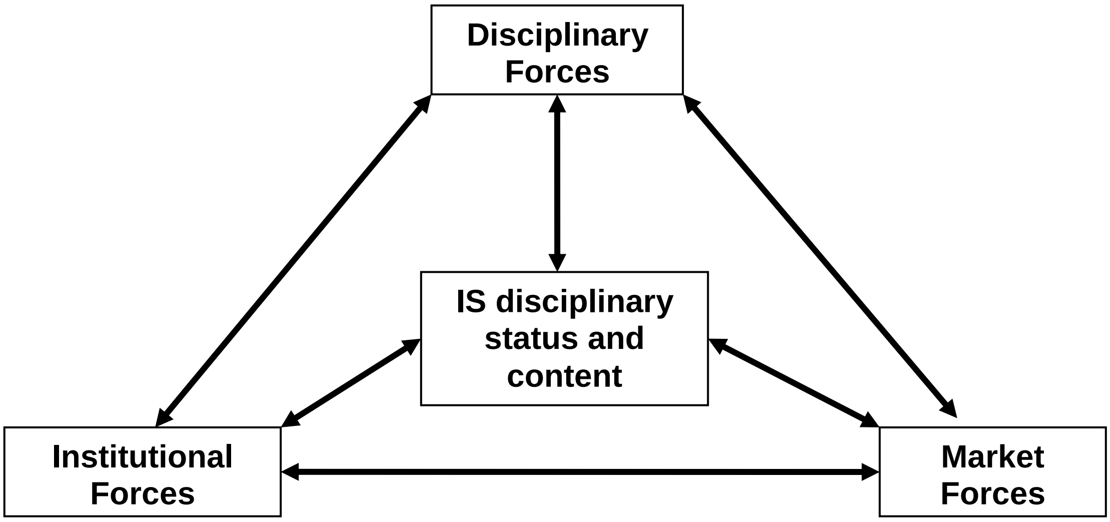


Fig 4.1 Theoretical framework for the study

Within this framework, the status and content of the IS discipline as it is practised within an institution is shown as being a product of the interaction and influence of three main groups of forces – disciplinary, structural and marketplace. The framework shows all the interactions between the model elements as two-way, with each element capable of both influencing and being influenced by the other elements. However, for the purposes of the study, most of the emphasis will be on the influences exerted on the disciplinary status and content of IS by the other elements.

The framework is not intended as a normative or predictive model, nor does it purport to provide a complete explanation or to be uniformly applicable to all institutions or educational environments. Rather it should be seen as an explanatory device, which helps to organize and make sense of the course of events. In this sense its use was motivated by sentiments which were less ambitious than those of the modernist historians and more like those of the postmodernists. That is, rather than claiming to represent definitive truth, it represents only one of many possible theories for explaining the past. Despite these limitations, it provides a useful basis for studying and understanding some of the key aspects of the evolution of the IS discipline as it has been implemented in practice. The elements of the model are outlined briefly below.

IS disciplinary status and content: This is the focal point of the framework and represents the level of recognition accorded to the Information Systems discipline within a university, and the nature of the subject matter which constitutes the discipline. The basic premise of the study is that IS disciplinary identity within any academic institution is expressed in the way in which the discipline is represented within the institution's organizational structures and academic programs. A discipline can be said to have established its place within a university, if it can demonstrate over an extended period of time that it has maintained an ongoing presence as an independent organizational unit, offering a clearly identifiable program of at least the status of a major, with a reasonably stable and coherent curriculum. In combination, the achievement of these three outcomes confirms the discipline's identity and legitimacy, and also serves to define the nature of the discipline as it is perceived within that university.

Thus, for each of the universities studied, the analysis of the evolution of the disciplinary status of IS and the nature of its disciplinary content was based on three factors:

- The place of IS in the organizational structure: the study examined the extent to which there were organizational units within each university's academic structure which were clearly identifiable as IS. It determined the location of any such organizational units in relation to other academic disciplines, and the status which they had reached within the academic organizational hierarchy in each university.
- The place of IS within the institution's academic programs: the study examined the extent to which IS had achieved recognition as a specialist area of study within the undergraduate academic programs offered by each university, either as nominated specialist streams of units, majors or independent degree programs
- The IS curriculum: the study examined the curriculum content of the designated IS units in each university's undergraduate programs, and used it as the main representation of the knowledge which was held to constitute the fundamental core of the discipline.

Disciplinary forces: This element of the framework represents the impact which the processes for the division and classification of knowledge have had on the establishment of IS as a disciplinary presence in each university.

As discussed in Chapter 2, a fundamental premise of the study is that academic disciplines are both intellectual and social constructs, and that both these sets of influences must be taken into account in order to understand the processes of disciplinary formation and growth. Three of the models of disciplines and disciplinary development referred to in Chapter 2 were used in the study to help explain the disciplinary forces which drove the evolution of the IS discipline in each of the universities:

- Metzger's (1987) model of the processes of disciplinary formation. This model describes four main formative processes for disciplines based largely around the development of structures based on their cognitive content. The study used this categorization of formative processes as the basis for analysing the way in which the IS discipline initially came into being in each university.
- Becher's (1989) 'tribes and territories' model of disciplines and disciplinary cultures: This model portrays disciplinary divisions in sociological terms as the division of academic 'territories' between different disciplinary 'tribes'. It was used in the study as a basis for identifying in each university the academic knowledge territories which the IS discipline was able to claim and their position in relationship to neighbouring academic territories. It was also helpful for analysing and interpreting the nature of the IS disciplinary culture within each university, and the relationships between IS and its neighbouring disciplinary 'tribes'.
- Biglan's (1973a and 1973b) model of disciplinary classification: Biglan's model provides a framework for classifying and grouping disciplines according to the broad cognitive characteristics of their content. It was used to help guide the analysis of the types of knowledge and cognitive style which were associated with the study of IS in each university.

Institutional structural forces: This element of the framework represents the impact of institutional structures on the processes of disciplinary formation and growth within a university. Gumport & Snydman (2002) identified two key ways in which a university's academic organizational structures help to shape the institution's approach to the identification, classification and management of disciplinary fields of knowledge.

The first of these concerns the place of specialist discipline-based academic departments in the organizational structure, and the role which they play in the legitimation of disciplines as specialised fields of study. Within the university, the department represents the most significant and most fundamental form of division of knowledge, and hence of disciplinary legitimation (McHenry, 1977). A department's primary goal is to foster and protect the culture and norms of the discipline which it represents, and it usually has a high level of autonomy and control over the structure and content of the discipline's academic programs. Departments which are seen as having some broader form of disciplinary affiliation are usually grouped together into a higher-level organizational unit, which in Australia is most commonly known as a faculty (although other names such as school, college or division are also sometimes used). This means that although discipline-based departments are generally assumed to operate as independent units "… the location of an academic tribe ... will have an important effect on the 'shape' of its disciplinary knowledge, as well as the obverse being the case" (Becher & Trowler, 2001, p38).

Secondly, Gumport & Snydman (2002) suggested that organizational structures can affect a discipline's responsiveness to pressures for change. On the one hand, they may act as an inertial force, resisting the pressures for change. The phenomenon of organizational inertia is well known in organizational theory (see for example, Hannan & Freeman, 1984 and 1989), and is particularly common in universities. Straus (1973) noted that:

> "As man's knowledge changes, it is logical and necessary that the boundaries of disciplines should change accordingly. ... Most such interchanges, however, take place outside of and in spite of the formal organization of universities. The formal organization exerts great force toward maintaining the status quo and is a major barrier to any change in the traditional and entrenched departmentalization of academic activity." (Straus (1973, p896)

On the other hand, the university's organizational structures may work in the opposite direction and help to address pressures for change. Clark (1983) and Kerr (1987) described examples of how the nature of university structures can act as a positive force in enabling disciplines to respond and adapt to their changing environments.

The study sought to examine both these aspects of the impact of organizational structures on the evolution of IS in each university – firstly, the effect which institutional structures had on the initial establishment of the an IS disciplinary presence in the university, and then the subsequent impact which the structural arrangements for IS had on the discipline's ability to adapt to changing circumstances.

Market forces: This element of the framework represents the level of demand for educational programs in the discipline. It has two dimensions: the perceived needs of the workforce for graduates with specific types of knowledge and skills; and the preferences for different disciplines shown by students in their applications for and enrolments in academic programs.

There have been numerous studies into the way in which financial effects of these market force pressures can flow through to all levels of university activities in even the most powerful, wealthy and prestigious institutions (see, for example, Eckel, 2000 & 2002, Gumport (1993 & 2000), Hardy (1987 & 1990), Manns & March, 1978, Morphew, 2000). In dealing with the pressures of the marketplace, Aronowitz (2001) suggested that the modern university has increasingly come to regard disciplinary knowledge as a commodity which the university departments produce in their role as part of a 'knowledge factory'. Consequently, the survival of an academic discipline in a university is now dependent at least in part on its ability to attract sufficient students to its 'product' and maintain 'market share'.

There are two main sources of marketplace pressures on university disciplines and curricula: Firstly, they may come in the form of demands from government, business, professional groups or the community that universities produce graduates with specific skills or qualities to meet the needs of the labour market or of society at large; secondly they are expressed through the levels of student demand and enrolments in academic programs. Pressures of the latter kind have become particularly significant in recent years, as universities have come under greater financial pressure and been called upon to function in a more business-like way.

As Chapter 3 has already showed, workforce demands were cited as a major influence on the development of the early versions of the ACM's model IS curriculum, but student demands became a more significant concern in more recent years. A similarly pattern was followed in this study, with the emphasis on the impact of workplace demands for the early years of the study period, and then a greater focus on student demand as the key form of market pressure affecting disciplines and disciplinary curricula in the later years.

4.3.5 Data sources for the study

What data sources were used as the basis of the study?

In its approach to the collection of data, the study sought to follow the classical Rankean precept of placing high value on primary source documents. In keeping with the classical Rankean tradition, the main sources of data used for the study were the documentary records produced and published throughout the study period by the teaching institutions and the key administrative bodies involved in Higher Education. Table B1 in Appendix B lists these sources, and briefly summarises their main characteristics.

The main strength of these primary documents as data sources lies in their status as the official records of publicly-funded organizations operating under government regulation, which generally ensures their existence, availability and accessibility. As indicated in the table, there were some minor qualifications to this, due to variability in the quality of organizational record-keeping. As later chapters will show, in the first half of the study period many of the academic institutions included in the study were small, and the official records of some of them were rudimentary. In addition, up until the early 1990s there were many mergers between institutions, and sometimes the historical records of the small institutions which were made defunct by mergers could not be found. The resultant gaps caused some problems in tracking the course of events at specific institutions, but these had only minor effects on the overall analysis.

The legal status of most of the documentary sources as official organizational records also means that they can generally be trusted to constitute an accurate record. Although, as Carr (2001) argued, official documents sometimes reflect what the authors want people to believe rather than what is actually the case, the nature of these documents and their content is such that it seems highly unlikely that they would significantly distort the overall picture of events at each institution. There may be some minor errors or inconsistencies in matters of detail, but these are irrelevant to a study of this kind, which is looking only at the broad pattern of events. The nature of the data which was gathered from the documents was also felt to largely eliminate postmodernist concerns about authorial intentions and the possibilities of mis-interpretation. The meaning of the data and the historical reality which they represent was felt to be sufficiently clear and uncontroversial that only the most extreme advocates of the ‘linguistic turn’ in historical research could regard them as subject to debate.

Although their status as official organizational records is the major strength of the documentary data sources, it is also a significant contributory factor to their major weakness. This is the fact that their ‘official’ status tends to lead to the use of standardised forms of presentation which are limited in the range and type of information which they provide. In particular, they generally confine themselves to statements of fact, and omit explanatory detail of the motivations or intentions behind them. As Veysey (1965) noted in his study of the history of American universities, official records of this kind contain plenty of documentary evidence about what is done at universities, but often very little explanation of why it was done. Consequently, “… One is led, therefore, to reason backward from the evidence of how the academic system functioned toward the causes for its appearance.” (Veysey, 1965, p267). This process of ‘reading between the lines’ to try to interpret the facts and ascertain the organizational intentions and values which lay behind them inevitably increases the scope for the intrusion of observer bias, a problem which will be discussed further in Section 4.5.7.

Consideration was given to using personal recollections as a data source to overcome the limitations of the documentary record. The potential value of such insights can be seen in Tatnall's (1993) study, which was based heavily around the recollections from some of the pioneers in computing education in Victoria. However, the use of personal reminiscences as data sources also has many potential problems. The human memory is notoriously selective, and people's recollections of events over the fifty year period covered by the study are likely to have been coloured by subsequent events. There is also the possibility of confusion arising from the so-called 'Rashomon effect' (Heider, 1988), where different observers or participants in a series of events hold markedly different perceptions of them according to their own biases and interests in them. Gable (2006) noted how problems of these kinds with the availability and reliability of personal recollections adversely affected their study's attempts to include historical elements in their survey of the state of the IS discipline. Consequently it was decided that the potential problems with the use of personal accounts outweighed its benefits as a data source.

Occasional use was made of secondary sources in order to supplement the documentary record, but this was kept to a minimum, serving only to provide corroborative evidence or to fill gaps where evidence from primary sources was unavailable. All such uses of secondary sources are identified and acknowledged wherever they occur.

4.3.6 Presentation of findings

What approach does the study take to the presentation of its findings?

The study employed a blend of narrative and analytical modes of presentation to describe the evolutionary path which IS followed. An analytical approach was used to describe the overall patterns and trends in events and their outcomes across the universities, while elements of the narrative approach were used to track developments at each institution. This choice of a combination of modes was driven by the need to blend the 'big picture' view of the progress of the discipline as a whole with the detailed view of events at each institution, which was needed to explain how that picture had formed. The elements of narrative presentation were needed to highlight the timing and sequence of events which was central to the evolutionary process by which the IS discipline formed and developed in each university. On the other hand, the analytical approach was also needed to show the overall patterns in the trends of IS implementation across all the universities and to highlight the areas of similarity and difference between them.

The main problem for both forms of presentation was the nature of the data which were collected for the study. The uniqueness of the individual circumstances of the institutions and their responses to the complexity of the changing educational environment meant that it was difficult to manage the sheer volume of data which was required to track the progress of the four elements of the theoretical framework over the duration of the 50 year time period covered by the study. The level of detail required made it impractical to describe fully the course of events at all institutions. The variability of the data across institutions also posed problems. From a narrative point of view it made it difficult to establish a coherent story-line which could draw together the separate narrative threads for each university; and from an analytical point of view it made it difficult to establish a uniform basis for comparing events across the universities and identifying patterns of similarity between them.

The problems encountered in striking a suitable balance between the analytical and narrative modes, also highlighted the philosophical issues regarding the incorporation of the historian's biases into the study findings. On the one hand the presentation aimed to avoid the criticisms by Carr of Rankean histories as consisting of 'dry-as-dust' recitations of facts, devoid of any interest or feeling. On the other hand, it also aimed to minimise its exposure to the postmodernist critique that narrative histories impose a story-line on the facts which are a reflection of the historian's biases, rather than an accurate reconstruction of actual events. The selectivity involved in determining the patterns and trends in the data which should be highlighted, choosing the institutional examples upon which to focus, and interpreting and explaining the significance of the factual data reinforces Hayden White's argument that the narrative is not just an objective account of the facts and events of history, but is the creation of the historian. This is an element of the unavoidable problem relating to the objectivity of the study, whose effects are considered in the next section.

4.3.7 Objectivity and the researcher's biases

To what extent can the study be seen to be objective and independent of the biases of the author?

In general terms, the approach adopted in this study accepts that although the historical past has an objective reality, it is not possible for any historical study to create an objective reconstruction of that reality. That is, objectivity is a desirable goal for a historian to seek, but it is impossible to achieve. However, there are many dimensions to the issue of objectivity, and the study approach incorporated elements of all three of the classical, modernist and postmodernist attitudes to it, as outlined in Section 4.3.6.

Firstly, the study approach conformed to Carr's view that all historical works are inherently subjective and at some level must be affected by the biases of the historian. That is, it is 'the bees in the historian's bonnet' which drive the selection of the aspects of the past on which the history is based. All the key elements of the study – its choice of purposes, its themes, its theoretical framework, its data sources and its mode of presentation are inherently the product of the researcher's biases in regard to fundamental issues, such as the nature of the IS discipline, the nature of higher education, the role of universities, and the like. It is almost inevitable that any other researcher setting out to examine the history of the development of the IS discipline would bring a different set of biases, which would lead them to gather different sets of facts and events from the history of IS, and thereby to create a somewhat different picture of the discipline's past. Although it would be possible to evaluate and compare the quality of the evidence presented in support of the positions expressed in different studies, the relative merits of the perspectives of the past which they present would be as much a matter of opinion as of demonstrable fact.

However, although the study approach was predicated on Carr's belief that the Rankean ideal of total objectivity is unattainable, it also adopted the position espoused by Elton, that it is possible to differentiate between the levels of objectivity which can be achieved in the act of gathering and recording data about the past and those which can be achieved in the act of explaining and interpreting them. In its selection of data sources, and in the care taken in assembling, validating and presenting the data from them, the study has been able to ensure the accuracy of the factual base on which it rests. Some aspects of the forms of analysis and presentation of the data can be seen to have introduced subjective elements, as discussed in Section 4.3.5, but in general the study can claim a high level of objective truth in its statement of facts about the evolution of the IS discipline in the institutions on which it focuses. The collection of this basic factual material relating to the formation and growth of the IS discipline in its sample group of universities was one of the purposes of this study, and in terms of this purpose the study can claim to have achieved a high level of objectivity.

Finally, the study adopted the postmodernist position that although the facts about the past on which the study is based can be regarded as objectively true, they are open to many possible interpretations. In doing so it acknowledges that the 'reading' of the facts, the patterns which were identified in them, the narrative which was constructed from them, and the conclusions which were drawn from them in the study, represent only one such interpretation. As discussed in Section 4.3.1 this interpretation was not driven by any specific ideological position, nor does it seek to 'close off' alternative viewpoints in the manner claimed by postmodernist critics like Jenkins. In fact the opposite applies. The aim of the study is to open up new lines of discussion and provoke further debate and new points of view which might assist with our understanding of the IS discipline.

4.4 Conclusions and implications for the study

The study started out with the optimistic belief that it could provide the definitive account of the development of IS as a discipline in Victorian universities. It was hoped that the history of IS evolution at these institutions could act as a microcosm for the discipline as a whole, and provide significant insights into the causes of the identity crisis which has afflicted IS for much of its existence. Furthermore, these insights could then provide a basis for identifying the sorts of actions that the discipline needs to follow in order to secure its future.

The broad outline of the problems of historical research given in this chapter has identified several areas in which these early aspirations for the study can be seen to have been over-optimistic. It has highlighted a variety of issues of both a philosophical and practical nature, which limit the scope of what can be achieved by any historical work. These issues extend across all aspects of historical research, and raise questions about the limitations of our capacity to know and understand the past, the methods and techniques which should be used in historical research, the validity of the outcomes such research generates, and the extent to which these outcomes can be used to inform our understanding of the present and guide our actions in the future. The discussion highlighted the fact that although these issues have been perennial subjects of debate between professional historians, they remain a source of ongoing controversy among historians and philosophers of history.

As a consequence, this study has had to temper its ambitions for its outcomes, and accept the limitations of what it can hope to accomplish as a historical reconstruction of events. The outline in Section 4.3 of the key aspects of the approach adopted by the study noted the factors which limit its ability to claim itself to be a definitively 'correct' account, and which leave open grounds for questioning aspects of the validity of the depiction of the past which the study presents. That is, although the factual base on which it rests can be shown to be accurate, the study must share the limitation common to all historical work, that it can claim only to represent one of many possible versions of the course of events from which those facts are taken. The broader implications of the study's findings, and applicability to the issues relating to the discipline at large will be addressed further in the study conclusions.

Chapter 5: Origins and early development: Computing education and the origins of IS programs in Victorian tertiary education institutions - 1960-1990

5.1 Introduction and overview

This chapter tracks the development of IS within the broader context of the growth of computing education in Victoria, from its origins at the start of the 1960s until 1990, when the changes associated with the implementation of the Dawkins reforms drastically altered the tertiary education environment.

Although the aim of the study was specified as being to examine the evolution of IS programs in universities, its scope must be extended in two ways for the period covered in this chapter. The first aspect of of this extended scope is due to the existence throughout this period of the so-called binary system of higher education which was described in Section 2.6. For reasons which will be explained in the next section, the CAE sector took on much of the task of establishing the application-focussed computer education programs from which most IS programs emerged. Therefore the chapter must cover developments in computing education, not only in universities, but also in the CAEs.

Secondly, the chapter must extend its coverage beyond academic programs which were specifically identified by the name 'Information Systems'. As will be shown, this name was not commonly used during this period for tertiary education programs or academic departments in either the universities or the CAEs. However, the IS programs and departments which were established in almost all universities in the following period had their antecedents in this period; in fact in some cases they retained much the same content, and their transition to being identified as IS involved little more than a change of name. Therefore, the chapter includes consideration of all types of computing and information-related programs.

This expansion in scope creates several problems for the study. The first of these is simply the number of institutions and programs involved, and the diversity of the organizational circumstances in which computing programs were created. At its peak, the CAE sector had in excess of 35 institutions of varying types, and even by the end of the period when amalgamations had reduced numbers significantly, it still had about 20. Furthermore, most of the institutions in the CAE sector went through significant changes during the period, as they adapted to their new roles in the binary system. This means that in each institution the sequence of events is a complex and unique story in its own right, making it impractical to try to give a detailed and precise chronology of events at them all. To exacerbate the difficulties involved in tracking these events, there are significant gaps in the historical record for many of the institutions, particularly in the early years of this period. Many of the technical colleges which were the pre-cursor institutions for the CAEs were small, lacked the kind of formal record-keeping practices which are standard in modern universities, and paid little attention to the archiving of historical records. Even in the larger CAEs the published documentation of their academic programs and units was sometimes relatively sketchy.

The combined effects of these problems mean that the chapter can provide only a broad outline of the developments in computing education which occurred during this period. It focuses mainly on the overall patterns of events across institutions and across the period as a whole, and does not attempt to give a precise chronology or a detailed explanation of the development of the programs at each institution. Examples from particular institutions are used only to highlight specific key points, and do not purport to represent the total picture of events at those institutions, nor do they claim to be fully representative of all other institutions. In general, the evidence on which the chapter is based comes from official institutional records, but some occasional use has also been made of other histories, particularly Tatnall's (1993) study of programs in business computing.

The structure of the chapter is as follows:

- Section 5.2 provides a brief outline of the origins of computing and computing education in Australia. This is needed to explain how the attitudes of the two sectors of the higher education system towards computing education were formed, and to set the scene for the subsequent developments in both sectors.
- Section 5.3 provides a broad overview of the all types of computing and computing-related education which became established during this period. In particular, it identifies the applied computing group of programs from which most IS programs ultimately emerged, and which is the focus of attention for the remainder of the chapter.
- Section 5.4 outlines the general pattern of formation and evolutionary development of applied computing programs.
- Sections 5.5 to 5.7 examine the influence of disciplinary, marketplace and organizational structural factors on the formation and growth of applied computing programs.
- Section 5.8 examines the characteristics of IS programs within the context of applied computing programs.
- Section 5.9 analyses and compares the curricula of applied computing programs as a whole and of IS programs in particular.
- Section 5.10 provides a brief summary of the chapter's key findings and their implications.

5.2 Computers, computing and the origins of computer education in Australia

Despite a promising start to the development of computing in Australia, there was little progress in the country's subsequent development and use of computing before the 1960s. The promising start was provided by the CSIR Mark 1 computer (later re-named CSIRAC), which was built by the federal government's Council for Scientific and Industrial Research and made operational in 1949. It has been claimed to be the fourth digital electronic stored-program computer in the world (CSIRO, 2012). But despite the initial success of CSIRAC, there was little immediate follow-up action in the development or use of computers throughout the country. For much of the 1950s, government and the universities were the only Australian organizations to make significant use of computers; Pearcey (1988) reported that in 1957 there were no computers in commercial use in Australia. Three years later, when the Australian Commonwealth Government Public Service Board sent a senior manager on an overseas fact-finding mission to investigate applications for computing use, he reported on his return that "… Australia in general is somewhat in the rear of modern nations on making use of computers." (quoted in Philcox, 1978). It was not until the 1960s that the number of installed computing systems began to grow to significant levels, with a little over a thousand systems operational by 1970 (Pearcey, 1988).

The early developments in computing education in Australia were closely associated with CSIRAC. Trevor Pearcey, who was one of the leaders of the CSIRAC project, offered a unit on the theory of computation in the mathematics department of the University of Sydney in 1947 (Pearcey, 1988). Despite this early sign of acceptance, Pearcey claimed that the 'educational establishment' of the mathematics departments resisted the teaching of computer science on the grounds that "…it was not an academically well-founded discipline" (Pearcey, 1988, p103). It was only when other parts of the university began to want to make use of computing capabilities that units in programming and other aspects of computing and computation began to appear and a specialist computing department was formed (Pearcey, 1988). A similar pattern was followed at the University of Melbourne, when it bought CSIRAC as its first computer in 1956. A Computation Laboratory run jointly by the departments of Physics and Mathematics was established to operate and maintain CSIRAC. The laboratory, which offered computer services for the university as a whole and established units in computation in the Bachelor of Science degree, provided the foundation for the university's Computer Science department which was eventually formed in the early 1970s (Moffat, 2006).

The main focus of these initial university computing departments and their teaching programs was on the computer itself and the science of computation. Studies of the application of computers and computing in business were generally dismissed as being inherently vocational in nature, and lacking the disciplinary legitimacy required by a university. The universities recognised the need for some academic units of study relating to the applications of computer technology, and it was common for introductory units in computing and its applications to be offered to students in many disciplines, particularly in the sciences, engineering and commerce. However, these units aimed to teach students only the basic computing concepts relating to the use of computers in these disciplines, and were not aimed at supporting the ongoing study of computing applications or the development of graduate careers in this area of work. This resistance to vocationally-based computing programs became further entrenched in the universities when the federal government launched its new binary policy for tertiary education, as described in Section 2.6.

The attitude which universities took towards vocationally-based computing education was epitomised in a paper by John Bennett (Bennett, 1963), who was a pioneer of the computing industry in Australia, a founder of the Australian Computer Society, and the country's first appointed professor of Computer Science (at Sydney University in 1982). Bennett argued strongly that education was a vital ingredient in promoting the use of computing. However, he suggested that universities should take responsibility only for teaching computer science with a strong research orientation, and for providing service units in introductory computing to students in other university disciplines. The training of students for careers in applied and commercial computing applications should not be done by universities, but should be left to the technical colleges. Philcox (1978) suggested that Bennett's views were strongly influenced by two problems he had encountered in establishing his teaching programs in computing at Sydney: first, that it was hard to find teaching staff in applied computing who had academic qualifications which met university standards; and secondly, that many university academics strongly opposed computing programs of any kind on the grounds that computing was too vocational in its orientation to fit with a university's mission. Computer Science was already finding it hard to gain a foothold in universities as a specialist field of study, and to add any form of vocational or applied elements to its programs would further jeopardise its chances of gaining academic legitimacy.

The reluctance of universities to involve themselves in vocational computing education began to cause problems in the early 1960s when government and commercial organizations began to try to increase their usage of computers. Their attempts to do so were severely hampered by the lack of computing professionals with suitable skills in areas such as systems analysis, design, implementation and other related aspects of the development of large-scale computer applications (Pearcey, 1988). Bambrough (1962) complained that "…It is lamentable that major technical schools and university faculties display little interest in training students for EDP".

One of the early driving forces behind the establishment of computing education was the federal government, whose Department of Defence and Postmaster General's Department were two of the key innovators in the use of computers to support their operations (for example, Hamilton (1995) described the origins of planning for the large-scale application of computers to data processing in the latter dating back to 1960). The government responded to the workforce shortage by developing its own internal training programs for systems developers (Tatnall, p84). These courses initially were three months long and comprised a mixture of theoretical and practical work. They included 'computer appreciation' courses for managers, programming courses and courses in systems analysis and design. The main professional course was soon extended to 12 months duration and became known as the "Programmer-in-Training" scheme (PIT). Despite its name, the PIT course was not just about the technical task of programming, but also included a significant component of systems analysis and design. By the mid-1960s, the PIT scheme had become "… the major source of trained recruits from both inside and outside the [Public] Service, for duties in the analysis, design and implementation of ADP systems in the Service" (Grainger, 1967, cited in Tatnall, 1993, p89).

Although it was successful, the PIT scheme was extremely resource-intensive, which led the Commonwealth Public Service Board to seek to outsource it to educational institutions which were willing and able to provide suitable programs. It found university computing programs to be generally unsatisfactory for its purposes. In a report on recruitment and training needs in the Public Service, Grainger (1965) noted that:

> "… In the development of ADP (Automated Data Processing), the Universities have played a prominent part, particularly in the significant areas of research and scientific applications. Unfortunately for the commercial user, Universities throughout the world have been slow to respond to the changing pattern of demand.
>
> With few exceptions, the evolution of University courses in ADP has resulted in a concentration of courses in 'Computing Science'. While I am sure that everyone will agree on the need for this type of sophisticated training … [such courses] will by no means solve our ADP staffing problems."
>
> (Grainger, 1965, cited in Tatnall, 1993, p86)"

In Victoria, the Public Service Board held discussions with both the University of Melbourne and Monash University with the aim of starting a suitable computing course, but neither university was willing or able to take on the task (Philcox, 1978).

Many of technical colleges (the pre-cursor institutions to the new CAEs which were established under the binary system) had begun to respond to industry demands by introducing short courses and certificate-level programs in various aspects of computing and data processing throughout the 1960s. The CAE sector's focus on vocational education made it relatively easy for these to grow further into application-based computing programs. For example, Caulfield Technical College had established data processing programs in 1961, which have been cited as among the first such courses in Victoria and perhaps even in Australia, (Greig & Levin, 1988). These programs started with a Certificate of Accounting (Data Processing) in 1961, developed into the first diploma-level courses in data processing in 1964, and finally achieved the status of a degree program in 1972. When the PSB decided in 1970 that the quality of education available in CAEs had reached a satisfactory standard, it handed over the running of its PIT scheme to four CAEs, two of which were in Victoria – at Caulfield and Bendigo Institutes of Technology.

This brief outline has explained the reasons for the extension of the scope of the study to include CAEs during this period. Limiting the study to computing at universities during this period would eliminate the vocationally-based CAE programs which formed the basis from which the majority of IS programs eventually emerged. As will be shown both in this chapter and in the detailed examination of events at Monash University in Chapter 8, there were some cracks in the opposition to vocationally-oriented computing programs in the universities. But it was not until the Dawkins reforms of the tertiary education system in the late 1980s that the opposition to applied computing within the universities began to break down.

5.3 Overall patterns in the establishment of computing and information-related programs

The easiest way to understand the overall pattern of developments in computing education during this period is to start with an overview of the state which had been reached at its end. Tables C1(a) and C1(b) in Appendix C provide this overview, by listing all the specialist IT and information-related undergraduate degree programs and majors which were offered in Victoria's multi-disciplinary tertiary institutions in 1990. The programs offered by universities are listed in Table C1(a), and those offered by CAEs are in Table C1(b).

The programs are grouped into the following categories according to their area of disciplinary specialisation:

- Computer Science programs: these programs focused on the nature of computation and on the knowledge and skills required for programming computers to carry out computational tasks;
- Computer Engineering programs; these programs focused on the electronic and machine aspects of the computer itself;
- Applied computing programs: this diverse group includes a range of vocationally-based programs whose stated aim was to prepare graduates for careers as IT professionals, working to assist with the development, usage and management of computers and computer-based systems.

- Other information-related programs: this group includes a wide variety of programs whose main focus was information and its management. They can be broadly divided into two main types:
  - Programs based around the traditional information management disciplines, such as librarianship, record-keeping and archives;
  - Business-related programs focusing on the information management tasks involved in office administration;

In some cases, these programs were also offered in whole or in part as specialist majors within a broader generalist degree, such as Arts, Science, Business or Engineering, or in combination with another degree as a double degree program. These variants are not shown here, because in essence their computing component is the same as that of the 'parent' program from which they derived.

The VTAC guide for applicants for tertiary study also included some other programs with high levels of computing content which are not included in either of the tables. These programs were of two types: first, there were programs in which all or part of one of the computing programs which are included in the tables was added to support studies in another discipline. Examples of programs of this type include the BApplied Science(Computer-aided Chemistry) and BApplied Science(Computer-aided Biochemistry) at Swinburne Institute of Technology, which blended elements of the institution's CS program with majors in chemistry and biochemistry. Secondly there were programs in which specialist non-computing disciplines had developed significant levels of computing content independently of the specialist computing programs shown in the tables. Examples of programs of this type include the BApplied Physics & Computing offered by the Department of Applied Physics at Footscray Institute of Technology, and the BSurveying(Land Information Systems) offered by the Department of Land Information at the Royal Melbourne Institute of Technology. Both these types of program were excluded from the analysis, because computing played only a support role and was not their primary focus.

Table C1(a) shows that in the universities the foundation IT disciplines of CS and CE had become well-established, with specialist CS programs being offered at all four universities, and CE programs offered at all except Deakin University. However, the relative scarcity of applied computing programs indicates how the resistance which the universities exhibited towards vocationally-oriented programs from the early 1960s had persisted throughout the period. Deakin was the only university which had had a significant long-term involvement in applied computing, and it came as a consequence of that institution's origins as the product of a merger of CAEs; both of its applied computing programs had been established at Gordon Institute of Technology before it had been involved in the institutional merger from which Deakin was formed. The only other applied computing program offered at a university was the Bachelor of Information Systems degree at Monash, which had been introduced only at the very end of the period, in 1988, and was developed largely as a consequence of an initiative from industry, rather than from within the university. Its origins will be briefly outlined in Section 5.5.1, and described in detail in the Monash case study in Chapter 8.

Table C1(a) also shows that information-related disciplines had likewise had little success in gaining recognition as university-based courses of study. The only example of such a program was La Trobe University's specialist information-based program in medical records administration, which the university had 'inherited' as part of an organizational merger with a CAE in the early 1980s.

Table C1(b) shows a very different picture for computing programs in the CAEs. This sector's emphasis on vocational education meant that the primary emphasis in their computing programs was on applied computing. The table shows that most institutions offered two applied computing programs – one based in a business-oriented faculty and the other in a science-oriented faculty. The table sub-divides the science-based programs into two similarly-sized groups – one consisting of programs which were identified as being broadly-based generic computing programs, and the other comprising programs which identified themselves as CS programs. The programs in the CS group had a similar vocational focus to the other applied computing programs, and have therefore been included within the broad Applied Computing category, rather than being kept separate as was done in Table C1(a) for the universities. The justification for classifying these programs in this way is discussed further in the next section.

Table C1(b) also shows that CAEs offered a number of information-related programs. These programs fell into two groups: one of them comprised the programs built around the traditional information disciplines of records management, librarianship and archives, which were oriented towards careers in those disciplines and had originally been developed independently of computing; the other comprised programs which were not linked to the established information disciplines of the pre-computing era, but which had been developed around the application of computers to a variety of organizational information management tasks. There were few signs of connections forming between these two groups during this period, but this would change in the years that followed.

The extensive array of computer-related programs set out in the two tables highlights the nature and extent of the progress which had been achieved during this period in establishing the disciplinary credentials of various aspects of the study of computers and computing. It demonstrates that by the end of the period the two foundation computing disciplines - Computer Science and Computer Engineering – were well-established in both sectors of the higher education system. Although at times they had encountered significant resistance in gaining acceptance into universities, (see, for example, Rood, 2008 and Moffat, 2006), by the end of the period, their claims to disciplinary legitimacy had clearly been established beyond dispute, if only on the grounds of the ubiquity and longevity of their specialist departments and programs. By contrast, the academic standing of the broader category of applied computing programs was much less clear. Although they were far more numerous across the tertiary sector as a whole, they were still confined largely to the second tier CAEs, and had generally failed to gain recognition as disciplines within the universities, which represented the upper echelon of higher education institutions.

Most importantly from the point of view of this study, the tables show that by the end of this period IS had made comparatively little progress in establishing a strong and clearly identifiable disciplinary presence in either educational sector. Only a handful of institutions offered programs that were designated as 'Information Systems', and only Monash University and the Royal Melbourne Institute of Technology had both a degree and an academic department of that name. It was not until the next period of the study that IS became widely established as a discipline, with departments and degree programs in virtually every institution.

In most institutions it was the applied computing programs identified in this section which provided the foundation from which IS programs evolved. Therefore it is the development of the programs within this group which will be the focus of the remainder of this chapter. The following sections examine the origin, evolution and key characteristics of these programs in detail to show how they influenced the nature of the IS programs and departments which emerged from them.

5.4 An overview of applied computing programs – their origins and patterns of growth

The abundance and diversity of applied computing programs makes it difficult to give a concise summary of their characteristics. Tatnall's (1993) study of some of the business computing programs in the applied computing group highlighted the extent to which the development path of each program was the outcome of a combination of circumstances which were specific and unique to the program and the institution in which it was offered. It showed that it would be difficult to find any generalisation which could be made about them as a group, without it being subject to qualifications or exceptions for specific programs at particular institutions. With this in mind, the description in this section should be seen only as an outline of the broad general patterns of their growth, which does not necessarily apply in all its details to every program.

The formation of most of the applied computing programs can best be explained in terms of what Metzger's (1987) model of disciplinary formation described as subject parturition. That is, a set of computing units, which was initially established as part of another discipline, outgrew their original supporting role, and took on an independent existence as a separate field of study. As shown by the distribution of applied computing programs listed in the previous section, the discipline with which the units were originally associated was equally likely to have been based in either a business or a science faculty. The initial set of computing units typically originated with an introductory unit in programming, or a general 'Introduction to Computing' unit, which taught a broad range of basic computing concepts at a superficial level. Over time more units were added either to cover the initial topics in more depth (for example, by adding more advanced programming units or programming in other languages) or to cover new topic areas (for example, by adding units on database, networking or some other aspect of computer technology).

The parturition process did not always mean an immediate complete separation between the 'parent' discipline and its computing 'offspring'. The two disciplines often continued to co-exist, perhaps as separate majors within a common degree program. On the other hand, in some cases, after earning its independence from its disciplinary parent, the computing program formed new affiliations and developed shared programs with other disciplines.

Within an institution, the process of evolution from supporting units to the status of an independent specialist program was normally spread over a period of several years. The speed with which it occurred depended on a blend of factors which were specific to the institution. Examples of such factors included the presence of key individuals to promote and champion computing as a discipline, the availability (or otherwise) of the resources needed to support computing programs, and the influence of external organizations with an interest in computing education. In many institutions the evolutionary path included a stage in which computing was also offered as a specialist vocationally-oriented short course at certificate or diploma level. Intermediate level programs of this kind facilitated the development of extra computing units, and acted as ‘stepping stones’ along the path to the establishment of computing as an independent specialist degree program. Another common means of staging the transition to independence was the use of majors, in which a group of 6-8 computing units was offered as a specialist stream within the degree program of the parent discipline. Usually majors of this kind were initially not offered as admission-level programs, but were made available as specialist options to students who had been admitted to the parent program.

In most institutions, the establishment of the initial computing units in the parent program occurred in the mid-late 1960s. The evolutionary nature of the path to disciplinary separation and the prevalence of intermediate-level qualifications like diplomas and majors makes it hard to define precisely the year where the computing component can be said to have achieved independent disciplinary status within an institution. However, the time chart in Table C2 in Appendix C identifies the point when each applied computing program was first offered in a VTAC guide as a specialist degree for which students could apply for admission at the time of entry to the institution. It shows that the earliest such specialist computing program was the Bachelor of Applied Science (EDP) which was offered for the first time at the then Caulfield Institute of Technology (later Chisholm Institute of Technology) in 1973. Programs at other institutions were added at a fairly steady rate throughout the rest of the period.

The most notable exceptions to this typical evolutionary pattern of growth were the Bachelor of Information Systems (BIS) program at Monash University, the Bachelor of Information Technology (BIT) at Swinburne Institute of Technology, and the BBusiness(Computing) at the Western Institute. These three programs were created as entire degree programs from the time of their conception, rather than being built through a process of gradual accumulation of units. The Monash and Swinburne degrees were formed at the same time as the result of an initiative by IBM, which approached several tertiary institutions with an offer to sponsor the establishment of vocationally-based undergraduate programs which were better-oriented towards the needs of industry for computing graduates with strong business skills. Monash and Swinburne took up this offer and these two degrees resulted. Swinburne’s BIT degree was created jointly by the departments which ran the computing programs which already existed in its business and science faculties, and its content can be seen as a blend of the content of these two programs. Monash also attempted a similar form of inter-faculty collaboration, with the initial development of its BIS program being shared between the Department of Computer Science from the Faculty of Science and the Department of Econometrics and Operations Research from the Faculty of Economics and Politics. This collaborative approach was unsuccessful, and ultimately the program was developed and run solely from within the Faculty of Economics and Politics. (The full story of the development of this degree is given in detail in Chapter 8).

In the case of the BBusiness(Computing) at the Western Institute, the institution itself was established only in 1986, by which time computing had become widely-recognised as a specialist field. Its Faculty of Business used the well-established applied computing program at Chisholm Institute of Technology as its model, and was therefore able to establish an equivalent program in its entirety from the start, without needing to go through the normal evolutionary process (Scollary, 2009).

In keeping with the educational mission of CAEs as providers of vocational training, applied computing programs were universally oriented towards preparing graduates for employment as computing specialists. This is demonstrated in Table 5.1, which gives the program objectives for a sample set of them, as they were described in the institutional handbooks at the end of this period. It shows that regardless of the differences in the names of programs and their location in a business or science faculty, the program objectives were described in similar application and practice-oriented terms.

Institution and Program	Handbook description of program objectives
Deakin University: BScience majors in CS and IS	"These courses have been designed to prepare graduates whose interests lie in the application of computers and data processing equipment to commercial technical and scientific problems for positions in the areas of computer programming, systems design or computer centre management". (Deakin, 1989)
Victoria College: BApplied Science major in Computer Science	"It is intended that the major sequence in computing should meet the needs of students who wish to specialise in: • Programming and software applications • Database design and applications • Systems analysis and design • Computer application in problem-solving The computing major sequence is intended to: • Provide a sound theoretical background in computing which will enable students to apply techniques sensibly and to discuss the use of various computing procedures with understanding; • Emphasise skill development and the practical application in the area of computing and computer applications (sic)". (Victoria College, 1989)
Warrnambool CAE: BCommerce Major stream in computing	"[The program] aims to develop… a common core of paradigms, skills and techniques necessary for information processing in a wide range of applications. … The premise on which the course design is based is that the computer is a tool that is useful in many unrelated applications, but is operated by people whose professional affiliation lies in both the field of application and in computing. … Graduates may find employment as programmers but are equally likely to be employed as accountants or other professionals where data processing and modelling are required. Such areas would include business analysis, corporate strategy, modelling or simulation in the social sciences and market research". (WCAE, 1989)
Footscray Institute of Technology: BBusiness Information Technology	"The BBIT has been specially designed to provide graduates with knowledge and skills in the use of information technology in business and government enterprises. This allows them to enter employment and build careers in either information management or in computing. … Subjects from a range of other business disciplines are also taken, providing a well-rounded business degree geared to the evolving needs of industry" (FIT, 1989)

Table 5.1 Program objectives for a sample of the applied computing programs
(Source: Institution Handbooks)

The handbook entries for the two Computer Science programs in this table highlight the point made in the previous section about the need to classify the CS programs at the CAEs and at Deakin University under the broad heading of applied computing, in order to differentiate them from the CS programs offered at the three large universities. The handbook entries show that these CS programs are indistinguishable from the applied computing programs in terms of their practical focus and vocational objectives, whereas the CS programs at the main metropolitan universities were much more theory-based, narrower in their scope and focused on the nature of CS as an academic discipline. This will also be seen in the outlines of their curricula which are examined in Section 5.9.

5.5 Disciplinary influences on applied computing programs

The most important influence on the nature of the applied computing programs which evolved during this period was the disciplinary source from which each program originated. To use Becher's (1989) tribes and territories analogy, computers and computer usage represented a new knowledge territory, but the pioneers who came to explore, inhabit and develop it came from a wide variety of different established disciplinary territories, and brought with them aspects of the cultures of their resident tribes.

The overview of IT programs in Section 5.3 showed the broadest level of categorisation of applied computing programs on the basis of their disciplinary origins - as business-based, science-based and information-based programs. The following analysis briefly discusses each of these three broad general categories in turn, and describes how they can each be further sub-divided according to the specific disciplines with which their programs were associated.

5.5.1 Business-based applied computing programs

The long history of the use of machines in data processing in businesses made it inevitable that computers and computing would be adopted as an area of interest by business-related disciplines. In the CAEs, the vocational emphasis of applied computing was an asset rather than a liability to the business sub-disciplines, many of which had themselves found it difficult to earn academic respectability because of their vocational focus. Business programs flourished in the CAEs, whereas universities favoured more academically-oriented programs in economics and commerce.

Accounting was the business discipline which was most commonly associated with the initial introduction of units in computing. This link between accounting and computing was a natural consequence of the long tradition of the use of punched card machines to support business accounting. As discussed in Chapter 3, computers were initially widely seen as simply a new and improved version of the tabulators, which had been a mainstay of accounting work (Haigh, 2001). McRae (1971) estimated that in 1964, 80% of computer time in the USA and UK was spent on the processing of accounting information; no comparable estimates could be found for Australia, but there is no reason to believe that the experience in this country would have been significantly different.

But accounting was not the only business discipline which sought to take advantage of the benefits which could flow from the use of computers. In particular, many business programs which emphasised quantitative and mathematically-oriented approaches to the study of economics, or which dealt with the use of systems for business processing were quick to add introductory computing units to their curricula. In the later years of the period, the rapid advances in the use of computers for word processing and general office work made computing also an area of interest for business programs which focused on administrative and secretarial studies.

Tracking precisely the closeness of the initial association of applied computing with specific business disciplines in each institution is difficult, in part because of the inadequacies of some of the early institutional records, but also because the CAEs were generally relatively small institutions, whose structures and academic programs did not always show clear and rigid lines of demarcation between the specialist disciplines within a field. For example, it was common, particularly in the early part of the period, for a faculty like business to have no designated departments, and to offer a single generic degree, perhaps with majors in a number of specialist business disciplines. In such cases it is difficult to tell from the institutional records which of these disciplines exerted the greatest level of influence on the development of the computing components of the program. The following examples identify some of the cases where there is clear evidence of the way in which applied computing programs evolved from a close connection with a specific business discipline.

(a) Accounting-based programs: At these institutions, computing units were initially introduced as part of an accounting program. Computing retained its close association with accounting, and the two remained as companion disciplines, even after computing had gained its independence as a specialist academic program in its own right:

- Ballarat College of Advanced Education: Data processing units were initially offered mainly as elective units within the Bachelor of Business(Accounting) offered by the School of Business. When the School developed the units into a major in data processing, the degree was re-named as a generic Bachelor of Business, with students in the degree being required to take a major in either Accounting or Data Processing. The Data Processing major was subsequently re-named to Information Systems.
- Preston Institute of Technology (subsequently part of the merger which formed Phillip Institute of Technology): The link between data processing and accounting at PIT was formalised through the formation of a Department of Accounting & EDP within the School of Business. Initially the major focus of the department's unit offerings was on accounting, and the BBusiness(Accounting) was its sole degree program. But over time the number and range of its data processing units gradually expanded to the point where they became a specialist degree called the Bachelor of Business(Computing).
- Warrnambool College of Advanced Education: The Faculty of Business Studies initially offered units in programming and systems analysis and design as compulsory units in the second and third years of the Bachelor of Business (Accounting). Eventually these units were consolidated into a specialist stream, which was offered as an alternative to the original accounting stream. This program was called the Bachelor of Business(Computing), and was advertised in the VTAC guide as enabling students to qualify for both the Australian Computer Society and the Australian Society of Accountants (VTAC, 1990).

(b) Programs associated with other business disciplines: At some institutions, computing units were also initially offered as part of accounting programs, but the development of the computing curriculum within accounting did not extend beyond these introductory units. Instead, computing became linked with another area of business, and it was from this association that a specialist computing program emerged:

- Monash University: After initially sharing an introductory computing unit with the Accounting department, the Department of Econometrics and Operations Research in the Faculty of Economics and Politics developed several OR-oriented computing units as electives for the Bachelor of Commerce degree. When the university decided to support an industry initiative to introduce a new vocationally-based computing degree, it was this department which was given the lead role by the faculty in developing the proposed program as a shared degree with the Department of Computer Science from the Faculty of Science. After a breakdown in the negotiations between these departments over the proposed curriculum, the responsibility for the program was assigned solely to the Faculty of Economic and Politics. The OR group from the Department of Econometrics and Operations Research was formed into a new department to manage and run the degree, with both the department and the degree being given the name 'Information Systems'.
- Swinburne Institute of Technology: Computing was seen as an important specialist area of study in business at Swinburne from its days as Swinburne Technical College, before it became an institute of technology in the early 1970s (Tatnall, 1993). Several computing units were included in the first Bachelor of Business(Accounting) program, which was established in 1972, but the head of the Commerce faculty saw computing as being more than just a support for accounting (Tatnall, 1993). The computing group was separated from accounting, and combined with a group which taught quantitative analysis and quantitative methods in economics, as part of a Department of Data Processing and Quantitative Methods. It was this department which developed and offered Swinburne's specialist BBusiness (Computing) program together with a major in quantitative analysis for business.
- Prahran CAE: Praharan was a CAE which eventually merged with several Teachers Colleges to form Victoria College in 1982. Business programs at Prahran were initially taught by a generalist Department of Business Studies, but when this department achieved the status of a multi-disciplinary school, data processing became a designated sub-group alongside economics and quantitative studies in the Department of Economics and Quantitative Studies. Shortly before the merger to become Victoria College, data processing separated to become a specialist department in its own right, offering a specialist BBusiness(Data Processing). This department and its program retained their independent status after the merger and became part of Victoria College's Faculty of Business.
- Royal Melbourne Institute of Technology: RMIT had a long-running and very successful program in secretarial business studies and office work, which was targeted for closure by the institution on the basis of its lack of an academically-respectable disciplinary base (Tatnall, 1993). The closure was strongly resisted and the undergraduate program was re-badged as a BBusiness(Office Systems). This degree struggled to attract students, and in the late 1980s its core office systems content was combined with technology-focussed units to create a new computing degree. Tatnall (1993) cited the inaugural head of the new department which offered the degree as describing it as being aimed at the 'intelligent user' rather than the system developer. Both the degree and the department were given the name 'Business Information Systems'.

5.5.2 Science-based applied computing programs

Applied computing programs which originated from within science-based faculties were subject to a less diverse range of disciplinary influences than their counterparts in business faculties. Whereas the business-based programs were associated with a variety of business disciplines, almost all the science-based programs evolved from the study of mathematics.

In most CAEs, mathematics was taught as an applied discipline based around the computational needs of specific types of problems. Hence, the computing units which originated from within mathematics often reflected the nature of the mathematical applications with which they were associated. The specialist computing programs which eventually evolved from these units varied in the extent to which they retained their links with their original mathematical applications. Some programs chose to reduce or entirely eliminate their emphasis on the application, and focus instead on computational techniques and computing as a science in its own right; they were usually labelled as Computer Science. Other programs maintained their strong emphasis on applications, and their computing content was oriented towards the specific computational techniques which these applications required; they were more likely to be labelled as generic applied computing programs. However, the division between the two types was by no means hard and fast, and some programs remained as hybrids, with a blend of CS elements and application-focused elements.

The following examples illustrate the way in which these two types of evolutionary growth manifested themselves in the formation of science-based applied computing programs in several institutions.

(a) Programs specified as Computer Science: As with CS programs in the universities, these programs grew out of an initial association with mathematics and the science of computation:

- Royal Melbourne Institute of Technology: RMIT was the first CAE to develop a science-based CS program. Its mathematics department began to offer computing units in 1962, and these offerings grew to become a full CS degree in 1973. The BApplied Science(Computer Science) course was described as being "… concerned with programming and usage of computer systems with scientific, technological, commercial and managerial applications" (VTAC Guide, 1973). The program curriculum was heavily mathematics-oriented in its curriculum, to the point where Tatnall (1993) described it as a "… mathematics degree with some computer science subjects". Computer Science eventually separated from mathematics to become an independent department in 1981, and from this point the level of mathematical content in its curriculum steadily decreased and it took on the appearance of a more conventional CS program.
- Swinburne Institute of Technology: At Swinburne, the academic group responsible for CS separated from mathematics at an early stage to form a Department of Computer Studies within the Faculty of Applied Science. Consequently, the CS major which the department offered into the BApplied Science did not retain the strong mathematical orientation of its counterpart at RMIT. Despite its focus on the study of computing in its own right, the major continued in its role of supporting computer-based applications in other scientific disciplines. Initially it had to be taken as one half of a double major with one of the other majors offered by the faculty, in chemistry, biochemistry and

instrumental science. By the end of the period it was offered in combination with software engineering as a specialist computer program, but was also integrated into specialist degrees in computer-aided chemistry and computer-aided biochemistry.

(b) Programs not specified as Computer Science: In these programs, science-based computing units evolved in the usual way from mathematical applications and the science of computation, but the computing programs retained their application focus, and were not given the label of Computer Science:

- Footscray Institute of Technology: Despite its location in the Faculty of Applied Science, the Department of Mathematics at FIT emphasised that its BApplied Science(Mathematics) program sought to integrate studies in mathematics with their applications in business. The main focus of the department's interests lay in the application of mathematical techniques to economics, econometrics and operations research. Computing units which were developed by the department were labelled as "Computation Science" or "Computing Science", and were closely integrated with related content in operations research, mathematical economics, mathematics and statistics. The computing content of the program eventually reached a level where it was re-named to the BApplied Science(Mathematics and Computing), and the department itself became the Department of Mathematics, Computing and Operations Research.
- Gippsland Institute of Advanced Education: The mathematical sciences group at GIAE was initially located in the School of Business and Social Sciences, where it developed a major focus on the mathematical techniques of Operations Research. This focus was retained when the group was re-located to the Faculty of Applied Science, and helped to stimulate the development of units in programming and other aspects of computing. These became part of a major in Operations Research and Computing which was introduced in 1982. Over time the purely computing elements of the OR major were downplayed, and in 1989 it was re-named as a major in Operations Research & Information Management. But the computing group continued to develop computing as an application-oriented area of study in its own right, and in 1990 it achieved degree status as a BApplied Science(Computing).

(c) Two institutions highlighted the significance of the distinction between CS and non-CS science-based computing programs by developing and offering programs of both types from within a single science-based computing department:

- Caulfield Institute of Technology: Although it had been initially associated mainly with business, the computing department which was set up when CaIT was established in 1971 was located in the Faculty of Applied Science. As a consequence of the department's background, the BApplied Science(EDP) which it developed and implemented was strongly application-oriented and bore little resemblance to the typical mathematics-based CS program. In 1975 the department added a CS major as an option within the Applied Science degree and continued to offer both programs for the remainder of the period.
- Ballarat College of Advanced Education: Ballarat's Department of Mathematics also implemented a CS and an application-focused computing program, but the sequence of development was the opposite of that at CaIT. The department developed a set of mathematically-oriented computing units which grew to the status of a major in CS in 1983. Initially the content of the major was heavily

mathematics-based, but by the end of the period the emphasis on mathematics had been reduced and it had taken on a much stronger computing flavour. The department added a BComputing program in 1990, which included some content similar to that of the CS major, but was described as being oriented more towards commercial computing applications.

5.5.3 Information-based applied computing programs

In the early years of computing, the capabilities of the computer as a general-purpose 'information machine' had given birth to the idea of 'Information Science' as a new multi-disciplinary field of study which would deal with all forms of information (Black, 2006). Signs of this vision can be seen in the early years of computing at both Monash University and the University of Melbourne, which both gave the name 'Information Science' to the new computer-focused departments and academic programs which they established in the late 1960s. In both cases the use of this name reflected a belief that the scope of the new discipline's interests would extend far beyond the computer itself to broader issues of information and its management and use. These ambitions were short-lived, and at both institutions the name was retained for only a few years, before the departments had it changed to the more narrowly-focused 'Computer Science', as a more accurate reflection of their actual disciplinary orientation (Moffat, 2006 and Rood, 2008).

As the previous sections have shown, most applied computing programs failed to demonstrate even this level of fleeting interest in the idea of computers as the basis for a broad information-based discipline. In both business and science faculties, the evolutionary nature of the process by which computing programs were formed ensured that they retained a relatively narrow focus on the computer itself and on the traditional data processing-related tasks of business and the computation-related tasks of science. Their interest in the study of information and its uses was confined to the information-related issues which arose from the specific applications around which they had been based.

Just as most computing-based programs showed little interest in the field of information for much of this period, so too did the information-based disciplines show little interest in computing. Academic departments and programs which were established around the traditional information-based disciplines – librarianship, recordkeeping and archives – were usually located in humanities and social science faculties, separate from the business and science-based computing programs described above. The curricula of their undergraduate programs maintained their traditional orientation, and treated computing as a topic of only peripheral interest. They typically included no more than one or two introductory units on basic computing concepts and on the potential impacts of computers in areas such as information storage, retrieval and security.

Only a few programs can be identified as representing significant attempts at bridging the disciplinary divide between computing and information. As the following descriptions show they come from different disciplinary roots, but shared a common goal of blending studies in computing with studies of aspects of the nature, use and management of information:

- Footscray Institute of Technology: The development of business-related computing at FIT initially followed a path similar to that of the other business-based programs described above, with the Department of Business Studies developing units in data processing alongside its programs in accounting and secretarial studies. According to Tatnall (1993), when the department upgraded its diploma level business program to the level of a bachelors degree in 1973, it planned to develop and offer several tagged specialist degrees, including a BBusiness(Data Processing). However these plans never came to fruition. The BBusiness continued with accounting as its sole primary focus, with data processing left only as an optional 6-unit specialist stream within the BBusiness(Accounting).

A new opportunity for expanding the computing curriculum came in the early 1980s, with the development of a new degree program called the BBusiness(Information Management and Communication). This program also had some of its roots in FIT's programs in secretarial studies; Tatnall (1993) cited the person who developed it as describing it as pioneering for the time, in that it focussed on information as a key organizational resource, rather than on computing technology. Students of the program were required to take a major in information management and a minor in computing. Towards the end of the period, pressure for a specialist computing program led to the program being modified to include majors in both information management and computing, and it was renamed as the BBusiness(Information Technology). Students were allowed to choose either major, but were encouraged to do units from both (Tatnall, 1993).

- Melbourne College of Advanced Education: MCAE originally operated as Melbourne State College, an institution devoted to teacher training. It changed its status to that of a more broadly-based college of advanced education in 1983, but education-based programs remained its primary focus. The first degree to be developed by the institution as something other than BEducation was a BArts(Information Management), which was first offered in 1987. This degree included core studies in information management, accounting, economics and computing, and its stated objective was to prepare its graduates "… for employment as facilitators in matching the information requirements of management in an organization with the available information technology" (MCAE, 1988). The program's specialist information management and computing units were taught by the Department of Business Studies, and covered a range of topics relating to the nature of organizations, their information needs, the capabilities of computer technology to meet them.
- Victoria College: The Faculty of Applied Science at the Rusden campus of Victoria College offered majors in various areas of science, including environmental management, biology, earth sciences, numerical sciences and computing. In 1985 the faculty established a new major in Information Management, which became the core of a new degree program, called the BApplied Science(Scientific Information Services). This degree was described as combining studies from the fields of science and communication. Its handbook description noted the impact of computer technology on information handling needs and capabilities, and stated that the new degree would satisfy the need for graduates who could combine the technical and scientific skills needed for information collection, storage and retrieval with the information and communication skills needed for its interpretation, presentation and transmission. When the faculty adopted a department-based structure late in the period, the IM major and the staff who taught it were made part of a Department of Information

and Numerical Sciences, which also taught majors in numerical sciences and computing.

5.5.4 Implications

The brief outlines of the selection of programs mentioned above has demonstrated the diversity of the disciplinary influences that shaped the formation and development of applied computing programs during this period. In this respect, the group of programs which fell into this broad category differed markedly from the programs in CS and CE, which constituted the other two main fields of computer education at this time. Academic programs in both those disciplines had generally followed a pattern of evolutionary development similar to that of applied computing programs, but the disciplinary parents from which they evolved were almost invariably the same – mathematics in the case of CS, and electrical engineering for CE programs. Consequently there was much greater uniformity in the backgrounds of the academics who were involved in those disciplines. This did not eliminate controversy and debate over what should be taught within their undergraduate curricula, but these disagreements focused around a relatively narrow and well-understood range of issues.

The immediate impacts of the diversity of the disciplinary origins of applied computing programs were reduced to some extent during this period by their shared vocational orientation. The need to teach the basic concepts of computers and computing which were essential to any computer-related career helped to obscure the differences in their underlying disciplinary foundations and philosophies. Tatnall (1993) cited Gerry Maynard, one of the pioneers of computing in Victoria, as going so far as to suggest that in terms of academic content it did not really matter during this period whether an applied computing program originated in a business or science faculty. The accuracy of this comment will be discussed further in the detailed analysis of program curricula in section 5.9, but for the moment it is sufficient to note that at a broad level it was true that the programs usually addressed similar themes regardless of their disciplinary roots.

But, as applied computing programs and the academic groups who offered them progressed towards disciplinary independence, it was inevitable that the fundamental differences in their disciplinary orientation to their subject matter would become more evident. As the academic territory associated with computing expanded, these differences would be increasingly reflected in differences in the way in which way in which the territory was perceived, what parts of it were deemed to be worth inhabiting, and where its boundaries should be drawn. The significance of these differences for computing education general and for IS in particular will become apparent in the next period of the study.

5.6 Market influences: Industry and student demand for applied computing

Although disciplinary influences were the key factor in shaping the applied computing programs which emerged during this period, market forces also played an important role in promoting their development. The rapid expansion of the body of knowledge relating to computers and computing made it inevitable that computing programs of some form would be created, irrespective of the levels of work force and student demand. For example, as discussed in Section 5.2, the formation of CS programs and departments in universities was driven largely by academic interest in the development of the discipline.

But the willingness of the tertiary sector to develop and offer programs in applied computing was driven mainly by the perceived level of marketplace demand for graduates to work as computing specialists.

This was particularly the case for the applied computing programs in the CAEs. The sector's primary role as a provider of vocational training meant that its institutions placed great emphasis on labour force needs. With universities continuing to show reluctance to take on vocationally-based education, and preferring instead to focus their attention on the more theoretically-oriented and academically respectable fields of CS and CE, CAEs were ideally-placed to become the key providers of programs which catered to marketplace needs for computing professionals.

In the early part of the period, limited industry awareness of the potential of computers and the slow rate of their adoption and use resulted in very conservative forecasts of likely workforce needs for trained computing professionals in Victoria (and also in Australia more generally). Pearcey (1988) cited an informal survey by Bellamy in 1963 to illustrate the prevailing mood at that time; he said that Bellamy claimed that on the basis of the opinions of senior managers in commerce and industry, "… only ten programmers would be needed in the state of Victoria over the next ten years!" (Pearcey, 1988, p110). Given sentiments of this kind, it is not surprising that many institutions in the notoriously poorly-resourced CAE sector were slow to take on the high costs and associated risks of developing and resourcing specialist computing programs during the 1960s and early 1970s. This was highlighted in Rood's (2008) history of computing education at Caulfield Technical College/Caulfield-Chisholm Institute of Technology, which noted that the institution's decision to invest heavily in the development of its computing programs to become the state's leading force in computer education during this period was initially perceived as a very risky one. The perceived lack of market demand for specialist computing professionals helped ensure that throughout most of the first half of this period computing generally remained an off-shoot of other disciplines, rather than developing as an independent discipline in its own right.

Evidence of the direct influence of workforce needs can be seen in the transfer of the Federal government's Programmer-in-Training scheme to CAEs as outlined in Section 5.3. It was a major factor in the breakthrough in computing education which came about with the establishment of the first specialist degree programs in computing to be offered in Victoria. The two CAEs which were given responsibility for the scheme in Victoria in 1971 – Caulfield and Bendigo Institutes of Technology – were already offering diploma courses in computing, but the stimulus provided by the scheme gave a major impetus for Caulfield to create its Bachelor of EDP(Data Processing) in the following year (Pearcey, 1980), and for Bendigo to follow suit shortly afterwards (Tatnall, 1993).

As the availability and levels of usage of computers increased in the 1970s, so too did the estimates of future demands for specialised computing professionals. A report commissioned by the Commonwealth Public Service Board in 1975 (De Ferranti & Smith, 1976) was particularly influential in raising concerns that the marketplace needs for skilled computing specialists would soon outstrip supply. The study's final report asserted that the computing workforce was already below the required strength, and suggested that there would soon be severe shortages in the supply of trained computer professionals. It recommended that there should be an expansion of computer education and training programs, not only in specialist degree courses in computing, but also in one-year conversion courses to enable graduates of other disciplines to train in computing.

The report also claimed that many employers were unhappy with the nature of the education provided by the more academically-oriented CS programs offered in the universities, and would prefer to have graduates from degrees with a stronger vocational focus:

> "... From our interviews with employers, clearly most do <u>not</u> want their EDP staff trained in computer science, as it is perceived by some Australian universities." (emphasis shown as in report) (De Ferranti & Smith, 1976, p161)

The acceleration in the development of applied computing programs throughout CAEs in the late 1970s and into the 1980s can be attributed largely to attitudes of this kind. (It is worth noting that a similar phenomenon was reported by Ensmenger (2010) as applying in the US at about this time; CS graduates were perceived to be too 'academic', and deficient both in their understanding of the needs of computer users and in their level of interest in finding out about them and catering to them).

According to Tatnall (1993), the influence of market forces also led to the first short-lived attempt by one of the three metropolitan universities to introduce an applied computing stream to its computing programs. La Trobe University, as the youngest and smallest of the three, struggled in its early years to keep pace with its larger and more prestigious rivals, the University of Melbourne and Monash University. La Trobe established a CS department and degree program in 1978, but David Woodhouse, the founding chair of the CS department, was quoted by Tatnall (1993) as saying that the university felt their CS program could not compete with its strongly academically focused competitors at Melbourne and Monash. The CS department therefore decided to direct the program more at the vocational needs of computer professionals, and developed a major in Information Systems as an option in the structure of the CS degree. However the major was only offered from 1978 to 1983, before being replaced by double degree which offered major studies in CS and Accounting.

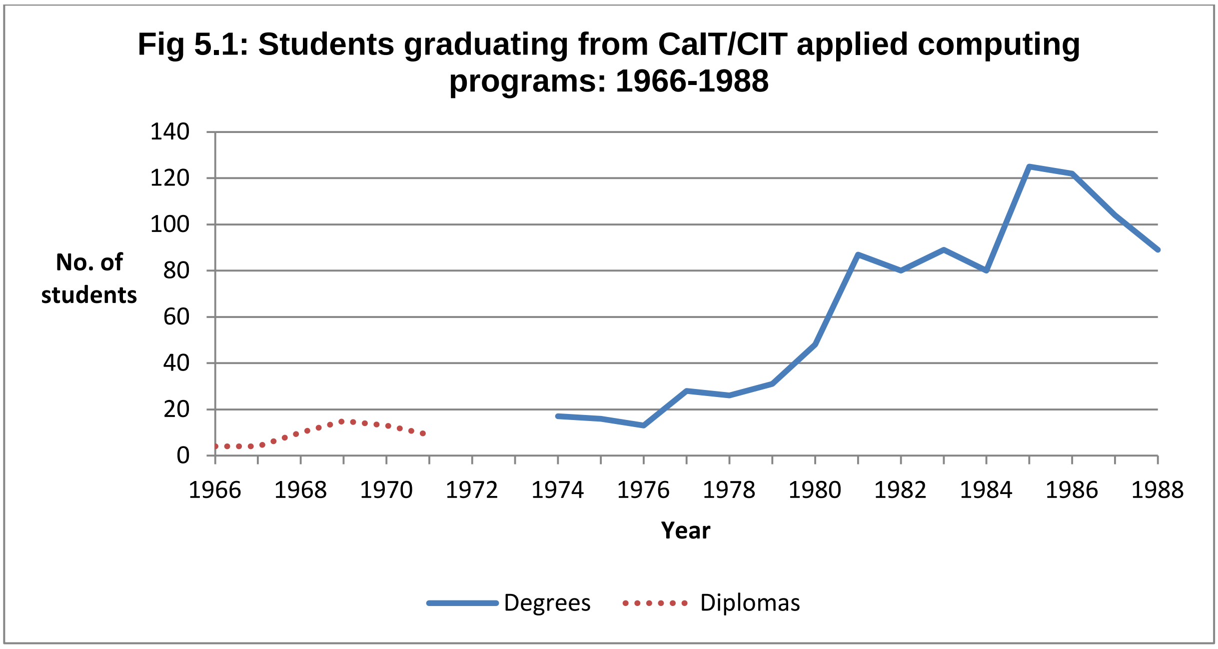
A final example of the impact of labour force demands on applied computing came at the very end of the period, with the development of the BIT at Swinburne Institute of Technology and the BIS at Monash University, two programs which were noted in Section 5.4 as having not followed the normal evolutionary development path. The stimulus for the creation of these programs came in early 1987, when IBM Australia approached a number of higher education institutions over its concerns that academic computing programs were not providing graduates with the range of skills appropriate to industry needs; they had too strong an emphasis on the technical aspects of computing, and were neglecting the required business skills. IBM and a number of other leading companies offered to sponsor the development and operation of computing programs with curricula which were designed to avoid these defects. Monash and Swinburne agreed to participate in the project, and as a consequence, the BIT at Swinburne and the BIS at Monash were developed and offered for the first time in 1988. The Monash program is of particular significance: firstly because it represented the first instance of an applied computing program being offered by one of the three main metropolitan universities (other than the short-lived IS major at La Trobe described above), and secondly, because it was the first full degree to be offered in Victoria with the name "Information Systems". A detailed account of the development of this degree is given in Chapter 8.

The other dimension of marketplace demand for computing education was the demand from students for places in computing programs. It had been hoped that the study could address this aspect of demand with an analysis of the level of applications and enrolments in computing courses during this period. However, the characteristics of the applications process for admission to tertiary education and of the computing programs themselves made it impractical to attempt an analysis of this sort. For much of the period there was no fully centralised process for admissions to tertiary institutions in Victoria, and much of the data about student demand and admissions to courses can be derived only from the applications and enrolment records of the individual institutions. This creates a number of difficulties: firstly, the records of applications and enrolments are difficult to find and access, even in the large institutions which existed for the entire period of time covered by the study, let alone in the small institutions which went out of existence during that time. Secondly, for much of the period, applied computing programs in most institutions were offered not as independent degree programs, but as groups of units or as specialist streams or majors in the degree programs for other disciplines. For such cases any analysis of the level of student demand would have to be done on the basis of individual unit enrolments. Finally, the periodic changes in institutions, their programs, their units and the way in which they were offered during the period would make it difficult to establish a stable baseline for analysing the trends in enrolment patterns. For all these reasons, the idea of trying to measure the impact of student demand across institutions for this period was abandoned as being both impracticable and unlikely to reveal anything of value.

The only readily-obtainable data which could be used at least as a tentative indicator of trends in student demand are those on course completions in the main computing programs offered by Caulfield Institute of Technology (CaIT) and its successor Chisholm Institute of Technology (CIT). As discussed earlier, CaIT was the first institution to offer such programs and it was widely-regarded as the market leader in computing education in the CAEs (Tatnall, 1993). The data on student completions of its courses were included in Greig & Levin (1988) in the form of listings of graduates of CaIT/CIT's diploma and degree programs in applied computing from 1966 to 1988.

Figure 5.1 shows the total number of students graduating from Caulfield Technical College's 1-year diploma programs from 1966-71 and then from CaIT/CIT's 3-year degree program from 1974-1988 (the last two years also include up to 15 students in each year who did the program as part of 4-year double degree with a BBusiness). CaIT's internal statistical analyses of student performance through the middle part of this period suggested that student attrition rates (ie the rate of loss of students due to drop-out or failure) generally remained fairly constant over time, which means that the trend line which the graph shows for program completions would be much the same for admissions. This would in turn probably correlate reasonably well with the overall level of student demand.

On the basis of these assumptions, the graph indicates that levels of student demand for IT programs were initially very low throughout the 1960s, but experienced generally strong upward growth over most of the rest of the period. However, the trend line is very erratic with some periods of rapid growth alternating with periods of stagnation and even decline. The anecdotal evidence about student demand in Tatnall (1993) conforms with this general pattern; he quotes sources in several institutions describing how student numbers in their computing programs waxed and waned, with both periods of surges in demand alternating with periods of decline and low enrolment numbers.



(Source: Derived from Greig & Levin, 1988)

In the absence of more detailed data across more institutions, it is not possible to draw any definite conclusions about the impact of student demand on developments in computing education. But given these moderate levels of student demand at a market leader of the standing of CaIT/CIT, it seems likely that the influence of labour force demand would generally have outweighed that of student demand in institutional decision-making about the development of applied computing programs.

5.7 Structural issues: The institutional location of applied computing programs

The evolutionary pattern of development which applied computing programs generally followed meant that organizational structural arrangements had little direct impact on most programs during this period. The initial location of the programs and the academic groups that taught them within the academic organizational structure of an institution usually followed as a natural consequence of their original disciplinary associations. Specialist IT groups formed initially within the department of the program's parent discipline, and usually grew organically within that department as the program evolved. The only important structural issue was the institutional decision as to whether the IT teaching group should separate from its parent department and be granted recognition as an independent specialist organizational unit within the academic hierarchy.

Several clearly identifiable stages can be seen in the transition to structural independence across tertiary institutions. In the beginning, when computing units were small in number and were seen purely in a support role to the parent discipline, the group responsible for computing typically received no explicit recognition in the institutional structure, and the name of department in which the computing units were taught remained that of the parent discipline. In the second stage, computing was recognised as being important enough to warrant recognition as part of the name of the department; and in the third stage, it achieved the status of an independent specialist department in its own right. A fourth and final stage saw computing achieve the status of a higher-level organizational unit, such as school or faculty, with the ability to create specialist departments of its own.

Table C3 in Appendix C demonstrates this process of transition by identifying the stage which had been reached at the end of this period by the organizational units which taught applied computing in each institution. The table shows that the evolutionary process for structures generally lagged behind that for the development of academic programs. Whereas previous sections showed that by the end of this period almost all applied computing programs had achieved independence from their disciplinary 'parent', only about a quarter of the academic groups responsible for teaching them had reached a comparable level of structural independence from the departments within which they had originally formed. The evolutionary process for the academic groups located in business-based faculties had generally progressed somewhat faster, and they accounted for five of the six fully independent computing departments. However the sixth of these academic departments, which was in the Science faculty at CIT, was the one which had progressed furthest in its evolution: it was the only applied computing teaching group which had reached the status of a multi-disciplinary school, divided into several departments specialising in different aspects of computing.

It should be noted that the stage which an academic unit had reached in this structural evolution can be regarded as only a broad indicator of the relative level of institutional recognition of the disciplinary status of applied computing. Decisions about structural change in an organization may not have been based not just on academic/disciplinary grounds, but on a wide variety of organizational circumstances and practices which could have varied significantly between institutions. This was particularly the case in CAEs, which did not always follow the traditional university practice of associating an academic discipline with an independent department (see, for example, Roche's (2003) study of the decision-making involved in establishing institutional structures during the formation of Victoria College). Issues such as staff and student numbers, staff relationships, and managerial philosophies and preferences for centralised or de-centralised structures could all have been as influential as academic concerns in the decision as to whether a discipline was granted the status of an independent department.

For example, of the five institutions shown in the table as being at Stage 1, in which applied computing had received no explicit recognition as part of a department name, three were based in provincial towns in regional Victoria (Ballarat, Warrnambool and Gippsland). This means that they were significantly smaller and perhaps had more closely-knit academic communities than most of their metropolitan counterparts. The failure of these institutions to give formal recognition to computing in the institutional structure was just as likely to be due to these factors, as to any reservations about its disciplinary status. Similarly, in the Stage 2 institutions which had established departments whose names recognised both computing and another discipline, the name does not necessarily indicate equality in terms of the size and status of the two disciplines. For example, the content of the handbook outlines and staffing structures for the Department of Data Processing & Quantitative Methods at Swinburne Institute of Technology seem to suggest that the Swinburne department was akin to a computing department which also included a small Quantitative Methods group, while the Preston department was more like an Accounting department which included a small computing group

Subsequent events at both institutions (described in the next chapter) would seem to bear out these assessments, but it is not possible to confirm judgements like this as definite fact, without a much more detailed study of the departments and their operations. Without such an in-depth study, care must be taken in using the table as a basis for assessing the extent to which structural arrangements reflected and/or reinforced perceptions of the size and disciplinary status of applied computing.

Although structural issues appear to have been generally less significant than disciplinary and market forces in influencing the evolution of applied computing programs during this period, there are a number of examples of cases where organizational structural decisions did have major impacts on the disciplinary orientation and content of their programs. These all occurred in the institutions in which applied computing groups achieved the status of independent academic units:

- Caulfield Institute of Technology (CaIT): The initial establishment and subsequent evolution of the applied computing program at Caulfield were substantially affected by organizational structural decision at the time of the formation of CaIT. Caulfield Technical College, which was the institutional forerunner to CaIT, was the first Victorian institution to establish a specialist computing department, called the Department of Electronic Data Processing (Greig & Levin, 1988). Throughout the 1960s, this department had mainly associated itself and its computing programs with business, and, despite its nominal independence, it perceived itself as a business-based department.

  But in the organizational re-structure when the college became CaIT, the foundation head of the new institute chose to locate the department in the applied science faculty. This structural decision, which was taken against the strongly-voiced objections of the department's own staff (Rood, 2008), meant that the department lost its close connection with business. Consequently, its new undergraduate applied computing program took on a much broader technical and development focus than was typical of its counterparts in business faculties, but without having the strong underlying mathematical focus which was typical of programs which had grown organically in science faculties. As Section 5.9 will show, this gave a unique flavour to the curriculum of CaIT's applied computing program.

  A second key structural decision at CaIT was its decision in the early 1980s to create a new multi-disciplinary School of Computing and Information Systems. This is of particular interest to this study, because it led to the establishment of the first specialist IS department at a Victorian tertiary institution. The creation of the School opened up the opportunity for the subsequent sub-division of the original Department of EDP into three specialised disciplinary departments – Information Systems, Computer Technology and Software Development. This helped to enhance the claims to disciplinary status of these specialisations, but also helped to entrench an institutional division between their academic content. The effects of this transformation on the IS curriculum at CaIT will be outlined in Section 5.9.

- Bendigo College of Advanced Education (BCAE): As at CaIT, BCAE's approach to applied computing was also strongly influenced by an organizational structural decision at the time of its establishment as a CAE. Like CaIT, BCAE decided to establish a specialist applied computing department to take responsibility for all its applied computing programs. Although the department was located in the Faculty of Business Studies, its status as an independent department both enabled and required it to take a much more broadly-based view of the computing discipline than was commonly taken by the departments that taught applied computing programs in most other tertiary institutions. This also meant it was not subject to the narrow disciplinary affiliations which were common to most applied computing groups. Rather than favouring a business-based or a science-based approach to computing, it was unique in being the only department to develop and offer separate degree programs with both business and scientific orientations, offering a BBusiness(Data Processing) from 1977 and a BApplied Science(Computing) from 1981.

- Monash University: Aspects of the story of the development of Monash's BIS degree have already been outlined previously in both Section 5.3 and Section 5.5.1. When the responsibility for the program was eventually allocated solely to the Faculty of Economics and Politics, the faculty decided that the Department of Econometrics & OR which had been primarily responsible for its development would not be a suitable home. Instead it chose to create a new Department of IS to manage and operate the program. This new department was initially staffed mainly by academics who were transferred from the Department of Econometrics and OR, so the structural change probably had little short-term impact on the program and its curriculum. But the decision to grant the teaching group the status of an independent department placed them in a position where they had much greater autonomy than if they had remained part of their previous department. As the next chapter will show, the freedom which this gave the department would have significant implications for the future development of IS at Monash.

- Royal Melbourne Institute of Technology (RMIT): Applied computing departments were usually created as a consequence of the development of an academic program, but RMIT provides a case where this normal order was reversed, and the structural decision to create the department preceded the development of its degree program. It is also of particular interest for this study because the department and its degree were eventually both given the name 'Business Information Systems'.

  The department's origins can be traced to a specialist EDP group, which had been established in the 1960s to support the data processing/computing needs of the Faculty of Business (Lukaitis et al, 2010). The group was initially located in accounting and then in the Department of Administrative Studies, but it eventually grew so large that the faculty decided to make it a department in its own right. Initially named the Department of Computing, it continued to offer service teaching throughout the faculty, but it also sought to establish a degree program of its own (Lukaitis et al, 2010). Its existence provided the necessary structural framework to accommodate the office systems group and its academic program, which ultimately led to the formation of the Bachelor of Business Information Systems as outlined in Section 5.5.1, and the re-naming of the department as the Department of Business Information Systems.

  RMIT also made an interesting but ultimately unsuccessful attempt to use organizational structural change to overcome the disciplinary divide between the disparate groups which offered its computing programs (Tatnall, 1993). It proposed a major structural change which aimed to bring together all RMIT's computing-related programs and their academic staff into a single Faculty of Computing. It was hoped that this would help to break down the disciplinary divisions between them, and enable a better-integrated approach to computer education. Tatnall (1993) cites a senior computing academic at RMIT as saying that the idea failed because of resistance from the applied computing staff in the Faculty of Business and the CE academic staff in the Engineering faculty, neither of whom wanted to leave their 'home' disciplines and departments. A second attempt was then made to achieve the same outcome through structural means by overlaying the departmental structure with an IT Division, described as a "...matrix grouping that would drive all the departments involved in a common direction" (Tatnall, 1993, p108). This idea also turned out to be unworkable, and was abandoned in 1990.

The events at these institutions demonstrate how organizational structural arrangements for the academic groups which taught applied computing programs could both influence and be influenced by the nature and content of their program. There were relatively few cases where structural decisions had major impacts of this type during this period, but they would become a key aspect of the further development of computing and IS programs during the next stage of their development, as the next chapter will show.

5.8 Information Systems and applied computing

From the point of view of this study, the most important aspect of the evolution of applied computing programs during this period is the limited extent to which the name 'Information Systems' was used to identify all or part of a degree program, and/or the academic department which taught it. The term was used as a name for individual units in a number of institutions from the early 1970s, but the first time it was used formally to identify a specialist disciplinary component of an academic program was in 1978, when both La Trobe University and Deakin University introduced IS majors to accompany their CS programs. Its use as a disciplinary label spread only slowly to other institutions during the remainder of the period. Table 5.2 lists the institutions in which IS had achieved explicit recognition as a discipline by the end of the period, as demonstrated by its use as the name either of a department or of a degree program or designated major.

One of the most striking features of this list of institutional uses of the name 'Information Systems' is the variability of the types of academic programs to which it was applied. At Deakin, La Trobe and Chisholm IT, IS was adopted as a name by science-based applied computing or CS departments. But at Monash University, Ballarat CAE and RMIT it was used as a label for business-based programs and departments which had developed in association with different business disciplines – with accounting at Ballarat, with OR and quantitative economics at Monash, and with office systems and secretarial studies at RMIT.

Institution	Department offering program designated as IS	Designated IS academic programs/majors/streams	Origins and evolutionary path
Universities			
Deakin University	School of Sciences Dept of Computing & Mathematics	Major in Information Systems in BScience	Offered at Deakin from the time of formation of the university in 1976. Offered alongside CS as majors in BScience. Closely linked to DP major which the department also taught into the BBusiness
La Trobe University	School of Mathematical & Information Sciences Dept of Computer Science & Computer Engineering	Major in Information Systems in BComputer Science (offered only from 1978 -1983)	First offered in 1978 as a vocationally-oriented optional major in BComputer Science. Developed in order to differentiate that program from CS programs at other universities, and thereby attract more students
Monash University	Faculty of Economics and Politics **Department of Information Systems**	BInformation Systems	Degree created in 1987 as an industry-sponsored and funded vocationally-oriented program designed to produce computing graduates with better business skills. Department formed to run it; initially staffed largely from Dept of Econometrics & Operations Research
CAEs			
Ballarat CAE	Faculty of Business (No departments)	Major in Information Systems in BBusiness	Developed as an offshoot of accounting. Offered as a specialist option alongside the accounting major from the time the BBusiness degree was established in 1978
Chisholm IT	Faculty of Technology School of Computing and Information Systems **Department of Information Systems**	Stream of 6 Information Systems units in BApplied Science (Computing)	Department established in 1985 from the sub-division of Dept of EDP into 3 specialist departments – IS, Computer Technology and Software Development. Units from the BApp Science(EDP) allocated between these three departments, with IS taking responsibility for 'non-technical' content in system development and management
Royal Melbourne IT	Faculty of Business **Department of Business Information Systems**	BBusiness Information Systems with a major in Information Systems	Initially named as Dept of Computing when it was formed in 1987 as a home for staff who taught generalist IT units across the business faculty. Degree added and name changed to BIS when moribund Office Systems/Secretarial studies program was merged with it in 1988

Table 5.2: Academic department and/or programs which were known by the name of 'Information Systems' in 1990
(Source: Institutional handbooks)

The name 'Information Systems' or some equivalent term was also widely used in the applied computing programs offered by many of the other tertiary institutions, but only as a name for individual units or small groups of units. Table C4 in Appendix C shows the extent of the usage of the name for units in other programs at the end of this period. It shows that there was at least one designated IS unit in almost all business-based programs, and in about half of the science-based programs.

The slow rate of institutional adoption of the name 'Information Systems' as a label for applied computing programs at this time is also apparent in the program descriptions supplied in the VTAC guides for applicants seeking admission to tertiary study. Each year the guide listed the major areas of study which were covered by each of their academic programs on the basis of information provided by the institutions. Table 5.3 shows the main terms used to denote applied computing programs in the 1990 VTAC Guide, and their relative level of usage by institutions as indicators of their program content.

Institution	Major areas of study listed in 1990 VTAC Guide			
	Business Information Systems	Information Systems/ Technology	Computing	Data Processing
Deakin Uni			Yes	Yes
La Trobe Uni			Yes	
Melbourne Uni			Yes	
Monash Uni		Yes	Yes	
Ballarat CAE	Yes	Yes	Yes	Yes
Bendigo CAE			Yes	Yes
Chisholm IT			Yes	Yes
Footscray IT		Yes	Yes	Yes
Gippsland IAE			Yes	Yes
Phillip IT	Yes		Yes	
RMIT	Yes	Yes	Yes	Yes
Swinburne IT		Yes	Yes	Yes
Victoria College			Yes	Yes
Warrnambool CAE			Yes	Yes
Western Institute			Yes	Yes

Note: MCAE does not appear in the table, because by the time of the publication of the guide, the institution and its programs had merged with the University of Mellbourne

Table 5.3: Major study areas in computing as designated in 1990 VTAC Guide

The table shows that 'Business Information Systems' was included as one of the list of major areas of study in the guide, but the term 'Information Systems' was not included on its own, but only as part of a combined term 'Information Systems/Technology'. Just over one-third of institutions indicated that either 'Business Information Systems and/or 'Information Systems/Technology' were areas of study which their programs covered. By contrast, all institutions indicated that

‘Computing’ was one of their major areas of study, and most also claimed coverage of ‘Data Processing’. (It is also notable that although all the universities were willing to include ‘computing’ as one of their major areas of study, none of the large metropolitan universities included ‘data processing’, reinforcing the point made earlier about their reluctance to recognise applied/vocational aspects of computing education as part of their teaching programs).

In assessing the significance of these indicators of the levels of recognition of IS as a distinct field of study, it is important to note the problems posed by the general lack of precision in the terminology used in computing throughout this period. As a new disciplinary area, computing had few established standards on which to base its program names. Consequently the names for degrees and departments seem to have been at times assigned in a somewhat arbitrary fashion. For example, the term ‘data processing’ was widely used as a name early in the period, but gradually fell out of favour, without any clear justification in terms of changes in the focus of departments or the cognitive content of their programs. However, as Table 5.3 shows, all CAEs continued to use the term as a descriptor for their programs in the VTAC Guide, presumably because they believed the name would resonate with that publication’s target audience.

These terminological problems are particularly acute when trying to assess the disciplinary status of Information Systems. Firstly, it is difficult to tell which of the many names institutions used for their programs or program components were meant to represent the discipline; names such as ‘Business Computing’, ‘Business Information Systems’, ‘Business Systems’, ‘Business Information Technology’ and the like could be applied equally to programs with a generalist technical computing orientation as to programs which associated themselves with the IS discipline. (This problem with program names was also identified in Chapter 3 as a problem for computing and IS programs in the United States). Secondly, these names were often used in two senses –– in what might be called the upper case form (‘Information Systems’) as the title of a specific area of study or, in the lower case form (‘information systems’) as a broad generic term, with no specific disciplinary connotations. It is often difficult to tell which of these two senses was intended in the institutional program descriptions.

The names given to the applied computing programs and their units at RMIT and Deakin University provide good examples of the confusion associated with names in general and IS in particular. At RMIT the Department of Business Information Systems differentiated between ‘Business Information Systems’ as the overall name of its degree program, and ‘Information Systems’, as the name of one of its two majors, with the other major being in Office Systems. At Deakin, the Department of Mathematics & Computing taught two applied computing majors in the business and science faculties. Despite strong similarities in their content, the major which was offered in the Bachelor of Applied Science was identified as ‘Information Systems’ in the program’s handbook descriptions, while the major which was offered in the Bachelor of Business was designated as a major in ‘Data Processing’. The majority of the units in both majors were named ‘Information Systems’. On the basis of the similarity of their content and unit names, it seems logical that if one the two majors was defined as IS, then surely the other should be labelled in the same way. But on the other hand, it could be argued that since the Faculty of Business chose to call its major ‘Data Processing’ rather than ‘IS’, then only the major in the Applied Science degree should be identified as an IS program. It was on the basis of this latter argument that the business-based major is excluded from the list of IS programs in Table 5.3.

But regardless of the impact of these problems with terminology, the overall picture seems to show clearly that IS made relatively slow and limited progress in gaining disciplinary recognition during this period. Only in the second half of the period did it begin to become commonly-used as a label for sets of units or majors within applied computing programs. It seems reasonable to assume that in all those institutions which had at least 2-3 units clearly identified as IS, there would be some teaching staff who would identify themselves as IS academics. On this basis it could be argued that IS had established some form of disciplinary presence during the period in either a business or science-based program in most institutions. However in only about one-third of the institutions had this level of recognition developed to the point that the disciplinary status of IS was explicitly acknowledged in institutional academic structures or academic programs.

5.9 Curriculum content of applied computing and Information Systems programs

Comparative analysis of the curricula of applied computing and IS programs is hampered by the variable quality of the curriculum descriptions contained in institutional handbooks. The handbooks of some institutions carried very comprehensive and detailed outlines of unit contents, but others provided little more than the unit name and a single sentence summary or list of topics. The sketchiness of many of these descriptions, combined with the imprecision of IT terminology, can make it difficult to be sure precisely what topics were covered in each unit, or what relative weighting was given to the coverage of each topic. The deficiencies of the source materials also make it difficult to track the detail of the way in which curricula evolved; as one goes back in time, the level of detail in most institutional handbooks tends to decrease. Therefore the section focuses mainly on the curricula as they stood at the end of the period.

Despite the deficiencies of handbook descriptions, it is still possible to identify some general overall patterns which clearly applied across the applied computing programs as a group, and it is these patterns which will be the main focus of the analysis carried out in this section. The analysis is divided into two sections: Section 5.9.1 provides a broad overview of the general nature of curricula which were taught within all applied computing programs, using examples from specific programs to illustrate. This is followed in Section 5.9.2 with a brief discussion of the curriculum content of the programs and program components which were identified specifically as IS.

5.9.1 General patterns in applied computing curricula

The curricula of the initial computing units from which computing programs eventually evolved usually focused on the general characteristics of computers, computer programming, or the nature of the application of computers in the discipline in which the units were offered. As the number of computing units increased, so too did the range of topics which they covered. As might be expected, given the similarity of their aims in turning out graduates to work as computing professionals, many of the general themes addressed by the units of different programs remained broadly similar across institutions. By the time a computing program reached the status of an independent field of study, the range of topics which its units typically covered included the following:

- Basic concepts in computers, information, systems and computer applications: Units which provided a broad introduction to the nature of information, systems and basic computing concepts and capabilities. They often included a broad outline of typical computer systems and the way in which they supported specific business or scientific applications. They normally included a broad discussion of IT components, and from the mid-1980s usually provided an introduction to the use of PCs and basic PC software – word processing, spreadsheet, list management packages, and the like.
- Computer systems: Units which explained the internal structure of computer hardware, hardware architecture and computer operating systems software. They often extended their coverage to include Operating Systems programming or low-level programming in assembler.
- Database: Units which examined the theoretical and practical elements of database, database design and the capabilities of database software. They sometimes extended to link to broader development issues such as data modelling or database programming.
- Communications and networks: Units which explained the principles of data communications, key components of communications technology and their practical implementation in communications networks and office systems. They often extended to include the characteristics of particular types of network configuration and issues in network design.
- Programming: Units which introduced the study of programming principles and practice. They usually had a strong emphasis on practice, with the aim of ensuring students emerged with a 'hands-on' knowledge of how to write a computer program in a scientific or commercial programming environment. COBOL was the most common language taught in business-based programs, while a variety of languages were used in science-based programs.
- Systems development: Units which explored the systems development processes, starting with a broad outline of the overall structure of the systems development lifecycle, and extending into detailed study of specific development phases such as systems analysis, systems design and systems implementation. They sometimes also included broader issues about the management of system development projects.
- Project work: Units which provided students with practical experience in the construction of a system for some real-life application. As well as requiring the use of specific computing knowledge and skills, the project work usually involved work management issues, such as team building, project management, problem solving and inter-personal communication, and sometimes included broader professional issues such as ethics and professionalism.
- Specialist topics: Units which included coverage of some more specialist aspect of the use of IT. These topics usually related either to broad IT trends and futures, and the social impacts of IT, or to the study of specific types of applications of computer-based systems.

It is worth noting that these generalist topics conform closely to those covered in both the 1973 and 1981 versions of the ACM's model IS curriculum, which were outlined in Sections 3.5.1 and 3.5.2.

Despite this commonality in their overall themes, the curricula had some significant areas of difference, which derived from the differences in the origins and ongoing disciplinary affiliations of each program. In order to illustrate the general features of the curricula and the main areas of difference between them, Table C5 in Appendix C compares the curricula of four applied computing programs – one from each of the four main program types identified earlier in the chapter:

- Ballarat IT: BBusiness(Computing) – an IS major which was developed and offered alongside accounting as one of two alternative specialist streams in the program offered by the School of Business;
- Swinburne IT: BBusiness(Computing) - a non-accounting based business computing program which was developed and offered by the Department of Data Processing and Quantitative Methods;
- Deakin University: CS major within a BScience - a CS program which was developed and offered by the Department of Mathematics;
- Bendigo CAE: BApplied Science(Computing) - an application focused program which was developed by the Department of Mathematics to complement the CS program which it also offered.

The following discussion of the key areas of similarity and difference between programs from different disciplinary origins uses the curricula of these four programs to illustrate the general points being made in the analysis:

- Main topic areas covered by the curriculum: The curricula of almost all programs focused on the topic areas listed above, but they varied in their approach to each topic. In general, business-based programs were more practically-oriented, less concerned with the internal workings of the computer and the process of computation, and more concerned with the nature of organizations, and with the issues which need to be addressed in the development, implementation and management of organizational systems in commercial environments. Science-based programs were more theoretical, more strongly focussed on programming and the way in which computer technology works, and less concerned with the organizational environment and the specifics of the applications for which computing could be used.

  For the sample group of programs, all the core computing units of the four programs can be categorized within the main themes listed above, except for a single specialist unit in each of the Ballarat and Bendigo programs – on knowledge-based systems at the former and on current issues and social implications for computing at the latter. However the curricula show some significant differences in their scope and depth of coverage of each theme. Computer hardware and programming were the only two topic areas for which all four programs had specialist units. On the other hand, data communications, which was included as a specialist unit by only two programs, was the only topic area for which less than three of the four programs had a specialist unit.

- Size of the curriculum and depth of coverage: The need to accommodate core business units and elective study usually placed significant restrictions on the number of compulsory specialist computing units in the business programs. In some institutions science-based programs had the same kind of size restrictions, because of similar requirements for students to take another science major and elective studies, but some science-based programs which did not have these restrictions were able to extend their computing content to as much as 18-20 units. Where additional units were offered, they were usually devoted to covering the standard set of topics listed above in greater depth, rather than expanding their scope into other areas.

  In the sample program curricula, the two business programs were typical in offering only eight core IT units out of the 26 units in the program at Swinburne and 24 in that at Ballarat. The CS major at Deakin was also restricted to 8 units, but the computing core of the science-based program at Bendigo was able to extend to 16 of the 30 units required for the degree. The Bendigo program also illustrates the way in which extra units were used to provide greater depth rather than breadth; for example, expand its coverage of programming to six units.

- Similarities in curriculum content across disciplinary divisions: Within the broad disciplinary categories of business and science, there was usually little to distinguish the curriculum of one program from another. This applied regardless of any differences between the specific business or science discipline with which the programs had been originally associated. This generalisation must be treated with some caution, however, because the lack of detail in many institutional handbook descriptions make it difficult to be sure precisely what was covered in their units; the brevity of two-sentence descriptions of two units may conceal underlying differences behind a superficial similarity in topic areas. But despite this qualification, the consistent pattern of similarity between units across programs from the same broad disciplinary category suggests that they similarity in the basic computing content they were covering meant that the differences in their specific disciplinary origins were largely immaterial.

  For example, the curricula of the Ballarat and Swinburne programs read very much the same, despite that fact that the former evolved in association with accounting, and the latter developed alongside an Operations Research style program that focused on quantitative methods and business modelling. Likewise the units of the two science-based programs look broadly similar.

- Differences in content due to disciplinary divisions: Contrary to the above comments about the similarity of curriculum content within the broad science and business disciplinary categories, clear signs of differences emerge when comparing the curricula of science-based programs with that business-based programs. This is evident at two levels: firstly, in terms of the distribution of their units across the standard themes, business-based programs tended to offer a relatively uniform spread of coverage across all the themes, whereas CS or science-based programs tended to have more units focussed on programming and the technical aspects of computer hardware; secondly, the unit descriptions in the curricula of science-based programs tend to show a greater focus on aspects of fundamental theory, while those for business programs focused more heavily on applications than theory.

The Bendigo program's concentration on programming units illustrates the first of these types of difference, while the unit descriptions for the Deakin CS program show clearest signs of the abstract, conceptual, theoretical qualities which differentiate them from units addressing the same themes in the business-based programs. Perhaps the clearest sign of the significance of the differences in curriculum orientation of business-based and science-based programs is the fact that regardless of any apparent similarity in their unit handbook descriptions, there was generally little or no sharing of units between programs within an institution. Thus, the departments which offered the sample science–based curricula at Bendigo and Deakin also offered separate applied computing majors into business programs, which covered much the same themes, but used different sets of units. The only exception to this occurred in the case of the other two regional institutions at Warrnambool CAE and Gippsland IAE. These were the two smallest institutions, and in both of them the same set of units was used to teach computing majors into both science and business-based programs.

Information-related programs, which constituted the final category of programs mentioned earlier in the chapter, were both too small in number and too varied in their backgrounds to enable meaningful generalisations about the characteristics of their curricula. But, to give some idea of the nature of these programs, Table C6 in Appendix C gives an example of the curriculum of one of them, the BA(Information Management) at Melbourne CAE. It shows that the program's core IM content was split evenly between computing and non-computing units, so that although the core as a whole was of similar size to most of the other curricula described above, it had much less room for specialist computing content. The themes and topics addressed in the specialist computing units of the program were similar to the other computing curricula, but with programming being a significant omission. However the reduction in the number of computing units meant that their coverage of each theme appears to have been much more superficial. The core non-computing units covered a variety of topics relating to the nature of information, how it is used in organizations, and the key issues surrounding its usage.

5.9.2 Information Systems curricula

For most of the programs which identified themselves with the disciplinary label of 'Information Systems', there is little to distinguish their curricula from those of the other applied computing programs. This is shown in Table C7 in Appendix C, which lists and briefly describes the units in the five IS programs which existed at the end of the period. The table shows that with the exception of the IS stream at Caulfield which will be discussed below, the characteristic of these programs were much the same as those described in the previous section for other applied computing programs, and showed no special features to differentiate themselves from them. That is, there is nothing about the curricula of the business-based IS programs in Table C7 which clearly distinguishes them from other business-based applied computing programs, and likewise the Deakin science-based program is indistinguishable from other science-based applied computing programs. In each case, the curricula are of much the same size and scope, and vary only in the details of the blend of themes and the depth to which they are studied. As for the other applied computing programs, the curricula of IS programs give no indication of their disciplinary origins, apart from the broad differences between business and science-oriented programs discussed in the previous section.

The sole exception to this general pattern for IS curricula was the IS stream of units offered by the Department of IS at Chisholm IT. As discussed in Section 5.7, the Department of IS and the IS stream at CIT were formed when the original Department of EDP was split into three separate departments. Under this division, the disciplinary scope of the Department of IS was confined to the 'non-technical' aspects of computing, while the other new departments of Computer Technology and Software Development took responsibility for hardware and software respectively. Therefore, the IS stream within CIT's BApplied Science(Computing) program was based largely around the system development process, together with some additional coverage of topics in IS management and general information and system concepts.

As indicated in Section 5.8, many of the applied computing programs which were not called 'Information Systems' used the name or some variant of it for some of their units. The term was used fairly indiscriminately, with the units including content from most of the standard curriculum themes. However the content with which it was most frequently associated was in the themes relating to systems development and to basic concepts in computers, information, systems and computer applications.

A final point worthy of note in the light of Chapter 3's discussion of the development of IS in the USA, is that there are relatively few signs of MIS and management decision-making earning recognition as a significant theme in any of the programs throughout the period. Early in the period, applied computing programs at a number of institutions (for example, Chisholm, Deakin and Swinburne) included at least one unit devoted to these topics; the program at Chisholm in particular emphasised concepts in systems and cybernetics and their application to organizational decision-making. But the level of coverage diminished, to the point that by the end of the period, there were only a couple of specialist units devoted to topics of this kind (notably, at Deakin and at Chisholm, where they were combined with coverage of knowledge-based systems). Other than that, references to MIS in program curricula were generally restricted to occasional mentions as a topic in broad introductory units on the organizational uses of information and computer systems.

5.10 Summary

This chapter has examined the early stages in the development of IS as a discipline, within the broader context of the development of programs in computing education in the tertiary sector. The key points to emerge from the chapter are as follows:

- IS was slow to establish a presence and gain recognition as an academic discipline during this period, particularly in universities. It was a little more successful in the vocationally-oriented CAEs, but even in that sector, by the end of the period only a minority of institutions had academic programs or departments which identified themselves as representative of the discipline of IS. In this respect IS lagged well behind the other computing disciplines, Computer Science and Computer Engineering, which had both become well-established as independent disciplines throughout the entire tertiary education sector.

- The academic programs with which the development of IS came to be generally associated were based around the applications of computing to practical problems involving the management and use of information. These applied computing programs had a strong vocational orientation aimed at meeting marketplace needs for specialist computing graduates. The nature of the applied computing programs determined the basic characteristics and content of the IS programs which began to emerge during the period.
- Applied computing programs generally grew in evolutionary fashion, starting as generalist introductory units supporting aspects of computer use in some academic discipline, developing as off-shoots of the ‘parent’ discipline, and finally separating to become academic programs in their own right. Programs of this kind developed in both business and science faculties, in association with a variety of disciplines; accounting was the most common parent discipline within business, and mathematics the most common within science faculties, but they were by no means the only ones. There was very little connection between applied computing programs and the traditional information disciplines, but some programs linking computing applications and organizational needs for information management emerged during the period.
- The pattern of evolutionary growth meant that disciplinary forces were usually the primary influence which shaped the orientation of applied computing programs. In some institutions, marketplace needs for computing graduates and organizational structural arrangements also played important roles in affecting the direction and rate of growth of their program(s). The blend of these forces was unique to each institution, which meant that each applied computing program and the group which taught it were correspondingly unique in their characteristics.
- In most institutions, applied computing programs achieved disciplinary independence by the end of the period, and were taught as specialist fields of study, separate from their parent discipline. However, the academic groups which taught them had generally been much less successful in achieving independent status within the organizational academic structure; at the end of the period, most of these groups still retained a close connection with the disciplinary department within which they had originally formed.
- The curricula of applied computing programs generally covered much the same range of standard themes, regardless of their original disciplinary associations. But the differences in the disciplinary orientation of the programs caused differences in the way in which these themes were covered. The clearest evidence of these differences can be seen in the comparison of the curricula of business-based and science-based and programs, which show differences both in the relative emphasis of their coverage of the themes, and in the nature of the content within each theme. Business-based programs generally offered more uniform coverage across the themes and focused more heavily on practical applications, while science-based problems generally had a stronger emphasis on technical content, and focused more heavily on theory and abstract concepts.
- Applied computing programs and departments were known by a variety of names, such as computing, data processing, business computing and the like.

Only a few programs identified themselves by the name ‘Information Systems’ during this period. The academic programs and departments which took that name were associated with both business-based and science-based applied computing programs, and their broad characteristics and curriculum content varied accordingly.

- Apart from its relatively infrequent use as the name for an entire applied computing program, the term ‘Information Systems’ was more widely-used as a name for individual units or groups of units within programs. The curriculum content of these units varied significantly between programs, but it most commonly included topics relating to systems development, and to broadly-based introductory material on the use of information, computers and computer systems in organizations.

Thus, the recognition and acceptance of IS as a discipline and the development and implementation of IS curricula in practice occurred only slowly and in a piecemeal fashion during this period. The roots from which the discipline grew are to be found in the applied computing programs which have been the main focus of this chapter. With the implementation of the Dawkins reforms to the tertiary education system, which were introduced in the late 1980s, these programs became the foundation from which most IS programs and departments emerged.

Chapter 6: Establishing the discipline: IS and IS curriculum in Victorian universities from 1990 to 1997

6.1 The impact of the Dawkins reforms

It was during the period of major institutional change following the Dawkins reforms to the Australian tertiary education system (outlined in Section 2.6), that IS became a well-established and clearly identifiable disciplinary presence in almost all universities. As the previous chapter showed, IS had already achieved recognition in some tertiary education institutions prior to the Dawkins reforms, and it is impossible to assess precisely how much its subsequent increased recognition during this period can be attributed specifically to the institutional re-structures which followed these reforms. In some universities it may have happened without them, as part of the normal growth and development of their IT programs. But the chapter will show that the organizational re-structuring which was required in all institutions as a consequence of the reforms acted at least as a catalyst for the establishment of IS as a disciplinary presence in almost all universities, and had a major influence on the composition of IS departments and the nature and content of their programs.

Section 2.6 highlighted the three main impacts of the Dawkins reforms which are of greatest relevance to this study:

- the introduction of the single tier tertiary education system and the elimination of the binary system's division between a research-oriented university sector and vocationally-oriented CAEs;
- the round of institutional mergers and re-structures which ensued as a consequence of the elimination of the binary system;
- the increased exposure of universities to the influence of the student market, and its consequential pressures on academic departments and programs to attract students.

For computing education, the elimination of the binary system threw into confusion the division which had been established previously, between the applied computing traditions of CAEs and the more academically-oriented CS and CE programs which predominated in the universities. Chapter 5 showed that before the introduction of the Dawkins reforms, CS and CE had both managed to win acceptance as academic disciplines in universities, whereas vocationally-oriented applied computing had been generally confined to CAEs. But it also showed that applied computing programs had been generally endorsed by the marketplace as providing graduates who were better equipped to meet industry needs than were their academically better-credentialled university counterparts. The creation of the single tier higher education system left computing departments and programs under pressure to find the right balance in program content to satisfy academic demands for disciplinary legitimacy, industry demands for vocational relevance, and economic demands for financial viability.

The round of institutional mergers was a mixed blessing for departments and academic groups who taught computing programs. In some universities the mergers posed difficult challenges in deciding whether to integrate these departments and academic groups and their programs (and if so, how), or whether they should be left separate. For applied computing programs in particular, the variability of their disciplinary backgrounds made this a potentially difficult task. On the other hand, if successful integration was possible, the mergers provided opportunities for computing groups to achieve the critical mass needed to establish themselves as independent disciplines. Again, this was particularly significant for applied computing programs, many of which were shown in the last chapter to have been unsuccessful in achieving this level of organizational independence during the previous period.

The most important aspect of the increased sensitivity of academic programs to student demand was its impact in reducing the relative emphasis given to the work force component of market forces. Chapter 5 showed that throughout the previous period, the perceived needs of the labour market for computing graduates had been the main driver in the development of specialist computing programs, especially in the vocationally-oriented CAEs. But as a consequence of the financial impacts of the Dawkins reforms, universities became increasingly inclined to assess the merits of their academic programs in terms of the level of student demand. This may initially have worked to the advantage of IT programs, because the increasing public interest in IT made it seem like a potential area for growth. However, it also put academic departments and their programs under pressure to demonstrate their financial viability or risk cut-backs or even closure.

The rising public profile of computers and computing was an important additional external factor which affected the academic environment for computing-related programs at this time. The advent of the personal computer, both for business and recreational use, together with the effects of increasing capabilities, reliability and ease of use, and decreasing costs of purchase and operation, had combined to make computers and computing more available and accessible to a much wider audience. In addition, the development and diffusion of new technologies such as the Internet, the web and multimedia began to take effect in expanding the range of ways in which computers could be used. Developments like these helped promote the image of computing as an important growth area, and added to the pressure on universities to develop programs which catered to the heightened general public interest in computer education.

As set out in Section 2.6 the precise timing of the round of mergers and re-structures associated with the Dawkins reforms was different for each university. For the purposes of this study, the end of 1996 has been chosen as the cut-off point by which the immediate impacts of the Dawkins mergers appear to have been bedded down for most institutions. The most notable exception to this is La Trobe University, which took until 2005 to implement a full amalgamation of disciplines and faculties between the pre-Dawkins La Trobe based at Bundoora and its main merger partner, Bendigo CAE.

The structure of the chapter follows broadly similar lines as that used in Chapter 5, but with the focus now exclusively on the sub-set of applied computing programs which came to be designated as IS programs:

- Section 6.2 provides a broad overview of the state of IT education in general, briefly summarising the key features of the changes which occurred to the sector during this period.
- Section 6.3 examines the impacts of disciplinary and structural influences on the formation of IS departments and programs.
- Section 6.4 describes the trends in the market for IT programs in general and in IS programs in particular, as expressed by student demand for admission to places in them.

- Section 6.5 compares the curricula of the IS programs which were formed at each institution.
- Section 6.6 brings the chapter to a conclusion, with a brief summary of the way in which IS evolved during the period, and an assessment of the state of the discipline at its end.

6.2 Overview: Overall patterns in Computing/IT departments and programs

This section follows the same approach as its equivalent section in the previous chapter, in providing a broad overview of the state of computing education at the end of the period. This overview is then used as the starting point for the subsequent analysis, which aims to explain how it came about.

Table D1 in Appendix D lists the specialist IT programs which were offered at Victorian universities at the end of this period, and the faculty and teaching department which were responsible for each one. The table follows the same basic structure as that used in Tables C1(a) and C1(b) in Appendix C, which showed the situation at the start of the period, but with two differences to accommodate important changes in the nature of IT-based programs. The first and most significant change is that the single broad category of Applied Computing programs (sub-divided according to their placement in science or business-based faculties), has been replaced by two separate categories – one comprising programs which were identified as 'Information Systems' and the other consisting of a group of programs labeled as 'Computing' or 'IT'. Secondly, a new miscellaneous category labeled 'Other computing' has been added which includes a small but varied group of new programs which emerged during the period.

The table shows that the main effect of the institutional mergers and re-structures was to expand substantially the disciplinary presence of IT, and broaden the range of areas of IT covered in the academic programs of each university. Whereas the pre-Dawkins institutions usually offered only 2-3 different IT-based programs, there was now an average of about 5-6 specialist IT programs per institution, representing a broad range of IT disciplines. Organizational structures now also gave greater recognition to the disciplinary status of IT, with the vast majority of IT programs being offered by organizational academic units which specialized in IT, independent of other disciplines.

The institutional changes generally appear to have had relatively minor effects on the academic departments and programs associated with CS and CE. These disciplines had been widely-accepted as academically legitimate areas of study in all institutions, and the similarity in their disciplinary origins, in mathematics and electrical engineering respectively, meant that the departments and programs in these areas were usually sufficiently similar in nature as to make them a natural 'fit' in any merger. The merging of the content of their programs may have required resolution of differences in the emphasis accorded to specific topic areas, but any such differences did not detract from the essential similarity in their disciplinary focus. Therefore, it is easy to trace a direct line of evolution from the CS and CE programs which were offered in the pre-Dawkins institutions to those which remained in the universities at the end of the period.

The evolutionary path of the IS and generalist IT/computing departments and programs from their applied computing antecedents was more complex. As indicated in the introduction to the chapter, the vocational focus which had provided the rationale for their existence in the CAE sector came into question in a discipline-oriented university setting. The programs were appreciated for their ability to attract a large and diverse student market, but they faced problems in establishing the kind of theoretical base which was expected of a university discipline. For several of the new universities this problem was compounded by the fact that some of the mergers brought together institutions with applied computing programs and departments which came from different disciplinary roots. In such cases, decisions about whether to merge the programs/departments or keep them separate were influenced by disciplinary and organizational structural issues as well as questions of student demand and financial viability. The processes by which the programs and departments in the IS group were formed will be the main focus of this chapter.

The other two categories in the table comprise two types of program whose fortunes trended in opposite directions during this period. The first group consists of new IT-based programs, which owed their existence to the growth and increasing diversification of computer technology and computer applications. The small group shown in the table which appeared during this period were based around the emerging fields of software engineering and multimedia technologies. They were the vanguard of a much larger group based around specialist areas of computer technology and its applications, which was to follow in the next period of the study. The second group, the specialist information-related programs, can be seen to be in decline. Traditional information-based disciplines appear to have been unable to benefit from the popular rhetoric about the so-called ‘information age’ and the ‘information revolution’. The number of departments and programs in these areas, which the previous chapter showed had already been small, suffered further losses in the institutional changes. The few survivors are of little direct relevance to developments in IT during this period.

Although the institutional changes during the period helped to accelerate the process of separation of all types of IT programs and departments from their original parent disciplines, the distribution of these departments and programs across institutional academic structures continued to reflect the diversity of those disciplinary origins. There were only limited signs of a new disciplinary convergence around IT as the basis for the establishment and definition of a new disciplinary territory. This is demonstrated in Table D2 in Appendix D, which shows where the programs associated with the different IT disciplines were located across the faculties within each university’s academic hierarchy at the end of the period. Each box in the table represents an organizational unit which was responsible for an IT-based academic program (some units are shown as teaching programs in more than one IT discipline). The table demonstrates the extent to which the mergers and organizational re-structures left IS and other IT-based programs scattered across faculties of business, science, engineering/technology and computing/IT.

Only Monash University and the University of Ballarat used the re-structure to bring all aspects of computer-related education together into a single organizational academic unit. Monash formed what it claimed to be Australia’s first specialist IT faculty, which consisted solely of IT-related academic departments. But even its efforts to unite the computing disciplines fell slightly short of total success, because a small group of academic staff who offered CE units in the Faculty of Engineering chose to reject their invitation to join the faculty and stayed with Engineering. At Ballarat, the School of Information Technology and Mathematical Sciences was formed to take control of all the institution's computing programs, but, as its name indicates, it was not a purely IT-focused academic unit, and continued to offer programs in mathematics and statistics.

6.3 Structural and disciplinary influences on the formation of IS departments and programs

As indicated in the introduction to this chapter, the emergence of a significant body of academic departments and programs which identified themselves by the name 'Information Systems' was one of the key features of the institutional changes in IT education which occurred during this period. The previous chapter showed that the 30 years of computing education leading up to the beginning of the period had seen only a small proportion of Victoria's tertiary institutions create academic programs and departments of that name. But by the end of the period, seven of the eight universities had designated specialist IS programs and six had IS departments. In fact two of the universities ended the period with two specialist IS programs, and one of them had two IS departments. Perversely, the University of Ballarat, which was the only university to end the period without an IS department or program, had been one of the CAEs which had had an IS major in the pre-Dawkins era, but it was lost as part of that university's re-structure.

At each university, the characteristics of its IS program(s) were uniquely shaped by the disciplinary and structural changes which were taken to cater for the impact of the Dawkins reforms. Differentiating between these disciplinary and structural influences is much more difficult than was the case for applied computing programs during the previous period. In that period the progression of events in each institution was such that the two different sets of influences could be easily separated in most cases. But during this period they usually occurred simultaneously, and their effects were so closely inter-related that it is not obvious which was cause and which was effect, or whether they were made in tandem. That is, decisions which were made about disciplinary division or formation may have created the need for organizational structural changes, or decisions which were made to rationalise organizational structures may have driven the need for changes to disciplinary affiliations

The impacts of the disciplinary and structural changes on the structure and content of IS are evident in the institutional handbooks, but unfortunately these formal published records give little or no insight into the organizational decision-making on which the changes were based. Detailed accounts of the processes by which IS departments and their academic programs became established are available for only two universities: an 'in-house' history of the birth of IS at the University of Melbourne (Dreyfus, 2004); and the detailed case study of Monash University in Chapter 8 of this thesis. But no such accounts of the interactions between disciplinary and structural decisions are available for the other universities. Consequently, the following outline of the evolution of IS departments and programs does not attempt to separate the influences of disciplinary and structural factors, and focuses largely on the outcomes of the disciplinary and structural changes, rather than on the reasoning behind the institutional decisions from which they derived.

Apart from this limitation, the main difficulty with the analysis is simply that from the point of view of presentation, the number of organizations, their programs and the complexity of their merger arrangements, makes for a somewhat tedious and repetitive narrative. In the previous chapter, a similar problem with the large number of applied computing programs was managed by grouping them into categories with broadly similar characteristics, and describing only a few exemplars of each category. This approach cannot be used here, because, as the following discussion will show, a key feature of events was the fact that the combination of circumstances and outcomes was unique to each university, making it essential that they each be described in full.

To help overcome this problem and to break the analysis into pieces of more manageable size, the following sections divide the universities into three groups, according to whether their IS programs were located, in business, science or computing-based faculties. The descriptions of events for each group of universities is followed by a summary which provides a broad overview of the state of IS across all universities at the end of the period.

6.3.1 IS programs in business faculties

Four of the post-Dawkins universities finished the period with designated IS programs and/or departments located in their business faculties. Table 6.1 summarises the main disciplinary and structural changes which were involved in the formation of these departments and programs during this period. The right hand column of the table shows that at each of the four universities, the outcome of events in this period was broadly the same, with a specialist department being formed to offer a specialist academic program in Information Systems. The entries in the table show two areas where there were variations in outcomes between the universities: in the size and scope of the IS-based program offerings, which varied from two majors at Deakin to full degrees at RMIT and Swinburne and two separate degree programs at VUT; and the use of slightly different names for the programs - ‘Information Systems’, ‘Business Information Systems’ and ‘Management Information Systems’.

<table>
<tr><th>Pre-Dawkins Institutions</th><th>Pre-Dawkins organizational units and programs</th><th>Post-Dawkins University</th><th>Post-Dawkins IS outcome</th></tr>
<tr><td>RMIT</td><td>Faculty of Business
Dept of Business Information Systems:
BBusiness Information Systems with major streams in:
o Information Systems
o Office Systems
o Computing</td><td rowspan="2">RMIT University</td><td rowspan="2">Faculty of Business
Dept of Business Computing:
BBusiness Information Systems</td></tr>
<tr><td>Phillip IT</td><td>Faculty of Business
Dept of Accounting & Business Computing:
BBusiness(Computing)</td></tr>
<tr><td>Footscray IT</td><td>Faculty of Business
Dept of Applied Economics:
BBusiness (Info Technology)</td><td rowspan="2">Victoria University of Technology</td><td rowspan="2">Faculty of Business
Dept of Information Systems:
• BBusiness (Information Systems) with specialist streams in
o Information management
o Systems development
o Systems technology
• BBusiness (Systems support)</td></tr>
<tr><td>Western Institute</td><td>Faculty of Business
Dept of Computing:
BBusiness (Computing)</td></tr>
</table>

<table>
<tr><td>Deakin University</td><td>Faculty of Commerce
Major in Data Processing, offered in the BBusiness
(taught by School of Computing & Mathematics)</td><td rowspan="3">Deakin University</td><td rowspan="3">Faculty of Management
School of Management Information Systems:
• Major in Management Information Systems offered into BCommerce
• Major in Management Support Systems offered into BCommerce</td></tr>
<tr><td>Victoria College</td><td>Faculty of Business
Dept of Computing:
BBusiness(Computing)</td></tr>
<tr><td>Warrnambool CAE</td><td>Faculty of Commerce
(no departments):
BBusiness(Computing)</td></tr>
<tr><td>Swinburne IT</td><td>Faculty of Business
Dept of Data Processing & Quantitative Methods:
• BBusiness(Computing)
• Major in Quantitative Analysis offered into BBusiness</td><td>Swinburne University</td><td>Faculty of Business
School of Information Systems
Dept of Information Systems & Technology:
BInformation Systems

Dept of Business Modelling:
Major in Business Modelling</td></tr>
<tr><td colspan="4">Table 6.1: Impact of mergers/re-structures on the creation of business-based IS programs and departments
(Source: Institutional Handbooks)</td></tr>
</table>

The following analysis briefly summarises the main elements of the disciplinary and structural changes which took place in creating a strong disciplinary presence for IS in the business-based faculty of each of these universities (for ease of reference, the relevant parts of Table 6.1 are repeated at the start of the discussion for each university). It concludes with a brief summary of the key aspects of these changes for this group of IS departments and programs.

- RMIT University:

  The RMIT University merger brought together two CAEs – Royal Melbourne Institute of Technology (RMIT) and Phillip Institute of Technology (PIT) – both of which offered business-oriented applied computing programs, but with different disciplinary origins.

<table>
<tr><td>RMIT</td><td>Faculty of Business
Dept of Business Information Systems:
BBusiness Information Systems with major streams in:
o Information Systems
o Office Systems
o Computing</td><td rowspan="2">RMIT University</td><td rowspan="2">Faculty of Business
Dept of Business Computing:
BBusiness Information Systems</td></tr>
<tr><td>Phillip IT</td><td>Faculty of Business
Dept of Accounting & Business Computing:
BBusiness(Computing)</td></tr>
</table>

RMIT's BIS department and program had both been created in the late 1980s, by bringing together two previously disparate groups from general business

computing and office administration (aspects of the unusual development path which led to their formation were outlined in Sections 5.5.1 and 5.7). By contrast, PIT's program was of much longer standing, and had been developed in a more conventional fashion in association with accounting. The differences in their disciplinary roots was very evident in their programs: the PIT curriculum generally conformed to the 'conventional' model of accounting-based programs, but the RMIT program offered an unusual blend of content, with a core major called 'Information Systems' offered in combination with optional majors in office systems and computing.
During the merger, the computing staff from PIT's Department of Accounting & Business Computing were combined with those from the RMIT department to form a new Department of Business Computing. Initially the new department continued to offer both programs in their original form on their original campuses, but this arrangement only lasted for a couple of years, until a revised degree was developed. In 1995 this new program, which was called the Bachelor of Business Information Systems, replaced the old degrees on both campuses. Despite the adoption of the name of the previous RMIT program, the new degree does not appear to have been more closely aligned with it than it was with its other predecessor in PIT; in fact it did away with the office systems major, which was one of the main distinguishing features of the previous RMIT program. The curriculum will be discussed in greater detail later in the chapter, but it showed no obvious signs of having been oriented towards the previous curricula of either of the merged programs.

- Victoria University of Technology:

  Like RMIT, VUT brought together two CAEs – Footscray Institute of Technology (FIT) and the Western Institute (WI) - which offered business-based applied computing programs which came from different disciplinary origins. FIT's BBusiness(Information Technology) had originated in association with studies in office administration, and offered majors in both information management and computing, while WI's BBusiness(Computing) program had been established alongside an accounting program, and its curriculum was typical of programs of that type. Also as at RMIT, the program in one institution – WI – was offered by a specialist Department of Business Computing, while the academic group which offered FIT's program was located within a department which combined computing with a business discipline (Applied Economics).

<table>
<tr><td>Footscray IT</td><td>Faculty of Business
Dept of Applied Economics:
BBusiness (Info Technology)</td><td rowspan="2">Victoria University of Technology</td><td rowspan="2">Faculty of Business
Dept of Information Systems:
• BBusiness (Information Systems) with specialist streams in
o Information management
o Systems development
o Systems technology
• BBusiness (Systems support)</td></tr>
<tr><td>Western Institute</td><td>Faculty of Business
Dept of Computing:
BBusiness (Computing)</td></tr>
</table>

Structurally the merger proceeded along much the same lines as had occurred at RMIT, with the computing staff from FIT's Department of Applied Economics being re-located and combined with the WI staff into a single department, which was initially called the Department of Business Computing. Again as at RMIT, the department initially continued to offer the two original programs separately on their original campuses, before developing a single program which replaced the old degrees on both campuses.

But there the resemblances with RMIT ended, as the new VUT department took a different approach to the problem of creating a single program. Whereas RMIT chose to integrate and consolidate the content of both the original programs into a new set of units, VU added them together to create a new enlarged BBusiness(Computing) program which retained most of the units from its pre-merger predecessors from both institutions. The pre-merger units also continued to be offered into the BBusiness degree, as designated majors in Information Management, Information Systems, Systems Development and Systems Technology, with the IS major as the biggest of the four.

In 1996, the department and degree were re-named from Business Computing to Information Systems. This was done without any further apparent changes to the department or the content of its degree program, and appears to have been a matter of change of a label, rather than as a consequence of any disciplinary changes. The department also further extended its disciplinary scope by launching a new program called the BBusiness (Systems Support), which targeted "… students who specifically wish to obtain a professional qualification in managing the Systems Support of developers and users of Information Systems" (VUT, 1997, p31). The program was based around a separate set of units to the BIS, so that apart from the core set of business units which were included in all business programs, there was virtually no overlap between the programs. A major in Systems Support was also offered into the general business degree to go with the original set of four majors listed above.

- Deakin University:

The merger at Deakin was a little more complicated, because it happened in two stages and involved three institutions which had significant differences in their previous arrangements for business-based computer education.

<table>
<tr><td>Deakin University</td><td>Faculty of Commerce
Major in Data Processing, offered in the BBusiness
(taught by School of Computing & Mathematics)</td><td rowspan="3">Deakin University</td><td rowspan="3">Faculty of Management
School of Management Information Systems:
• Major in Management Information Systems offered into BCommerce
• Major in Management Support Systems offered into BCommerce</td></tr>
<tr><td>Victoria College</td><td>Faculty of Business
Dept of Computing:
BBusiness(Computing)</td></tr>
<tr><td>Warrnambool CAE</td><td>Faculty of Commerce
(no departments):
BBusiness(Computing)</td></tr>
</table>

In its first stage, in 1990, the merger involved the two regional institutions, Deakin University and Warrnambool CAE. At both these institutions, the teaching of computing had been centralized within a single organizational unit, which offered both business and science-based applied computing programs. However that organizational unit was located in the Science faculty at Deakin and in the Commerce faculty at Warrnambool. When the business and science faculties of the two merging institutions were combined, these separate arrangements for computing education remained the same: at the main Geelong campus, the science faculty's School of Computing & Mathematics continued to offer a major in data processing into the BCommerce, while the Commerce faculty staff at Warrnambool continued to offer a BBusiness(Computing) on that campus.

Deakin's subsequent merger with Victoria College (VC) at the beginning of 1992 involved more substantial change, because VC was a much larger institution than Warrnambool (having itself been formed from a merger of CAEs and teachers colleges in the early 1980s). Unlike Deakin and Warrnambool, VC had arrangements for applied computing which were more typical of CAEs, with separate departments and programs in its science and business faculties. Its Faculty of Business included a Department of Computing, which had originally been associated with studies in quantitative methods in business. It offered a BBusiness(Computing) program at its Burwood campus, while the Department of Information and Numerical Sciences in the Faculty of Applied Science taught both CS and generalist computing majors at the Rusden campus.

Under the merger arrangements, the business-based disciplines from all three institutions were combined into a new Faculty of Management, which consolidated and standardized programs in all business-based disciplines across the university. The re-structured faculty included a new specialist School of Management Information Systems, which took over responsibility for all IS and computer-related teaching in the faculty across all campuses.

The business computing programs which had previously been offered at Warrnambool and VC were closed down, as was the data processing major which the School of Computing and Mathematics had taught into the business faculty at the Geelong campus. In their place the School of MIS established a single set of units which was used across all campuses. Some of these units were direct replacements for the units previously offered by the computing programs on each campus, and others were completely new units.

Initially these units were offered in the form of three specialist majors for students studying the BCommerce. Two of the majors covered content similar to that of the old programs which had been scrapped: a major in MIS was offered on all campuses, and one in software development was offered at Burwood and Warrnambool. The third major in Management Support Systems consisted largely of new units with no previous equivalents, and it was also initially offered at all campuses. (At Warrnambool some of the new units were also used for a short time to continue the arrangement in which business computing units were used as the main computing content of a computing major in the BApplied Science at that campus; however this program survived for only a couple of years).

The system development major did not last long, and was closed down before the end of the period. This left the school with its main MIS major, which it continued to offer on all three campuses, and the Management Support Systems major which was restricted to the Burwood campus. In conformance with the Faculty of Management's standards, these majors comprised only six units, but the school also offered a range of IS electives. By combining the MIS major with a suitable set of these additional elective units, a student could meet the Australian Computer Society requirements for accreditation as a computer professional.

Although the focus of this section is the impact of the mergers on business-based computing, it should be noted that these changes also affected the teaching of computing and IS in the science faculty at Deakin. The termination of the role which the School of Computing and Mathematics had played in offering a data processing major for business had significant implications for the IS program which it also offered. These are discussed in the following section's analysis of science-based IS program.

- Swinburne University:

Swinburne was in a much simpler situation than the other institutions described above, because its merger partners had no computing programs of any significance. Therefore, although the institution went through a major internal re-structure as part of its up-grade to university status, it did not have to deal with the integration issues which confronted the other universities. The IS department and its degree program appeared as a consequence of a series of structural and disciplinary changes which reflected the ongoing evolution of the discipline.

Swinburne IT	*Faculty of Business* *Dept of Data Processing & Quantitative Methods:* • BBusiness(Computing) • Major in Quantitative Analysis offered in BBusiness	Swinburne University	*Faculty of Business* *School of Information Systems* *Dept of Information Systems & Technology:* BInformation Systems *Dept of Business Modelling:* Major in Business Modelling

The first of these was a relatively cosmetic change, which occurred after the institution changed its status to become a university in 1992. This change saw the department re-named from 'Data Processing & Quantitative Methods' to become the Department of Information Systems, while its quantitative analysis major was re-named to 'business modelling'. In 1995 the Department was up-graded to the status of a School of Information Systems, and its computing-based and modelling-based components were split into two departments – the Department of Information Systems & Technology and the Department of Business Modelling. The computing major was also re-named to Information Systems & Technology, but with no observable effect on its content. It was then up-graded and offered as a fully-fledged BIS degree in 1997.

> Thus, in the absence of any need to deal with institutional merger/integration problems, the process by which the IS department and program were formed appears to be a continuation of the evolutionary path which was described for applied computing programs in the previous chapter. That is, the computing-based component gradually split away from the business discipline with which it had been originally associated to form its own department and degree program.

Summary

Although all four universities can be said to have ended the period with a similar outcome – a business-based academic department and undergraduate program in Information Systems - the most striking feature of their development is the variability of the circumstances associated with the achievement of that outcome. Although there were some individual points of similarity between the institutions, the following points highlight the fact that the overall blend of integration issues, approaches to resolving them and the nature of the outcomes was unique in each of the four universities:

- The circumstances of the merger required the integration of programs and academic groups from three institutions at Deakin, and from two at RMIT and VUT; while Swinburne's re-structure involved disciplinary separation, rather than integration.
- The mergers at each university brought together groups with different combinations of disciplinary backgrounds – office systems, accounting and computing support at RMIT; accounting and quantitative methods at Deakin, information management and accounting at VUT; while Swinburne's re-structure ended the disciplinary association of computing with quantitative methods and business modelling.
- RMIT and Deakin dealt with the problem of integration of teaching programs by re-structuring and consolidating them; in doing so, RMIT eliminated its previous links with office systems, while Deakin strengthened its coverage of quantitative analysis. VUT integrated by aggregating the content from its merging groups to form a new enlarged set of units; Swinburne was able to maintain its previous content largely unchanged
- The IS departments at RMIT and Swinburne consolidated all their teaching into a single degree program; Deakin developed multiple independent majors; VUT developed multiple majors and two separate degree programs

The effects of these differences in circumstances and approaches will be seen in the analysis of their curricula in Section 6.6. It will show how the nature of the content of the BIS programs and the breadth of their range of topics varied to reflect the diversity of the circumstances of their formation.

A final issue to be noted is the way in which the name 'Information Systems' (or some variant of it) came to be used as the designation for the department and its program in each university. As the discussion above has shown, RMIT was the only one of the institutions involved to have a department and program of that name before the mergers/re-structures, with the others using a variety of names, such as 'business computing', 'data processing', 'information technology', and 'information management'. There is nothing in the public record to explain why they all decided to re-name themselves as 'Information Systems', although some possible factors are outlined in the summary in Section 6.3.4 below. But only at Deakin was the re-naming of the department and its program immediately associated with the merger and the formation of the new department and its program. At the other universities, the adoption of the name appears to have been the outcome of a more gradual process.

For example, at Swinburne the name was first used for the school, which included both its computing and business modelling components; then, when these two component groups separated, the name ‘Information Systems and Technology’ was used for the computing-oriented department; it was finally adopted as the name of that department’s academic program only when it was up-graded from a major to a full degree. At VUT, the merged department retained the name ‘Business Computing’, and ‘Information Systems’ was initially used only as the name of one of the majors it offered; it took until several years after the merger before it was adopted as the name for the department and for one of its degree programs. Even at RMIT, the naming of the new department and its new combined program seem to represent a compromise between the merging parts, with the department retaining the ‘Business Computing’ label by which the PIT program had been known, while the degree retained the ‘Information Systems’ label from RMIT.

The overall impression given by this pattern of gradual name change is that the adoption of the term ‘Information Systems’ was generally more a matter of a change of a label, rather than a sign that the focus of the department and its teaching programs had altered in some way as to make that name more appropriate than the one which it replaced. This issue is addressed further in the summary in Section 6.3.4 below.

6.3.2 IS programs in science faculties

Three universities ended the period with a designated IS program and/or department in a science-based faculty – Deakin, La Trobe and the University of Melbourne. Table 6.2 summarises the main disciplinary and structural changes which were involved in the formation of these departments and programs at each of these universities. The right hand column of the table shows that at each university, the outcome of events in this period was the creation of a specialist academic program in Information Systems.

<table>
<tr><th>Pre-Dawkins Institutions</th><th>Pre-Dawkins organizational units and programs</th><th>Post-Dawkins University</th><th>Post-Dawkins IS outcome</th></tr>
<tr><td>Deakin University</td><td>Faculty of Science
School of Computing & Mathematics:
IS major and CS major in BApplied Science</td><td rowspan="3">Deakin University</td><td rowspan="3">Faculty of Science & Technology
School of Computing & Mathematics:
• Major in Information Systems in BSc(Computer Science & Software Development/Information Systems)
• BApplied Science (Applied Computing)
• BApplied Science (Information Management)</td></tr>
<tr><td>Victoria College</td><td>Faculty of Applied Science
Dept of Information & Numerical Sciences:
Majors in Information Management and computing studies offered in BApplied Science</td></tr>
<tr><td>Warrnambool CAE</td><td>BApplied Science (Computing) (taught by Faculty of Commerce)</td></tr>
</table>

<table>
<tr><td>La Trobe University</td><td>Bundoora campus
School of Physical Sciences
Department of Computer Science:
• BComputer Science
• BComputer Systems Engineering</td><td rowspan="2">La Trobe University</td><td rowspan="2">At Bundoora campus:
Dept of Computer Science and Computer Engineering
• BInformation Systems
• BComputer Science
• BComputer Systems Engineering</td></tr>
<tr><td>Bendigo CAE</td><td>*Faculty of Business*
Dept of Computing & Information Science:
• BBusiness(Data Processing)
• BApp Science(Computing)</td></tr>
<tr><td>University of Melbourne</td><td>No applied computing/DP programs or teaching departments</td><td rowspan="2">University of Melbourne</td><td rowspan="2">Faculty of Science
Dept of Information Systems
BInformation Systems</td></tr>
<tr><td>Melbourne CAE</td><td>*Faculty of Arts &Information Studies*
Dept of Business Studies and *Dept of Library & Information Studies*
Programs in librarianship and information management</td></tr>
</table>

Table 6.2: Impact of mergers/re-structures on the creation of science-based IS programs and departments
(Source: Institutional Handbooks)

But in contrast to the picture for business faculties seen in the previous section, the Table shows that only at the University of Melbourne was a specialist IS department formed in a science-based faculty; at both Deakin and La Trobe, IS was one of several programs offered by a technically-oriented computing department.

The following analysis briefly summarises the main elements of the disciplinary and structural change which took place in order to create a disciplinary presence for IS in each of these universities (as in the previous section, for ease of reference, the relevant parts of Table 6.2 are repeated at the start of the discussion for each university). It concludes with a brief summary of the key aspects of these changes for this group of IS departments and programs.

- Deakin University:

  Before the Dawkins mergers, the School of Computing and Mathematics had been the sole organizational academic unit which taught computing at Deakin. In the pre-merger Deakin, the school had developed one of the first designated IS majors in Victoria, which it offered alongside a CS major into the BScience. As indicated in the earlier discussion of business-based IS at Deakin, it had also taught a major into the BBusiness, which was called a data processing major, but which had similar content to its IS major. The school and its programs were not affected by Deakin's first merger with Warrnambool CAE, because Warrnambool had no science-based computing department, and the campus maintained its previous arrangements whereby all computing was taught through the Faculty of Commerce. But in the merger with Victoria College (VC), it joined with that institution's Department of Information & Numerical Sciences, which also taught science-based computing and information management programs, to create an enlarged cross-campus School of Computing & Mathematics.

<table>
<tr>
<td>Deakin University</td>
<td>Faculty of Science
School of Computing & Mathematics:
• IS major and CS major in BApplied Science</td>
<td rowspan="3">Deakin University</td>
<td rowspan="3">Faculty of Science & Technology
School of Computing & Mathematics:
• Major in Information Systems in BSc(Computer Science & Software Development/Information Systems)
• BApplied Science (Applied Computing)
• BApplied Science (Information Management)</td>
</tr>
<tr>
<td>Victoria College</td>
<td>Faculty of Applied Science
Dept of Information & Numerical Sciences:
Majors in Information Management and computing studies offered in BApplied Science</td>
</tr>
<tr>
<td>Warrnambool CAE</td>
<td>BApplied Science (Computing)
(taught by Faculty of Commerce)</td>
</tr>
</table>

Initially the new school retained its CS and IS majors in the BScience, together with two degrees based around the previous VC offerings – a BApplied Science(Applied Computing) and a BApplied Science(Information Management). But, as described in the discussion of business-based IS in the previous section, the formation of the new School of Management Information Systems meant that it was no longer able to offer the data processing major which it had previously taught into the BBusiness. For the IS program this would lead to a major change in its content and orientation.

Soon after the merger, the School carried out a major review of all its programs to bring them into line with the academic standards established by the merged university. As a consequence of the review, the old CS and IS majors were increased in size and combined into a new specialist degree, with the rather unwieldy name of BScience(Computer Science & Software Development/Information Systems), which required its students to take a specialist stream in either or both CS and IS. But although the new program appeared to increase the size and profile of the IS stream, it in fact eliminated much of its distinctive character. The original IS major had had a strong business application focus, which meant that its only common content with the CS major which ran alongside it had been an introductory first year unit. By contrast, the new enlarged IS stream shared 10 of its core units with the core of the CS & Software Development stream.

It seems likely that this change in the orientation of the IS program structure was influenced both by the closure of the data processing major which the school used to offer into the business faculty, and also by the merger of the Deakin and VC science-based computing departments. With the new School of MIS taking over the role of business-focussed IT education, and the programs which came from VC occupying other parts of the science-based applied computing domain, the IS program was left without a clear academic territory to occupy. Although it retained the appearance of a separate and independent discipline, in content it began to decline to the status of an off-shoot of CS.

- La Trobe University:

  Both La Trobe and Bendigo CAE were largely unchanged by their merger during this period. Under the merger agreement, the academic departments and programs of the two institutions did not fully integrate, and the Bendigo campus operated as a multi-disciplinary faculty, independent of La Trobe's main Bundoora campus (an arrangement which persisted until 2005). Therefore, despite the merger, the computing departments and programs which existed at each institution in the pre-Dawkins era remained separated.

<table>
<tr><td>La Trobe University</td><td>Bundoora campus
School of Physical Sciences
Department of Computer Science:
• BComputer Science
• BComputer Systems Engineering</td><td rowspan="2">La Trobe University</td><td rowspan="2">At Bundoora campus:
Dept of Computer Science and Computer Engineering
• BInformation Systems
• BComputer Science
• BComputer Systems Engineering</td></tr>
<tr><td>Bendigo CAE</td><td>Faculty of Business
Dept of Computing & Information Science:
• BBusiness(Data Processing)
• BApp Science(Computing)</td></tr>
</table>

  From the experiences at the other CAEs, the applied computing programs at Bendigo might be expected to have been the likeliest source of an IS program, but in fact there was little change to computing on that campus during this period. There were minor name changes to the department in the School of Business which taught them, and to the programs themselves, but the overall program content remained much the same. The names "information systems" and "business systems" remained only as names of individual units within each program.

  Instead La Trobe's BIS emerged at the more technically-oriented Bundoora campus. The computing group on that campus had offered programs in CS and CE in the School of Mathematical & Information Sciences, but in the general re-structure which the university undertook at the time of the merger, it separated from Mathematics to form a specialist School of CS and CE in the newly-created Faculty of Science & Technology. In 1996-97 the School carried out a major re-structure of its CS program, and as part of that process, it established a specialist BIS degree.

  The content of this degree was driven by the nature of the changes made to the CS program as part of this re-structure. Previously, the first two years of the CS degree had consisted of three full year units – CS1, CS2 and CS3. The handbook description for the first two of these units did not break them up any further into individual units, but listed only a range of broad topic areas which they covered. For the third year unit, the content was divided into what were termed 'components', of which students were required to take a certain minimum number; a total of 25 such components were listed in the 1996 handbook. In the re-structure of the CS degree, its curriculum was changed to a more conventional format, with the content of all three year levels broken into a number of discrete units unit based around specific topics. The 3rd year components which had been listed in the 1996 handbook became elective units in the new degree. The new BIS program was created as a selection of the new units from the CS program, supplemented by an introductory specialist IS unit and two units in communication skills. Four of the compulsory IS units were also core units in the CS degree, and almost all the others were also electives in that program.

This approach to the formation of the La Trobe BIS appears to be little different to the same school's previous short-lived foray into IS which was outlined briefly in Section 5.6. As described in that section, the then head of school had characterised the establishment of the IS major at that time as a market-driven initiative aimed at providing a vocationally-focussed option which could help distinguish the CS program from its competitors. It is impossible to say whether the development of the BIS was similarly-inspired, but it certainly perpetuated the treatment of IS as essentially a sub-set of the school's CS program.

- University of Melbourne:

The University of Melbourne is an unusual case, because it is the only institution in which the IS department and undergraduate program which were formed in this period had no direct precursors in its organizational structures or teaching units. Melbourne had had no applied computing programs prior to the Dawkins mergers. The programs offered by its merger partner, the Melbourne CAE, were re-located to the Faculty of Education during the merger, and were all discontinued within a few years. The new IS department and its undergraduate program were established from scratch, as the university's first venture into applied computing. This makes their development particularly interesting, because the decisions about the desired disciplinary orientation for IS were addressed directly, rather than flowing from the historical roots of the program in some other discipline.

<table>
<tr><td>University of Melbourne</td><td>No applied computing/DP programs or teaching departments</td><td rowspan="2">University of Melbourne</td><td rowspan="2">Faculty of Science
Dept of Information Systems
BInformation Systems</td></tr>
<tr><td>Melbourne CAE</td><td>Faculty of Arts &Information Studies
Dept of Business Studies and Dept of Library & Information Studies
Programs in librarianship and IM</td></tr>
</table>

The story of the origins of the program were told by Dreyfus (2004) in an otherwise unpublished departmental history, which featured for several years on the university web site. Dreyfus quoted the university vice-chancellor at the time, David Penington, as acknowledging that Melbourne had lagged behind most Australian universities in beginning a program in IS:

> "… I think it is a valid comment that we were slow to identify it as a discipline in its own right, although aspects of it were being covered by both Computer Science and Economics and Commerce prior to the establishment of the Department. It was a growing area of

> applied study and it would be perhaps not surprising that the newer institutions that are more committed in applied education would have seen it as a growth area before the older established universities that were not looking for applied disciplines". (Dreyfus, 2004, p7)

This remark is illuminating, not only as an explanation for the university's decision to take on IS, but also as a further illustration of the point raised in earlier chapters about the reluctance of the 'older established universities' to accept the validity of applied fields of study.

In 1994, the question of how to handle the emergence of IS as a discipline had become a topic for discussion among senior academics at the university, but Penington was unhappy with progress, and took direct action himself. He called on Peter Weill, a senior academic in the Postgraduate School of Business, to prepare a proposal for an IS degree without regard to the discussions which had gone before, and without regard to the issue of where the program should be located. Dreyfus (2004) suggested that at that time, Weill was "… one of only two people in the University with expertise in Information Systems" (p2). [This would appear to be somewhat at odds with Penington's claim in the quotation in the previous paragraph that aspects of IS were already being covered in other faculties, but the subsequent development path of the IS program would seem to support Dreyfus's assessment].

Weill organized a team to help him, which included representatives from the Department of Computer Science, which was located in the Faculty of Engineering, and the Department of Management and Industrial Relations from the Faculty of Economics and Commerce. The team examined the IS programs at other leading universities around the world, and noted the diversity in their locations and orientations, from the highly technical to the strongly business-focussed. According to Weill, each of the key members of the team brought a different perspective to the debate over program content - the CS department representative argued strongly for more technical content, the Management department representative wanted more managerial content, while Weill (whose original degree was in Engineering) wanted more content related to systems development and implementation (Dreyfus, 2004).

The program which finally took shape was a compromise between these three points of view, but with its primary focus identified as business processes. The representatives of the three points of view described above were each given responsibility for designing and specifying one-third of the program's units, according to their area of specialist expertise (Dreyfus, 2004).

The final key question to be decided was where the program and its department should be located. Both the Faculty of Economics and Commerce and the Faculty of Engineering, which housed the Department of Computer Science, had lobbied hard for ownership. When asked for his opinion by Penington, Weill indicated that he preferred Economics and Commerce, but Penington decided to choose neither. Senior staff interviewed by Dreyfus suggested that a home with the other computing departments in Engineering was seen as being likely to make the new department too technical and hardware-oriented; there was also concern that a practical discipline like IS should be kept away from the influence of the highly theoretical approach of the CS department. Economics and Commerce was also seen as unsuitable; Penington did not want the new discipline to become "… a narrow professional subset of Management that the Faculty of Economics saw it becoming." (Dreyfus, 2004, p2). IS was instead located in the Faculty of Science, which Penington described as "… neutral ground – away from the clutches of both the engineers and the economists and accountants" (Dreyfus, 2004, p5).

That faculty's willingness to take IS (albeit initially on a two-year trial basis) is itself an illustration of the changing attitudes towards academic disciplines at the time. According to Penington, the Science faculty was suffering from declining enrolments in the traditional scientific disciplines, which had given it cause to regret its previous rejection of recent opportunities to take on new disciplines on the grounds that they were 'not real science' (Dreyfus, 2004, p6). In 1989 it had allowed Computer Science to move to the Faculty of Engineering, and subsequently it had rejected overtures to take over Psychology, which had gone on to flourish in the Faculty of Medicine. Penington suggested that it was these experiences which were responsible for the faculty now being willing to take on IS.

Summary

As with the business-based group of programs, the main feature of this group of IS programs is the diversity of both the circumstances by which they were formed, and the outcomes in terms of disciplinary. The following points highlight some of the key areas of difference between them:

- Origins and method of formation: At Deakin the IS major gave the appearance of being a continuation of the long-running IS stream which the university had offered almost since its foundation. However, the loss of the data processing stream into the BBusiness to the newly-formed School of MIS meant that the re-vamped IS major was very different to its predecessor, and was now much more closely affiliated with its companion CS major. At La Trobe the appearance of the BIS as a new degree was similarly misleading, as its content derived largely from the BComputer Science with which it was closely connected. Only at Melbourne was the IS program formed as an entirely new program, with no indications of its content having been influenced by the content of other programs. It was the only IS program which was designed from the outset as an IS degree, with its content deriving largely from the academic descriptions of the discipline, rather than evolving from the pragmatic needs of a vocationally-based applied computing program.

- Disciplinary affiliations: As indicated in the previous point, the IS programs at both La Trobe and Deakin were closely linked with CS, to the point where they were effectively off-shoots of that degree. The location of the Melbourne degree in the Science faculty was motivated not by any perception that it sharing a particular affiliation with any scientific disciplines, but as a defensive measure to protect it from CS and Economics.

- Independence and status: Only at the University of Melbourne, did the discipline achieve the full disciplinary status and independence of a specialist degree in a specialist department, whereas at both Deakin and La Trobe it had no separate organizational unit, and was offered alongside other technically-oriented IT programs. At La Trobe IS was granted full degree status, but at Deakin it was offered only as a major stream within the Science program.

- Adoption of the IS name: At all three universities, the IS program was identified with that name from the outset. That is, there was no repetition of the pattern which the previous section showed was common among the business-based programs of adopting the name 'Information Systems' as a new label for a program which had been previously known under some other name.

6.3.3 IS programs in computing faculties

As indicated earlier, two universities, Monash and the University of Ballarat, took the organizational mergers as an opportunity to consolidate their computing-based programs into a single academic organizational unit – a Faculty of Computing and Information Technology at the former, and a School of Information Technology & Mathematical Sciences at the latter. Table 6.3 follows the same format as the tables in the previous sections for business-based and science-based programs to show the contrasting results which ensued for their IS programs.

Pre-Dawkins Institutions	Pre-Dawkins organizational units and programs	Post-Dawkins University	Post-Dawkins IS outcome
Monash University	*Monash University* *Faculty of Economics & Politics* *Dept of Information Systems:* BInformation Systems	Monash University	*Faculty of Computing and Information Technology* • *Dept of Business Systems:* BBusiness Systems • *Dept of Information Systems:* BInformation Systems
Chisholm IT	*Faculty of Technology* *School of Computing & Information Systems* *Dept of Information Systems:* IS stream in BApplied Science (Computing)		
Ballarat CAE	*Faculty of Business* *(no departments):* IS major offered within BBusiness(Accounting & IS) *Faculty of Applied Science* *Dept of Mathematics & Computing:* • BComputer Science • BComputing	University of Ballarat	*School of Information Technology and Mathematical Sciences:* No specified IS department or program

Table 6.3: Impact of mergers/re-structures on the creation of IS programs and departments in computing-oriented faculties
(Source: Institutional Handbooks)

The table shows that at Monash, the merger of Monash with Chisholm IT led to the formation of a new specialist Faculty of Computing and IT. Both institutions had specialist IS programs and departments, and the outcome of the merger saw both departments taking places in the new faculty. This created an unusual situation of two departments with the same name, which necessitated a change in name for one of the two, from ‘Information Systems’ to ‘Business Systems’. But at the University of Ballarat, the consolidation of computing into a new School of IT and Mathematical Sciences brought an end to the long-running IS major which had been offered in the Faculty of Business.

The following discussion briefly outlines the key events in the organizational transformation at each of these universities as they affected the nature of their implementations of the IS discipline (for ease of reference, the relevant sections of Table 6.3 are repeated at the start of the discussion for each university).

- Monash University:

  The IS departments at Chisholm IT and Monash came from faculties associated with different disciplines. The Department of IS in the pre-merger Monash was located in the Faculty of Economics and Politics, and taught the vocationally oriented BIS degree, whose origins were described in Section 5.7. Chisholm’s Department of IS was located in the School of Computing and Information Systems in the Faculty of Applied Science, and taught a specialist stream of undergraduate units which constituted one-third of the compulsory content of the BApplied Science(Computing).

<table>
<tr><td>Monash University</td><td>Monash University
Faculty of Economics & Politics
Dept of Information Systems:
BInformation Systems</td><td rowspan="2">Monash University</td><td rowspan="2">Faculty of Computing and Information Technology
• Dept of Business Systems:
BBusiness Systems
• Dept of Information Systems:
BInformation Systems</td></tr>
<tr><td>Chisholm IT</td><td>Faculty of Technology
School of Computing & Information Systems
Dept of Information Systems:
IS stream in BApp Sci (Computing)</td></tr>
</table>

  In the negotiations over the merger arrangements, the university accepted a proposal put forward jointly by the Department of CS at Monash and the computing departments in CIT’s School of Computing & Information System that they should come together to form a new specialist Faculty of Computing and Information Technology. Other computing-related academic units, including the Monash Department of IS, were also offered places in the new faculty. Initially the Monash Department of IS expressed a preference not to join, but rather to stay as part of a business-oriented faculty. However, when it saw the outcome of merger negotiations over the structure of the university’s new Faculty of Business and Economics, it changed its decision and elected to join the computing faculty.

  Despite their common name, the differences in the disciplinary orientation of the two departments and their academic curricula were such that there appears to have been no serious consideration given to combining them into a single department. Instead, they remained as separate organizational units, and the problem over their identical names was resolved by giving the new name of ‘Business Systems’ to the former Monash department and its program on the university’s Clayton campus.

  The remaining Department of IS on the Caulfield campus sought to consolidate its position as representative of the IS discipline at Monash by expanding the scope of its undergraduate curriculum. Immediately after the merger it pushed hard, and eventually successfully, for the structure of the campus's main BComputing program to be altered, so that the stream of units which it taught into that program could be enhanced to achieve the status of a major. The changed structure also enabled the department to increase the number of undergraduate units it was able to offer as electives into the program. Later in the period, the department took the next step and established its IS program as an independent specialist degree.

These events left Monash in a similar state to Deakin University, with two departments and two degree programs which had been established with the name 'Information Systems', although in Monash's case, the change of name of the Clayton department and its program made this conflict less apparent.

- University of Ballarat:

Ballarat CAE	*Faculty of Business (no departments):* IS major offered within BBusiness(Accounting & IS) *Faculty of Applied Science Dept of Mathematics & Computing:* • BComputer Science • BComputing	University of Ballarat	*School of Information Technology and Mathematical Sciences:* No specified IS department or program

Ballarat makes an interesting exception to the other universities, because it was the only one which ended the period without an IS program. This is despite the fact that for many years previously the institution's Faculty of Business had offered a major in IS alongside a major in accounting as the only two streams within the BBusiness degree. The loss of this IS major can be attributed to the major organizational re-structure which was carried out as part of Ballarat's transformation from a CAE to a university.

This transformation occurred more slowly than was the case for most institutional responses to the Dawkins reforms. Initially Ballarat CAE considered merging with Deakin University, but when a suitable agreement could not be reached, it became an affiliated college of the University of Melbourne, and was re-named as Ballarat University College from 1990. At that stage the institution's intention was to become a regional campus of the University of Melbourne, but that plan was eventually dropped in favour of becoming a university in its own right. Consequently, the re-structure of the institution went through several stages as the plans for its future changed.

In the initial change from Ballarat CAE to Ballarat University College, a new Department of Information Management was created in the Division of Business, bringing together the staff who were responsible for information-related academic programs. The new department was staffed by two groups – the IS group who taught the IS major into the BBusiness, and the staff from the Department of Librarianship which had previously been located in the Faculty of Human Studies and which taught the BA(Librarianship). The new department continued to offer the IS major, and added a BA(Information Management) to its librarianship program.

But these arrangements did not survive the subsequent re-structure in 1994, when Ballarat became a university. It was this re-structure which consolidated all the new university's computing-related teaching into a new School of Information Technology and Mathematical Sciences. This school was built around the Department of Mathematics and Computing, which had been previously located in the Applied Science faculty, and offered a CS major and a science-oriented BComputing program.

The Department of Information Management in the Faculty of Business was closed down in the re-structure, and its staff dispersed, with only a few making the move over to the new School of Information Technology and Mathematical Sciences. The faculty's IS major was also closed down, as were its specialist undergraduate librarianship and information management programs. The BBusiness(Accounting/Information Systems) was replaced with a BCommerce, which included a computing stream taught by the School of IT and Mathematical Sciences, and designated as a major in business computing. It included several units from the School's maths/science-oriented BComputing program, and maintained a similar orientation to that program.

Summary
As with the business-based and science-based IS programs described in the previous sections, the key point to be noted from this brief outline of the changes at both universities is the variability in the circumstances which they encountered as a consequence of the Dawkins reforms, the variability of their responses to these circumstances, and the consequent contrasting impacts on the state of the IS discipline in each institution.

6.3.4 Summary

The final outcome of the changes described above in terms of the IS departments and programs which existed at the end of the period is summarised in Table 6.4. As well as listing the IS departments and programs, and the faculties in which they were located in each university, the table shows:

- the timing of the formation of each IS academic department as shown by their first appearance in the university handbook;
- the timing of the first offering of the IS academic programs as shown in the VTAC tertiary admissions guides;
- the size of the specialist departments which were responsible for IS as shown by the number of academic staff listed in the 1996 university handbooks

Not surprisingly, the largest departments were those at RMIT, VUT and Deakin which had formed from the merger of at least two separate pre-existing departments, and whose IS programs were offered across multiple campuses. The smallest department at the University of Melbourne had had no such pre-cursor departments and was still in the early stages of its development.

University	Structural Characteristics				Academic program	
	Faculty	**Department Name**	**Year Formed**	**Academic staff (1996)**	**Program Name**	**Year of First Offering***
Ballarat		No department	-	n/a	No program	n/a
Deakin	Management	Management Information Systems	1994	25	• Major in Management Information Systems • Major in Management Support Systems	1994
	Science	No specialist IS department (IS taught by School of Computing & Mathematics)	-	n/a	Major in Information Systems	1994
La Trobe	Science	No specialist IS department (IS taught by School of CS & CE)	-	n/a	BInformation Systems	1997
Melbourne	Science	Information Systems	1995	10	BInformation Systems	1996
Monash	Computing & IT (Caulfield campus)	Information Systems	1985	20	BInformation Systems	1997
	Computing & IT (Clayton campus)	Business Systems	1988	24	BBusiness Systems	1987
RMIT	Business	Business Computing	1993	28	BBusiness Information Systems	1988
Swinburne	Business	Information Systems & Technology	1992	19	BInformation Systems	1997
VUT	Business	Information Systems	1997	32	• BInformation Systems • BBusiness (Systems Support)	1997

* For IS programs which had existed previously but were re-structured, this column shows the year of first offering of the re-structured program

Table 6.4: Overview of specialist IS departments and academic departments in existence in 1996/97

Source: Institutional Handbooks

The table highlights the speed with which specialist IS departments and academic programs proliferated in the mid-1990s, and the relative uniformity of the choice of 'Information Systems' or some close derivative as their name. As the descriptions above showed, in many cases this name was chosen as a new label for a program of department which had previously existed under some other name. An obvious question is why this occurred so quickly and so consistently across the tertiary sector. It is likely that the answer to this lies in the development of the broader social and institutional framework for the discipline which occurred in Australia during this period. In particular, the following significant events raised the profile of the discipline and increased the level of recognition of the name:

- IS accreditation: In 1989, the Australian Computer Society began to recognise and accredit Information Systems as a computer-related discipline (Clarke, 2006).
- IS Conferences: A conference for IS practitioners which was called the First Annual Conference on Information Systems was held at Monash University in 1990. This inaugural conference was only a one-day event with 15 submitted papers, but it was repeated the following year as the Second Australian Conference on Information Systems, and by 1994 had become a 3-day long Australasian Conference on Information Systems. Its keynote speakers included distinguished international scholars in the field, such as Rudy Hirschheim, David Avison, Guy Fitzgerald, Ronald Stamper and TW Olle (Gable et al, 2008).
- Journal: The first edition of Australia's first specialist IS journal, the Australian Journal of Information Systems was published in 1994.
- ACPHIS: The Australian Council of Professors and Heads of Information systems formed in 1995 as a consequence of an informal meeting of senior figures in the discipline at the ACIS conference of that year (ACPHIS, 2012). It was formalised as the peak body to represent he interests of IS academics in Australia in 1997. One of its early achievements was the organization of a conference on IS curriculum in Australia, the papers from which were subsequently published as Arnott et al (1996).

These developments undoubtedly served to raise the profile of the term 'Information Systems' during the period and may well have contributed to the speed with which that name replaced terms such as 'business computing' 'data processing' and the like, which Chapter 5 showed had previously been the commonly-used labels for applied computing programs. But the uniformity of the adoption of the name helped to hide the variability of the academic programs which used it. The differences in these programs will become apparent in the discussion of their curricula in Section 6.5.

6.4 Market issues for IT and IS – levels of student demand

Despite the rapidly increasing importance of market force issues in tertiary education overall, it seems likely that they were of secondary importance in the evolution of IS programs during this period. As the previous section showed, in most institutions the main direct influences on the development of IS departments and programs during the period were the immediate needs for structural and disciplinary changes brought about by the Dawkins reforms. Although there can be little doubt that issues of market demand for computer-related programs would have been a topic for consideration in the discussions over disciplinary and structural changes, there is no indication of them having had any direct impact on institutional decision-making.

Table 6.4 also showed that most IS programs came into being or adopted that name late in the period. This leaves little scope for meaningful analysis of trends in market demand specifically for IS during the period. Therefore the analysis of market trends in this section looks at IT programs in general, to gauge the extent to which the heightened public interest in computing at the time was reflected in stronger demand for IT programs.

The data on which the analysis is based comes from the Victorian Tertiary Admissions Centre (VTAC), a body which was set up and funded by the State's tertiary education institutions to administer the process by which students applied for and were offered places in tertiary courses. The discussion which follows assumes a broad understanding of the workings and terminology of the VTAC admission system. The way in which the system operates is explained fully in Appendix B2.

Although the VTAC system maintains extremely comprehensive records of applications and enrolments in all courses in all institutions, the nature of the data presents some difficulties for analysis. The first of these is simply the problems which the instability of the educational institutions and their teaching programs create for any form of longitudinal analysis of the patterns of student demand during the period. The nature and extent of the changes in all institutions – with some teaching programs being merged, some being scrapped and some being created or enhanced – combined with the fact that the timing of the changes differed from one university to another, make it difficult to establish a firm baseline for making comparisons or tracking trends across institutions or within them. Secondly, the way in which some institutions structured their programs for admissions purposes makes it impossible to separate out the demand for specific degree programs. For example, a business faculty which included an IS program as one of several degrees which it offered might have used a single application code for admission to all of these programs, making it impossible to tell what proportion of the pool of applicants and admissions for that course code were interested specifically in doing IS.

A further complication in terms of the presentation of the results of the analysis is that under the terms of its agreement with the universities, VTAC maintains strict controls over the use and publication of its data. Researchers are allowed access to it, but are not permitted to publish the data or analyses of the data in a form which enables the identification of the details of the performance of individual programs or institutions. As the next chapter will show, in later years VTAC itself began to provide more information about student enrolments and cut-off scores for admission to programs, but this was not done during this period.

In light of these difficulties and constraints, the method of analysis followed here was to analyse and present aggregated data on student demand for a sample group of IT programs, which are listed in Table 6.5. Each of the programs in the sample was available for applicants for admission to tertiary education within the VTAC system in every year from 1991 to 1997, under its own VTAC code. The sample is large enough in aggregate to conceal the details of each individual program, in line with VTAC confidentiality requirements. It includes programs from all universities, except the University of Melbourne, none of whose IT programs met the requirement of being offered under their own admission code throughout the period. It also includes programs from all the main IT-related discipline areas – CE, CS, IS, and generalist IT. This makes it a broad enough sample to be considered representative of the general trends in student demand for IT.

University	Degree Program
Ballarat	Bachelor of Computing
Deakin	Bachelor of Business (Computing)*
La Trobe	Bachelor of Computer Systems Engineering Bachelor of Computing
Monash	Bachelor of Computing (Caulfield campus only)* Bachelor of Computer Science Bachelor of Business Systems
RMIT	Bachelor of Computer Science (city campus only) Bachelor of Business Information Systems
Swinburne	Bachelor of Information Technology Bachelor of Computer Science and Software Engineering
VUT	Bachelor of Applied Science (Computer Technology)
* For part of the period this program was offered under two separate codes for full-time and part-time students. For the sake of consistency, only the data for full-time are included in the analysis	

Table 6.5: IT programs used in analysis of student demand for IT

Figures 6.1-6.3 show three key indicators of the market performance of these programs. The data on which the graphs are based is included in Tables D3, D4 and D5 in Appendix D.

Figure 6.1 shows the popularity of the programs as shown by the number of applicants for university admission who expressed a strong preference for them. It shows the number of times in which these programs figured among the first four preferences listed by applicants for tertiary admission. The graph shows that the number of preferences followed a generally cyclical pattern of rises and falls, with peaks in 1993 and 1996, and with the total number of preferences for the programs at the end of the period being similar but slightly lower than at the start. The data was also tested using only the applicants' first preferences and also for the aggregate of their first eight preferences, and the trend line remained virtually identical. The trend lines for the preferences for the individual programs also generally followed much the same cyclical pattern as that exhibited by the group as a whole, but with variations in the size and timing of the peaks and troughs in demand. Just over half the programs earned fewer preferences in the final year of the period than in the first year, while just under half finished with more than they had started.

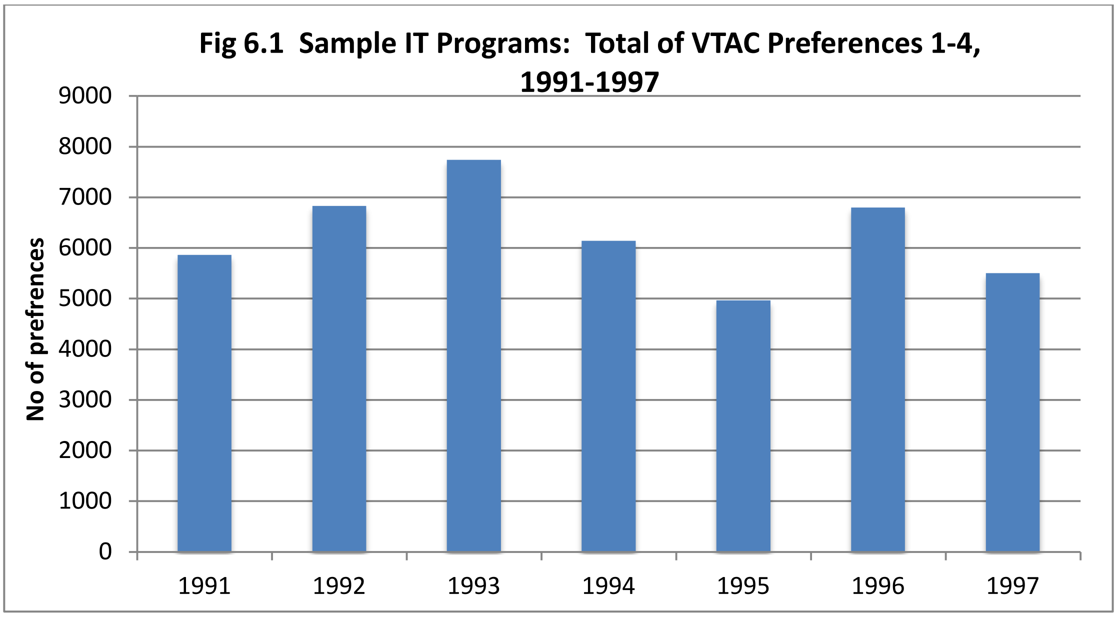


Fig 6.1 Sample IT Programs: Total of VTAC Preferences 1-4, 1991-1997
No of prefrences
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1991
1992
1993
1994
1995
1996
1997

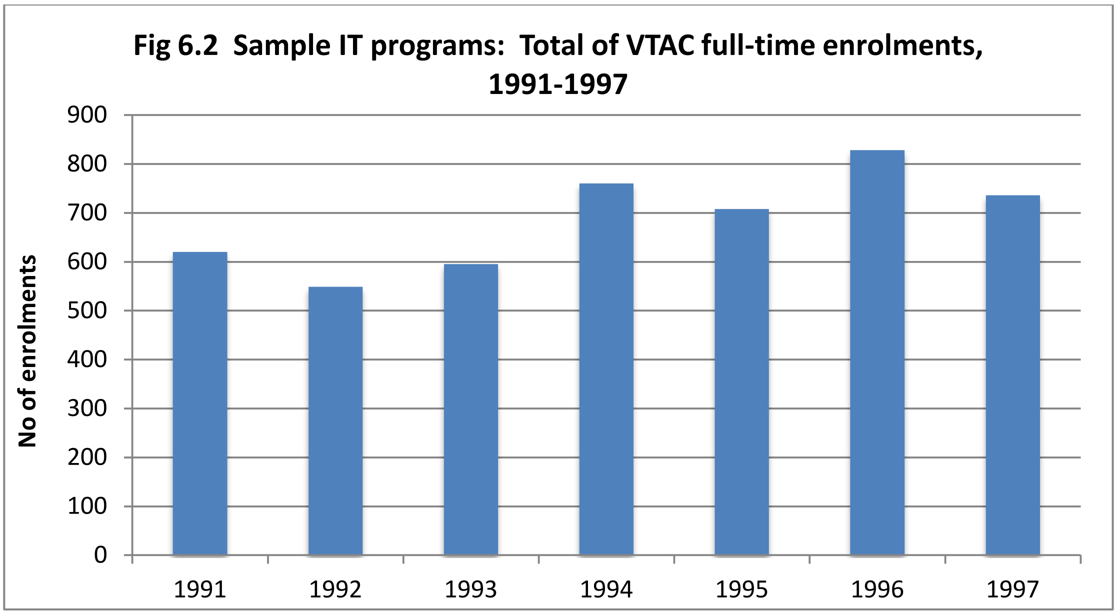


Fig 6.2 Sample IT programs: Total of VTAC full-time enrolments, 1991-1997
No of enrolments
900
800
700
600
500
400
300
200
100
0
1991
1992
1993
1994
1995
1996
1997

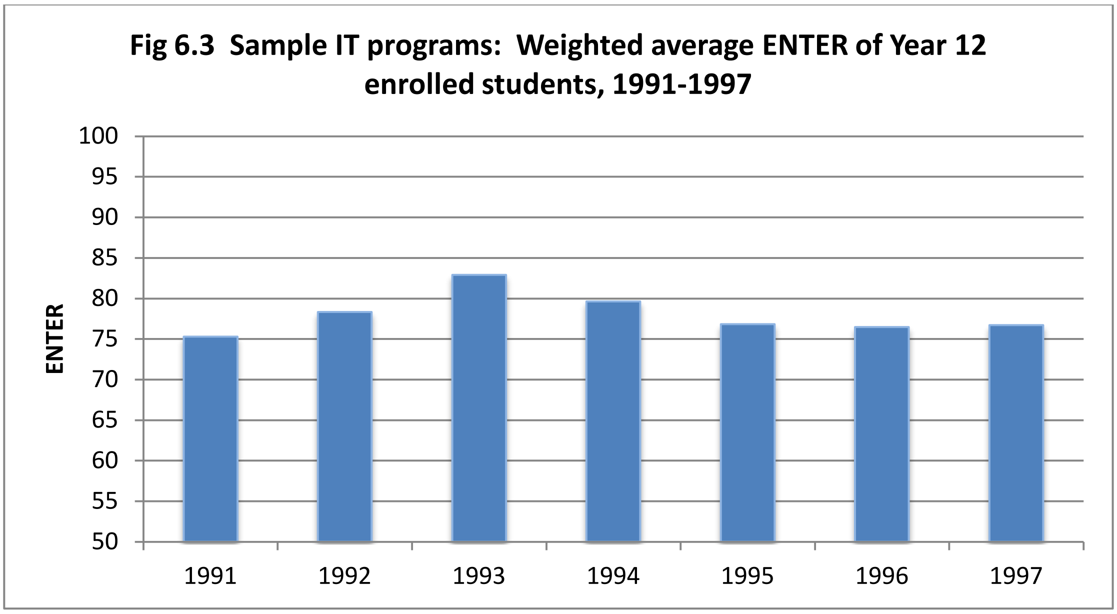


Fig 6.3 Sample IT programs: Weighted average ENTER of Year 12 enrolled students, 1991-1997
ENTER
100
95
90
85
80
75
70
65
60
55
50
1991
1992
1993
1994
1995
1996
1997

Figure 6.2 shows the extent to which the demand expressed by applicant preferences for admission was translated into actual enrolments in the programs. It shows the aggregate number of students registered in the VTAC system as having been offered a place and enrolled as full-time students in one these programs. The pattern of enrolment numbers was also variable, but showed a slightly more consistently upward trend throughout the period than did the preference data, which meant that by the end of the period, total enrolments were significantly higher than at the start. In contrast to the pattern for preferences, the enrolment patterns for the individual programs were extremely variable, with little similarity between the trend lines of the different programs. Just under half the programs finished the period with fewer enrolments in its final year than in its first, while just over half finished with higher enrolments

Figure 6.3 shows the 'quality' of the students who were admitted to the programs, as measured by the ENTER of students who earned admission on the basis of their Year 12 results in the previous year (ie students who went straight from secondary school to university). These students comprised the bulk of admissions through the VTAC system, normally accounting for at least 70% of the overall total. The graph gives a weighted average of the ENTERs for this cohort of students for each year, which was derived by calculating the average ENTER of the students admitted to each program, and then calculating an average of these ENTERs, weighted according to the number of students in each program.

The graph shows that the average ENTER scores remained relatively stable over most of the period, except for a significant rise which coincided with the early peak in student preferences in 1993. Virtually all the individual trend lines for each program followed much the same general pattern, with their average ENTER scores climbing to a peak in about 1993-94 before falling back to about the same levels as at the start of the period. But as one would expect, there were significant differences between universities in terms of the range of ENTER scores through which this trend line passed. In the larger and more prestigious universities, average ENTER scores were usually in the mid-high 80s, rising as high as the low 90s at their peak, while at the other end of the scale, in the smaller and lower-status universities, ENTER scores spanned from the mid-high 50s to peaks in the low 60s.

These data suffer from some obvious limitations as the basis for drawing definitive conclusions about demand for computer-education during the period: they are only for a sample group of IT programs, they include only the main intake of local Australian students at the beginning of the academic year and omit mid-year intakes which some universities offered (but which were not done through VTAC), and they omit international applications and admissions, which began to increase significantly during this period. They also do not allow for consideration of factors internal to institutions, such as the allocation of quotas for places in programs which may have affected decision-making over enrolment numbers.

Notwithstanding these limitations, the data give clear indications that there was only sluggish growth in the domestic student market for IT during the period. Despite the growing public profile of computers, their increasing ubiquity, and the recognition of the importance of their role in business, government and society, specialist degree programs in IT still attracted only a moderate level of interest among university applicants, with no signs of any significant consistent upward trend. This is also despite the fact that this was a period of strong increase in university student intakes, in which the number of students undertaking tertiary study in Victoria grew at an average rate of more than 4% per year (DETYA, 2001). The overall trends in the data for the sample set of IT programs appears barely to match this general increase, let alone show any significant increase in IT demand. The data show no consistent pattern of growth in either the absolute numbers of students applying for IT programs or in their ENTER scores; that is, there is no clear indication of IT attracting increased levels of attention overall, or from high-performing students. Some programs performed strongly both in numbers and in quality of students, but there was no consistent trend across the sample group of programs as a whole.

As indicated at the start of the section, it is difficult to assess the performance of IS programs as a specific part of the IT market, because so many of them appeared so late in the period. Only the IS programs at Deakin, Monash and RMIT were offered throughout the period, and they were included in the sample group of IT programs analysed above. There were differences in the performance of these three programs, but they constitute too small a group to enable any meaningful analysis of these differences without breaking the VTAC restrictions on confidentiality. But for the group overall, it is fair to say that their aggregate patterns of preferences, enrolments and average ENTER scores were in broad conformance with the patterns described above for the IT sample group as a whole.

The data for 1997, which was the only year in the period in which all IS programs were offered, shows that they were among the most popular IT programs in Victoria. In each of the seven universities which offered an IS program, comparison of its performance against that of the other IT programs offered by the university showed the following:

- At five of the seven universities, the IS program rated as either the first or second most popular IT program offered by the university that year, in terms of student preferences for admission (using the total of VTAC preferences 1-4 as the measure of popularity).
- At four of the seven universities, IS programs were first or second among its IT programs in terms of student intake for that year (using full-time student enrolments through VTAC as the measure of intake).
- At five of the seven universities, IS programs were first or second among its IT programs in terms of the quality of the students who were enrolled in that year (using the average ENTER of the Year 12 students who were admitted into each program as the measure of student quality).

Only two of the IS programs listed in Section 6.3.4 failed to appear in at least one of these groups. Thus, although the data on market demand suggests that the level of demand for IT programs overall was relatively weak and showed few significant signs of growth, IS programs were consistently among the leaders in terms of student demand within the IT program group as a whole.

6.5 IS Curriculum

The discussion in Section 5.9 of the curricula of applied computing programs offered by CAEs during the pre-Dawkins era highlighted the way in which the appearance of uniformity in their content belied the differences in their disciplinary origins. It showed that on the basis of the brief unit descriptions contained in institutional handbooks, differences in curricula during that period were generally observable only at the very broadest level of disciplinary categorisation into science-oriented or business-oriented programs. Although the IS programs which were formed during this period grew out of these similar-looking applied computing programs, this section will show that their curricula began to display a much greater level of individuality. Most of the IS programs which were established had their own unique set of characteristics which enable the curriculum of each program to be clearly differentiated from the others.

Two key factors can be identified as having contributed to the change from the uniformity of the applied computing curricula to the individuality of their IS successors. The first is simply the fact of the increased size in the curricula. As discussed in Section 5.9, the limitations in the size of the applied computing curricula and the commonality in the range of basic themes they covered left little scope for the differences in their origins to show themselves. That is, computing majors offering as few as 6-8 units on the basic features of computer hardware, programming, database, system development and the like looked much the same, no matter what discipline they had been originally associated with. By contrast, IS departments operating as fully-fledged, independent academic units with their own degree programs were able to increase substantially the number of units they offered. This enabled them to extend the range of topics which they covered well beyond the basic computing concepts which had taken up so much of the curriculum of their applied computing predecessors, and include units covering the more specialised aspects of computing applications which were associated with their original disciplinary parent(s).

The second factor was the impact of the disciplinary and structural changes described in Section 6.3, which served to accentuate the uniqueness of the organizational environment in which each program was developed. Although Chapter 5 also stressed the diversity of the circumstance in which applied computing programs had been formed, it showed that there was a much greater level of commonality among them in terms of groups of programs with shared similar disciplinary origins. For example, the group of programs which originated in accounting might have differed from the group which originated in operations research, but there was likely to be a high degree of similarity between the programs within each of these two groups. But Section 6.3 showed how the variability in the circumstances surrounding each of the organizational re-structures in this period meant that each of the IS departments and programs was formed as the product of a unique combination of conditions. This diversity in their origins was reflected in the characteristics of their program curricula.

The curriculum outlines for all the IS programs as they stood at the end of the period demonstrate this diversity (see Tables D6(a) and D6(b) in Appendix D). The division of the programs into the groups in each table has been done both for ease of presentation, and also to enable continuation of the comparison across the science-business divide which was featured for in the analysis in Chapter 5; Table D6(a) includes the programs which originated in business faculties, and Table D6(b) includes those which originated in science faculties. The tables use the same basic structure to categorise the units as that used in Chapter 5, but also include an additional field to include other units which the IS department offered as elective options. The unit outlines comprise only summaries of the brief unit descriptions given in university handbooks.

The ongoing need for all the programs to continue to cover key fundamental concepts in IT means that, at first glance, it is easy to get an impression of similarity between the program curricula. This is demonstrated in Table D7 in Appendix D, which shows the level of coverage of these fundamental concepts within the core units of each program. It shows that all programs offered at least one specialist unit covering five of the ‘standard’ fundamental IT themes identified in Section 5.9.1 - basic concepts, database, programming, systems development and project work; the other standard themes - in computer hardware, networks and data communications and IS management – were included in specialist units in at least half the programs.

But a closer inspection of Tables D6(a) and D6(b) reveals the differences between the curricula, as expressed both through the details of their coverage of these fundamental themes, and through the inclusion of units on other specialist topics. These differences and the factors which caused them are explained in the following discussion, which briefly outlines the key defining features of the curriculum of each program; the discussion first examines the programs which originated in business-based disciplines and then those which originated in the sciences (Monash’s two IS programs which were based in a Faculty of Computing are located according to the faculty from which they originated, while the program at Melbourne which did not originate with any specific discipline is placed with the sciences group, in keeping with the department’s location in the Faculty of Science).

6.5.1 Programs with origins in Business

The need to retain a core of introductory units in business disciplines reduced the flexibility and scope for diversity of most business-based IS programs. All programs except that at Monash included a similar set of introductory units in a variety of aspects of business, such as accounting, management, economics, business law and quantitative methods. Therefore the clearest evidence of the differences in their emphasis came in their choice of specialist and elective units. The following discussion briefly outlines the key differentiating features of their curricula:

- Deakin (Business): The IS major at Deakin was the most flexible of all the IS programs in its structure. It had only a single compulsory introductory unit, and divided the rest of its 15 units into two groups, from which students had to select a prescribed minimum number. The flexibility of this structure was in keeping with the fact that Deakin was the only university in which IS was still available only as a major (both in this program and in its science-based program described below), and was therefore much more limited in terms of the number of units it could prescribe. The fact that the program was formed as a consequence of a 3-way institutional merger may have also contributed to the need to keep it as flexible as possible to accommodate the desired curriculum orientation of each campus – the units in the major were not all offered on all campuses.

  The Deakin curriculum maintained the close connection which IS had previously had with the quantitative methods group at Victoria College, and which joined it in the re-structure as part of the new School of MIS. This connection is apparent from the list of specialist and elective units in the curriculum outline, in which units with an operations research flavour predominate. The School also offered these units as a part of separate major in management support systems.

- Monash (Clayton): The decision of the IS group at Monash (Clayton) to leave the business faculty to join the university's new Faculty of Computing and Information Technology meant that it was unique among the business-based programs in having been able to dispense with the business core. It required students to take only a single business unit, which meant that the IS content of the curriculum was much larger than for the other business-based degrees.

  Despite the removal of this aspect of its connection to business, the program otherwise retained its original business focus. Its extensive range of specialist and elective units were oriented largely around IT applications in large businesses, with a particular emphasis on techniques in quantitative analysis and system modelling, which reflected its origins in operations research. It also retained the industry-based learning component which had been a central feature of the program from its conception (as outlined in Section 5.6). The final unusual feature of the program was that its core included only one generalist introductory unit on the systems development process, and the teaching of that unit was outsourced to the Department of IS at Monash's Caulfield campus. This arrangement was a consequence both of the lack of emphasis on that aspect of IS within the Clayton department, and also of the specialist focus on it by the Caulfield department (as discussed in the next section).

- RMIT: The BBIS at RMIT was the only program which retained the same name through the institutional mergers and re-structures, which gave it an appearance of greater continuity than its IS counterparts in the other universities. But despite this appearance of continuity, its curriculum underwent significant change during the merger with Phillip IT.

  The description in Section 5.7 of the RMIT program's pre-Dawkins origins noted that a major factor in the formation of both the BIS department and its degree program was the desire to continue to support studies in office administration and systems. In its original design, the BIS degree had explicitly rejected the objective of producing system developers, and had been oriented to meet the needs of the 'intelligent user'; its content had included core content in office systems, and offered a major stream in Office Systems. But in the course of the merger with the PIT program in business computing, the BIS was transformed into a more conventionally-oriented generalist applied computing degree.

  The program objectives and likely career outcomes were modified from their 'intelligent user' focus to emphasis the more usual IT-oriented roles in systems analysis, programming, technical support and the like, and the sequences in office systems and office administration which had been central to its formation were closed down. In making these changes the program lost any obvious signs of its original disciplinary origins at either PIT or RMIT.

The core curriculum remained largely confined to the standard set of IT themes identified earlier for applied computing programs, and its units were uniformly spread across them, with no evidence of any orientation towards any particular theme.

The clearest evidence of the diverse influences on the curriculum is its extensive range of electives – the largest group of electives of any of the programs at this time, rivalled only by VUT. These electives included a few units on specialist topics such as knowledge-based systems, decision support systems and groupware, but the majority to them were focused on technical aspects of computing, with a particular emphasis on programming.

- Swinburne: As indicated in Section 6.3.1, the IS department at Swinburne was virtually unaffected by the institutional mergers during the period. Consequently its IS program was the one which changed least in its orientation. Its only significant change was that it doubled in size from the basic set of 8-10 units which made up the major at the start of the period to almost twenty units which were offered by the time it became a full degree program. The units of its curriculum continued to focus almost exclusively on the basic set of fundamental technology-based themes, with its new units simply extended the level of coverage given to them.

  In the Swinburne handbook, the units were categorised into three broad groups – business computing units, which aimed to meet the needs of students who saw themselves as users of IS, rather than as IT professionals; business systems units which were based around the analysis and specification of business information needs; and software development units which focused on systems design and implementation in businesses. The units were distributed fairly uniformly across the standard set of IT themes identified earlier, with no sign of bias towards any one of them. The only unit on a specialist topic that did not fit into one of those themes was an elective on knowledge-based systems.

- Victoria University of Technology: At VU, the decision to retain the different flavours of the applied computing programs from both the merging institutions created what appeared to be the most diversified IS curriculum of all the universities. Not only did it support multiple separate designated majors – in information management, information systems, systems development, systems technology and systems support – but its focus on issues in IS management was deemed sufficient to require a separate degree, the BBusiness(Systems Support). Although separate from the BIS, this program was described in as being equally focused on IS, providing graduates with "… sound knowledge and experience of both the conceptual foundations and practice of Information Systems" (VUT, 1997, p31).

  The core content of these two programs overlapped significantly in their coverage of core areas of IT – programming, database, systems development and the like, but the emphases in their coverage were sufficiently different for the department to continue to maintain separate sets of units on each topic to suit the specific requirements of each degree. The range and diversity of elective units reflected the diversity of the separate majors supported by the department.

6.5.2 Programs with origins in Science

The science-based group of programs were even more diverse than their business-based counterparts. Their curricula show much more obvious differences between each program, and, as a group, their orientation was distinctly different to that of the business programs.

- Deakin (Science): The re-shuffle of the computing programs which the School of Computing and Mathematics offered into Deakin's science faculty appears to have had a significant impact on the curriculum of its IS major. Previously, the IS major had shared several units and appeared to have much the same orientation as the data processing major which the School had offered into the business faculty. But after the business faculty replaced the data processing major with its own new MIS major, the content of the IS major within the awkwardly-named BScience(CS & Software Development/IS) was modified to make it very much an off-shoot of the CS major. Ten of the units in the curriculum of the IS stream were also core units of the curriculum of the CS stream.

  The curriculum outline in Table D6(b) shows that the units continued to cover the standard themes in IT fundamentals as before, and the brevity of the unit descriptions in the handbook make it difficult to gauge the effects of the change on the orientation of the program. However even on the basis of these limited unit outlines it seems that the revised IS curriculum took a much more theoretical and technical approach than it had done in its previous form. For example, two of its three units covering systems development were now named as software engineering units, and its electives focused on technically-based content typical of a CS degree.

- La Trobe: As at Deakin, the main feature of the La Trobe BIS was the closeness of its association with the university's CS program, with almost all of its units being taken from the curriculum of that program. The curriculum outline in Table D6(b) shows that most of the curriculum continued to be based around the fundamental IT themes, but the impact of the disciplinary association with CS is even more obvious than it was at Deakin. This is shown most obviously in the inclusion of 5 specialist programming units and a unit on artificial intelligence in the curriculum core. Many of the other unit descriptions also show a technical and theoretical orientation typical of CS. The program offered no specialist IS elective units and almost all its core units were also designated as electives for the BComputer Science.

- Monash (Caulfield): The unique feature of the Monash BIS at its Caulfield campus was the extent to which its core elements were taught by other departments. Six units of technical content in computer hardware and operating systems, database and programming were taught by its neighbouring IT departments at Caulfield, and a unit on project management was taught by the Department of Business Systems, which offered Monash's other IS-oriented program at the Clayton campus.

The need to outsource the technical units in this way derived from the way in which IS was originally defined as being based around the non-technical aspects of computing, leaving all hardware and software-related content to the other specialist departments (outlined in Section 5.7). This arrangement was retained when the IS major was up-graded to degree status, which made for an odd situation in which the IS department owned and taught only about half the core units of its own BIS program. The other outsourced unit in project management came as part of the arrangement which saw the Caulfield department teach a systems development unit into the Clayton program in exchange for the Clayton department teaching the project management unit at Caulfield.

The outline of the objectives for the BIS identified the system development process as its primary focus, and most of the units taught into the degree by the Department of IS emphasised that theme. The study of decision support systems was also an important element of the curriculum. The other notable feature of the curriculum was its inclusion of a requirement for students to include two business units in their electives and to take a minor in a non-computing discipline. As explained in Chapter 5, applied computing and IS at Monash's Caulfield campus had originated in close association with business, before an organizational re-structure forced a reluctant re-location to science. After the Dawkins mergers enabled IS to be re-located again into Monash's new specialist IT faculty, the inclusion of these non-computing requirements showed that the original affinity for business had not been lost, and that IS was perceived as having a strong association with the social sciences.

- University of Melbourne: The process by which the program was created (described in Section 6.3.2) ensured a unique orientation to its curriculum. Designed from scratch, with input from academics from varied disciplinary backgrounds and with the deliberate aim of preventing its domination by any specific discipline, the resultant curriculum showed the mixture of influences on its development from technology, business applications, organization theory and systems development.

  The unit outlines in Table D6(b) show that much of the content of the core units covered the same fundamental IT themes which were common to other IS programs. The specialist and elective units demonstrate an eclectic blend of content from each of the contributing disciplinary areas, with no sign of any one area appearing to be dominant.

6.6 Summary and conclusions

The structural changes which took place under the Dawkins reforms had a profound effect on the development of the IS discipline in Victorian universities. In the short-term, they helped consolidate the place of IS as an academic discipline, by giving it widespread formal recognition through the establishment of specialist IS departments and programs within most universities. But more importantly, from a long-term perspective, they determined the place which the discipline would occupy within the academic and disciplinary structures of each university. These structural decisions established the framework for future relationships between IS and other disciplines, and determined the directions in which IS could develop.

It is worth noting that this contrasts with the situation for CS and CE programs, for which the structural changes were much less significant. The fact that CS and CE teaching departments and programs were already relatively well-established and were generally located in similar faculties and departments in each institution meant that the process of consolidation and merger of departments and programs was relatively straightforward for most universities. It is easy to trace the transition from pre-Dawkins to post-Dawkins institutions and the location of the departments and programs in the merged institutions generally followed a predictable path.

The following points summarise the key outcomes of the period:

- Disciplinary recognition of IS: By the end of this period, IS had clearly established a distinct disciplinary identity and presence in every university, except the University of Ballarat. With the exception of Ballarat, almost all universities had designated IS departments and offered full degree programs in IS – the only exceptions were Deakin University, which offered IS as a major rather than a full degree, and La Trobe University, which did not have a specialist IS department.
- Basis of formation: The circumstances which led to the formation of IS departments and programs in the post-Dawkins universities varied significantly from one university to another: some had been created in the previous period and continued on in much the same form (Monash, Swinburne); some were the product of departmental mergers (RMIT, VUT, Deakin); some were created from scratch (Melbourne, La Trobe); while Ballarat's previous IS program and department were closed down as a consequence of the organizational re-structure caused by the Dawkins reforms.
- Applied/vocational heritage: In almost all cases, the origins of IS departments and programs can be traced directly to the vocationally-based applied computing programs whose characteristics were outlined in Chapter 5. The main exception to this was the University of Melbourne, which had no previous applied computing program, and in its case the development of its IS program and department was motivated at least in part by concern over its lack of such a program. (The IS program at La Trobe University did not have an immediate direct precursor, but had had a precedent in the vocationally-oriented IS major which offered in the late 1970s and early 1980s).
- Diversity of origins: Each of the IS departments and programs was the product of a unique set of circumstances which governed its formation. Firstly, they varied in terms of the blend of disciplinary influences from the applied computing programs with which they were originally associated; and secondly, each department/program was shaped by a unique set of structural factors associated with the mergers and re-structures caused by the Dawkins reforms.
- Individuality/uniqueness of department/program orientation: The diversity in the circumstances governing their formation meant that despite their common name and similar applied/vocational origins, there were significant differences in the orientation of the IS departments and programs. This was shown in the split between business-based and science-based departments/programs, but was also evident in differences between the departments/programs within

these broad categories; it was most conspicuous at Deakin and Monash, where two programs (and at Monash two different departments) formed under the banner of IS.

- IS curricula: The expansion of the scope of IS academic programs which occurred as a result of their achievement of disciplinary recognition enabled the differences in their orientation to become more evident than had been the case with their applied computing predecessors. Although they retained the similar set of core themes of computing fundamentals, their curricula began to show clear signs of the differences in their disciplinary origins.
- Market demand: The availability of IS programs during the period was too limited to enable a clear picture of trends in its popularity as a discipline. The limited data available suggests that it performed reasonably well in comparison with other IT programs, but the IT sector as a whole was only moderately popular in terms of the number and quality of domestic students it attracted.

Chapter 7: Rise and fall - the evolution of IS and IS curriculum in Victoria from 1997 to 2011

7.1 Introduction and overview of developments in this period

For IS and for IT education in general, this period was dominated by a boom and bust cycle in public interest in computer education, as expressed in student demand for IT-related programs. During the first part of the period in the late 1990s, the continuing rise in the accessibility of computers, together with technological developments in areas like multimedia and the world-wide web caused the surge in interest in IT which manifested itself in the so-called dotcom boom (Lowenstein, 2004). This was reflected in rising student applications and enrolments from both the domestic and international student markets. Then, in the aftermath of the crash which followed the boom, levels of domestic student demand for IT began to fall, and continued to decline virtually to the end of the decade. Enrolments of international students in IT programs also declined from the levels seen in the dotcom era; the rate of their initial decline was generally slower than for domestic students, but it quickened with the onset of the global financial crisis in 2007.

The academic literature indicates that this pattern of changing demand for IT was not just an Australian phenomenon, but was observed at universities throughout much of the developed world during this time. Granger et al (2007) claimed that world-wide enrolments in IS programs which had boomed in the late 1990s to reach their peak levels in about 2001, then dropped by as much as 70-80% by 2007. Similar problems of declines in student numbers and quality were widely reported in CS and CE (Sydell, 2004, Abramson, 2008, Benokraitos et al, 2009), though signs of a turn-around in fortunes were reported towards the end of the study period (for example, Markoff, 2009).

The consequences of these fluctuations in the popularity of IT were exacerbated by the ongoing changes in the higher education system in the aftermath of the Dawkins reforms. Although the stated aims of those reforms had been to simplify and unify the tertiary education system, they had the effect of plunging Australian universities into "... a perpetual state of 're-organisation'" (Atkins & Herfel, 2006). One of their most important consequences, which was further reinforced by subsequent government policy decisions on tertiary education, was to accentuate the role of universities as mass education providers. Time-series comparisons of student numbers are made difficult by the change in the institutional environment, but Bradley (2008) noted that between 2000 and 2006, enrolments of domestic students in Australian universities increased by 7% and international student numbers more than doubled to become about 25% of the total university enrolments. These increases added further impetus to the trends which had begun in the 1990s towards increasing student diversity, and increasing expectations that university programs would meet vocational educational needs (Kirkpatrick & Garrick, 1998).

At the same time, the level of government financial support for university operating costs diminished, and universities were instructed by the federal government to take steps to become more financially self-sufficient and operate in a more business-like way (Marginson & Considine, 2000). Inevitably, economic viability became progressively more important in the assessment of academic departments, and the ability of their programs to attract students came under increasing scrutiny. For many Australian universities their main source of financial salvation during this period was the rapid increase in the popularity of Australia as a destination for international students; the sharp decline in this market during the global financial crisis caused what was widely described in the higher education sector as a crisis in funding levels. As a consequence, many universities began to initiate organizational re-structures and in some cases cuts in staffing (see, for example, ABC, 2008).

For IT departments, the problems created by the fluctuations in the student market were exacerbated by the rate of technological change, both in traditional technologies and in emerging specialist areas such as web design, e-commerce, games development, security and mobile computing. They were faced with decisions over whether these advances should be integrated into existing programs as an extension of traditional computing, or treated as new and fundamentally different areas of study which warranted new programs in their own right. This involved consideration of intellectual issues relating to the knowledge content of these new areas and its relationship to existing disciplinary boundaries, and also pragmatic issues such as the resource costs involved in extending disciplinary coverage into these areas, and the likely income which they might attract from new student enrolments.

To complicate the picture still further, IT departments also faced increased competition from other disciplines over some areas of computing. The increasing availability and commodification of the technology meant that application-focussed programs in areas like web design, multimedia or electronic commerce might equally be taught in a design or business department as in a specialist computing department. In an increasingly corporatised university environment, where departments and faculties competed for resources, these changes meant that the approach which a specialist IT department adopted to new areas of computing had to take account not only of the intellectual issues of disciplinary knowledge, but also economic issues of costs and benefits and long-term strategic issues of control over areas of academic 'territory' within the institution.

This chapter's analysis of the way in which IS fared during the period is structured in a similar way to the two previous chapters, with some slight variations in sequencing and emphasis to account for the changing circumstances:

- Section 7.2 gives an outline of the changes which occurred in the overall state of IT education programs of all types.
- Section 7.3 comprises a detailed analysis of the changing state of the student market for IT programs in general and for IS in particular.
- Section 7.4 describes the consequences of the fluctuations in the student market as they were seen in disciplinary and structural changes which affected IS departments and programs.
- Section 7.5 assesses the impact of all these changes on IS curriculum.
- Section 7.6 provides a brief summary of the state of the discipline at the end of the period.

7.2 Overall patterns in the development of IT and information-related programs

Both the boom and bust phases of the changing student market for IT during the period caused instability and change in the offerings of all types of IT-based academic programs. Many new programs were introduced and existing programs modified or scrapped in attempts either to capitalise on IT's popularity during the boom years, or to halt its declining student enrolments during the bust. A detailed analysis of these changes would be a significant study in its own right, but the following broad overview is sufficient to set the context for the subsequent analysis of IS-related programs. As in previous chapters, it starts with an outline of the position of IT education in universities at the end of the period and then analyses the changes during the period which brought it to that state.

Table E1 in Appendix E lists the specialist undergraduate IT-related programs which remained at the end of this period as shown in the VTAC guide for 2011. The table includes only IT programs which had achieved the status of independent degrees, and does not show majors or streams of IT units offered within other disciplinary degrees.

At first glance the overall picture of IT education revealed by the table looks broadly similar to that shown by the equivalent table at the beginning of the period (shown in Table D1 in Appendix D). The overall number of IT-related programs remained almost exactly the same, and IT still retained a strong presence in most universities. The table shows some minor changes in the nature of IT programs, which have been reflected in its program categories. The four mainstream IT program categories which existed at the start of the period – IS, generalist IT, CS and CE – remained much as before, although with some changes in their relative strength. In particular, CE had suffered a significant reduction in overall program numbers, but the level of recognition of Software Engineering as a specialist program had increased to the point where it has been classified as a category in its own right. But the information-related programs, which were noted as being in decline in the previous chapter, finally disappeared completely at the undergraduate level (although some of them remained as postgraduate programs). By contrast, despite the removal of Software Engineering from this category, there was a significant increase in the number of programs classified as 'Other IT'. The new programs in this category covered a variety of specialist topics such as games development, security, networking and multimedia.

On a university-by-university basis, the biggest losses in programs were at the two largest universities, Monash and the University of Melbourne. Monash reduced its program numbers by more than half after a major re-structure of its IT faculty, which will be discussed in more detail later in the chapter. At Melbourne, the closure of all its undergraduate IT programs resulted from the introduction of a new model of undergraduate education called the Melbourne Model in 2008 (University of Melbourne, 2012). Under this model, almost all of the university's specialist undergraduate programs were closed down and replaced with a very small number of broad generalist degrees, such as Arts, Science, Commerce, and the like. Specialist programs were generally retained for offering only as postgraduate degrees to be taken after completion of an appropriate generalist undergraduate degree. The table lists the IT programs which were being offered in 2008 before the Melbourne Model was introduced to demonstrate that at that stage they remained the same as at the beginning of the period. The main contributors of new IT program offerings to balance these losses were the technology-oriented RMIT and Swinburne universities, both of which almost doubled their numbers of IT-related programs, mainly by the addition of new specialist programs of the 'Other IT' category.

But the apparent sense of stability implied by this simple comparison of the overall number of programs at the beginning and end of the period is misleading, and fails to show the extent of the change which IT education underwent during the period. Table E2 in Appendix E gives a better indication of the level of turbulence, by making a comparison between the actual programs offered in 2011 and those which were offered at the beginning of the period. It shows that only about half of the 2011 programs had survived throughout the entire period, with the others being new programs whose introduction counter-balanced the loss of others which were closed down during the period.

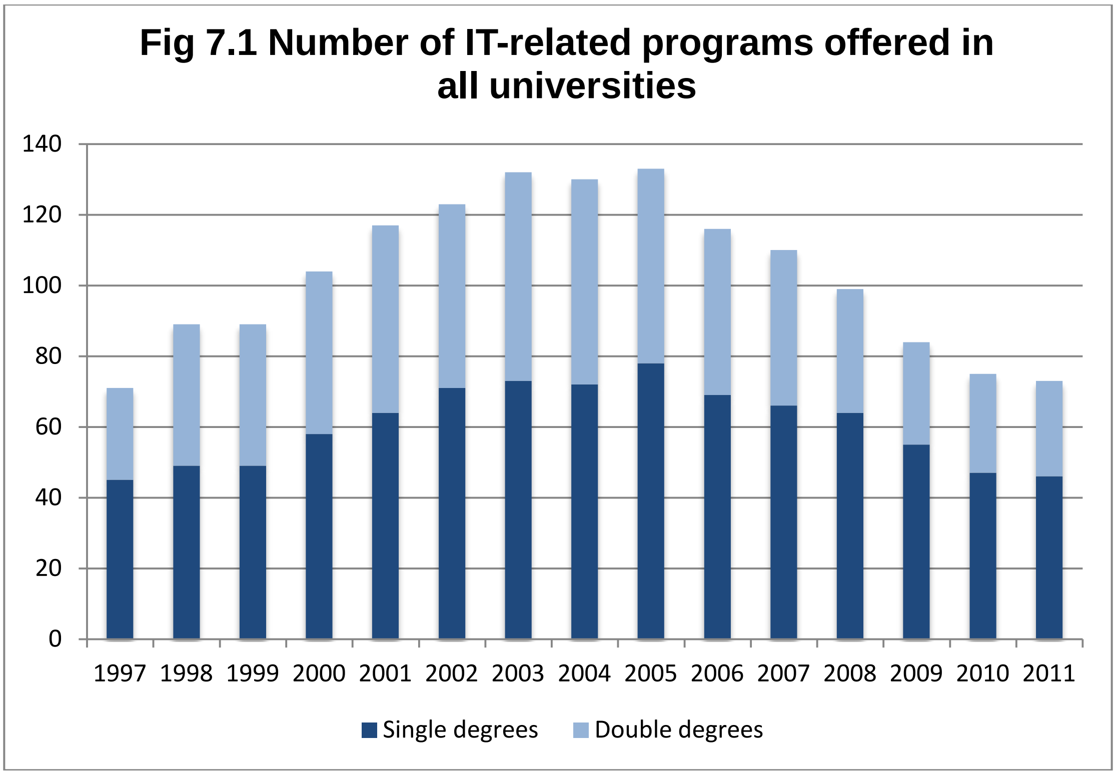
It should be noted that this comparison necessarily involves some subjective judgements as to whether the changes in a given program constitute the replacement of an old program with a new one, or the continuation of the old program in modified form. The descriptions of programs given in handbook entries and VTAC Guides are sometimes so sketchy as to make it difficult to make this assessment. For example, some programs which existed in 1997 were re-structured and their content changed to such an extent during the period that the 2011 version appears to be effectively a completely different program, even though it retains a similar name and the same VTAC code; on the other hand, some 2011 programs with new names and VTAC codes appear to be much the same in content and objectives as a 1997 predecessor which was discontinued. The assessments made in drawing up the table were based on the information on programs and their curriculum content contained in the university handbooks, but there may be some cases where these judgements of program continuity are incorrect. However, any errors of this kind would be few enough in number not to affect the overall picture which the table presents.

Even this more detailed analysis understates the level of change in IT programs during this period, because it does not show the programs which were introduced after 1996, but then discontinued before 2011. These programs are listed in Table E3 in Appendix E, together with their years of offering.

The programs in this group which originated in the early part of the period, up until about 2002, can generally be seen as attempts to capitalise on the growing student market for IT during that time, while those which were introduced in later years were generally attempts to stem the subsequent tide of declining enrolments in mainstream programs. It is not possible to track the reasons for their discontinuation, but all suffered from low and declining student applications and enrolments years, and it appears certain that these were a major factor in their closures.

The net effect of the changes in IT programs can be seen in Figure 7.1 which plots the trend in their total numbers, including both single and double degree programs, which were offered across all the universities throughout the period. Again there is some subjectivity involved in the data for this graph. For example, the blurring of disciplinary boundaries leaves room for argument over whether some programs should be deemed to be IT programs, and there are some cases where the offering of programs with similar characteristics makes it difficult to tell whether they are separate and distinct programs, or are merely different versions of a single program. However, the number of such cases is again small enough to have no effect on the general patterns shown in the graph.

The graph shows how the rapid increase in the number of IT programs during the dotcom boom continued after the boom ended and reached a peak in the years 2003-2005, when there were almost double the number which had been offered at the beginning of the period. At that point, when it became clear that the slump was continuing and would not be brought to an end by simply re-organizing programs or introducing new ones, the rate of closures began to excess the rate of commencements, and numbers began to decline. By 2011 the overall number of programs had returned to about the same level as in 1996.



Although this analysis is brief and relatively superficial, it is sufficient to show the remarkable level of instability in the IT sector overall during the period. The following section examines in detail the marketplace factors which were the main cause of this turbulence.

7.3 Market demand for IT and IS programs

As indicated in the introduction, the pattern of increasing student demand for IT at the time of the dotcom boom followed by the long-term trend of severe decline in the aftermath of the dotcom crash is a phenomenon that affected IT programs in universities throughout much of the developed world. Despite the level of concern it has caused in general discussion among IT academics, it has been subject to surprisingly little detailed analysis.

The most comprehensive study in Australia was that by Dobson (2007), which was commissioned by the Australian Council of Deans of Science. His study used the enrolment data which all universities were required to provide to the Australian Government's Department of Education, Science and Training to track the broad trends in enrolments in IT-related programs between 2002 and 2005. It showed that despite the upward trend in total university enrolments, which increased by 6.8% over that period, enrolments in IT programs declined by about 20%. It also noted that the early returns for 2006 enrolments indicated that this trend of decline in IT program demand was continuing and even intensifying in some universities.

Dobson's (2007) report provides a useful overview of the overall decline in IT enrolments after the dotcom crash, but as a relatively high-level study it lacks the level of detail which is required for this study: it covers only a relatively brief period of time, it provides mainly aggregated data across all Australian universities, much of its analysis does not differentiate between undergraduate and postgraduate study, and it treats all IT-related programs as a single group, without distinguishing between the separate IT disciplines. The analysis in this section aims to fill in some of this additional detail.

Further improvements in this period in the reporting of student applications and enrolments through the VTAC admissions system mean that there are a lot of data available on which to conduct the analysis. The main problems with the data lie not with its availability or quality, but with its continuity; the changes in the institutional offerings of IT programs, together with changes in the methods of data collection and publication combine to make it difficult to establish a stable base line against which to measure changes over time. This will become apparent in the discussion below. Despite these difficulties, the data on trends in domestic student demand shown in this section are sufficient to demonstrate the nature and extent of the boom and bust phases discussed earlier, and highlight the effects of market forces on IT programs generally and on IS programs in particular.

The most significant weakness of the analysis is that it is based only on VTAC admissions data, which means that it deals only with domestic student demand in the main VTAC round for admissions; that is, it does not include enrolments at other times of the year, and nor does it contain data on international applications and enrolments. As explained in the discussion of university admissions processes in Appendix B, both these types of applicants and enrolments are handled by the universities individually, and there are no published figures for them. Of the two, the international student applications and enrolments are the more significant omission, because this market segment played a more important role in sustaining some programs despite the rapidly declining levels of domestic student demand.

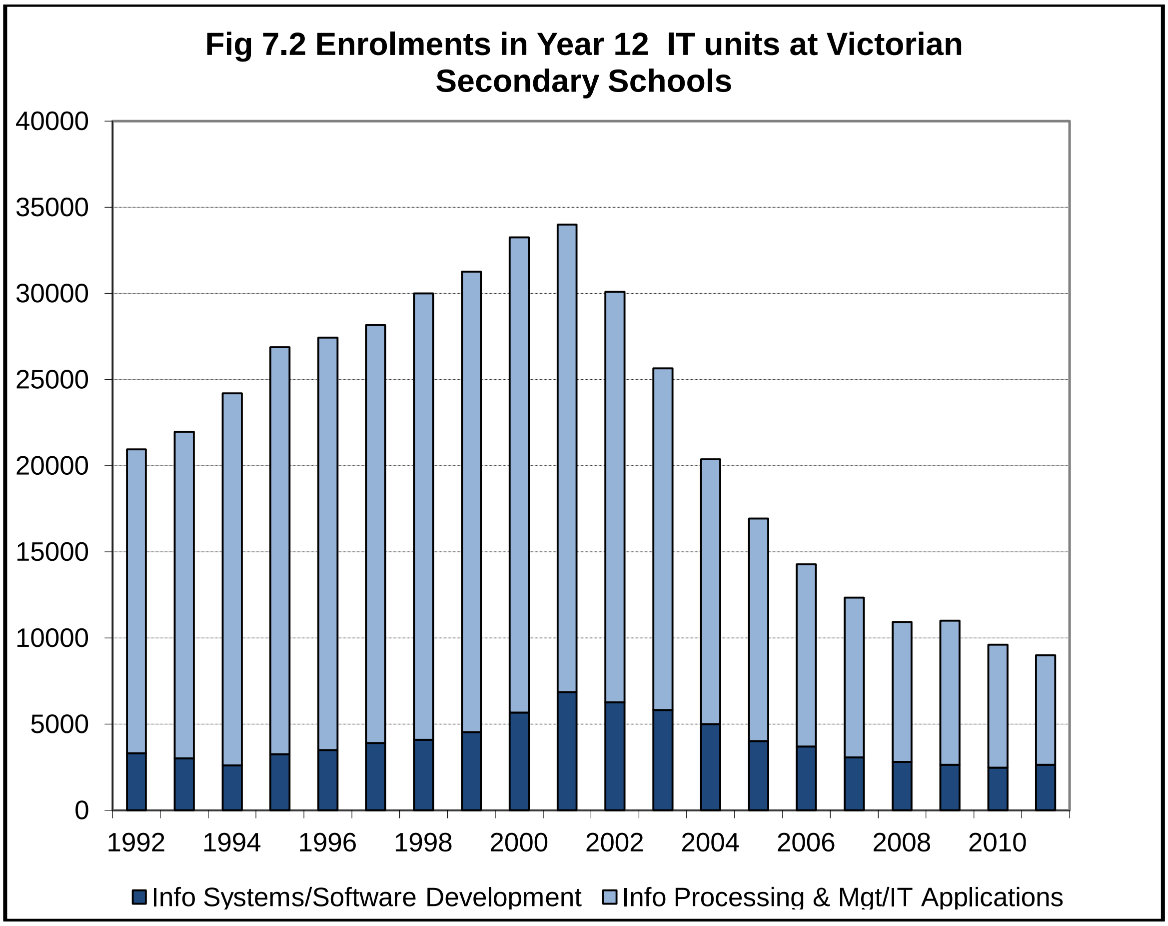
The analysis examines the data on domestic student demand for IT in three different ways, before focussing on the specifics of the demand patterns for IS programs. Firstly, section 7.3.1 gives a brief outline of the changes in the student enrolments in IT units in the final years of secondary school; section 7.3.2 then looks at the overall trends in aggregate student applications and enrolments for IT programs across the IT sector as a whole; and section 7.3.3 examines the data at program level by analysing trends in applications and enrolments in a sample group of programs representing a cross-section of the IT disciplines. Section 7.3.4 then uses the pattern of demand which this analysis establishes for IT overall, as the background for a similar analysis of the demand for IS programs.

7.3.1 Demand for IT in secondary schools

Students' choices of units in the final years of their secondary schooling are not necessarily a good indicator of what discipline they will select for study at university, but they provide some measure of student attitudes towards IT as a field of study. It seems reasonable to assume that the number of students taking specialist IT units in their secondary schooling is likely to have a general correlation with the number who go on to study it at university. Secondary school data are also useful because there was much greater stability in the offerings of IT units in the secondary school system, which means that there are few problems with continuity of data.

From 1992, Victorian students in the final two years of their secondary schooling had the option to take an integrated set of specialist units in IT. Units 1 and 2, offered in Year 11, provided a broad introduction to IT as a field of study, while at Year 12, Units 3 and 4 could be taken in either of two separate streams offering more advanced study in specialist topics (VCAA, 2012). One of the two Year 12 streams was initially called Information Processing & Management and the other was called Information Systems, but in 2007 they were re-named to IT Applications and Software Development respectively. The content and format of the streams and their component units have changed from time to time during the period, but Information Processing & Management/IT Applications has focussed on information needs and the capabilities of IT applications for meeting them, while Information Systems/Software Development has focused on programming and the construction end of the system development process.

Figure 7.2, shows how the combined enrolments in these Year 12 units have changed since their introduction in 1992 (the data on which the graph is based are included in Table E4 in Appendix E). It shows that the early part of this period saw a continuation of the steady increase in enrolments which had been evident since the units were first offered. But, after reaching a peak in 2001, enrolments then fell steeply and continuously. By the end of the period numbers were down to less than half the level at the time the units were first introduced, and less than one-third of their peak levels in 2001.



The only other factor which could be regarded as significant in the interpretation of the picture shown by the graph is the number of schools offering the units. This number increased steadily until the peak of the dotcom boom and then declined steadily in line with declining enrolments. This means that it could be argued that some of both the rise and the decline in enrolments can be attributed to the changes in the number of schools offering the units. However, it is clear from anecdotal discussions with IT teachers and other senior staff from secondary schools that the two trends have been mutually reinforcing, with schools first adding and then reducing their IT unit offerings as student demand changed. Therefore the effect of this variable is not believed to alter the overall picture of changing demand shown by the graph.

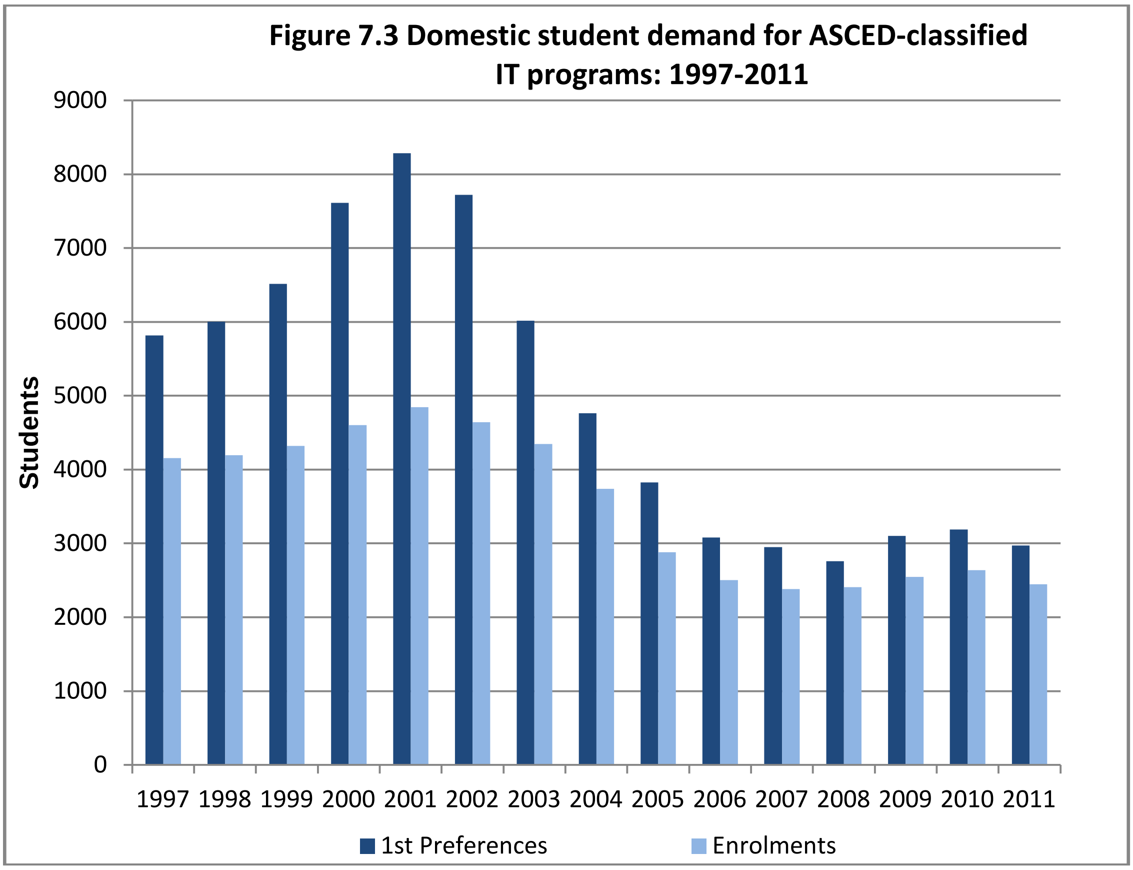
7.3.2 Student preferences and enrolments for IT programs overall

The simplest broad indicator of levels of student demand for IT at tertiary level comes from the summaries of university application and enrolment statistics which are published annually by VTAC (VTAC, 2012). These data are based on a classification of university academic programs called the Australian Standard Classification of Educational Disciplines (ASCED), which was developed by the Australian Bureau of Statistics (ABS, 2012).

The ASCED classification is a hierarchical one, in which the top layer comprises twelve broad fields of study, which are then sub-divided in the lower layers to narrower sub-divisions and topics. Every university is required to provide VTAC with a classification of each of its programs (and also each of their constituent units) according to the ASCED system. Since 2001 the ASCED classification system has included IT as one of its twelve top-level fields, defining it as "... the study of the processing, transmitting and storage of information by computers", whose main purpose is "... to develop an understanding of information systems, programming languages, information management and artificial intelligence, and the ability to apply them to solve problems." (ABS, 2012).

There are some idiosyncracies with the ASCED classification, which affect its use as an indicator of trends in demand for IT. Firstly, there are some gaps, anomalies and peculiarities in its treatment of different types of IT programs: for example, it excludes Computer Engineering from IT and classifies it within Electrical and Electronic Engineering and Technology; Information Management is grouped with Librarianship and Curatorial Studies under the broad field of Society and Culture; e-commerce is included under Commerce and Management; and multimedia is included under Creative Arts. Secondly, ASCED took its present form in 2001, replacing a similar style of classification which used somewhat different categories for previous years, and which included a top level classification called Computing and Information Systems as its highest level field of study related to IT. According to Dobson (2007), the effect of the 2001 change to ASCED was to cause some programs which would previously have been classified under another field such as science to be transferred to IT. Therefore he suggested that caution needed to be exercised in longitudinal analyses of student enrolments which spanned across these years, because the change in classification system would have contributed to a growth in numbers between 2001 and 2002.

Notwithstanding these limitations, the ASCED data still provides a useful broad indicator of the overall trends in student demand for IT. Figure 7.3 shows the changes in first preferences and actual enrolments in IT-related courses, based on the ASCED data published in the VTAC annual reports of university admissions in Victoria from 1997 to 2011 (The data on which the graph is based are included in Table E5 in Appendix E).



The graph shows the rapid rise in student interest in IT from 1998 to 2001, as expressed through the number of first preferences given to a degree program with an IT classification. The peak level reached in 2001 was just over 40% higher than the level four years before. Then follows an even sharper but more extended decline in first preferences for IT programs from 2001 to reach their nadir in 2008, at a level just under half that at the beginning of the period in 1997, and almost exactly one-third of the 2001 peak. The number of first preferences then plateau-ed at about that level over the following three years.

The trend in enrolments follows the same general form as for first preferences, but with a flattening of the extremes both at the peak and at the low level towards the end of the period. Thus the peak enrolment numbers were less than 20% above the 1997 figure, and at their low level they were about half of the 2001 peak and about 60% of the 1997 figure. The flattening effect at the peak is due to the relative inflexibility in the number of student places available; it is not always easy for universities to increase the number of places in a program to cater for higher demand, so the effects of that demand are seen in higher standards for admission rather than extra enrolments. Likewise at the bottom end when demand falls, universities may lower the admissions standards for a program to ensure it still fills its quota of places.

The ASCED data provide an important general indicator of the overall pattern of demand for IT programs, but as with the secondary school IT unit enrolments, it is difficult to determine the effect on the data of the volatility of IT program offerings during the period.

That is, it is not clear to what extent the trends shown by the ASCED numbers are affected by the dramatic changes in program offerings described in Section 7.2. As with the secondary school unit enrolments, the general pattern in the data is so strong as to be unmistakeable, but in order to determine its impact in detail, it is necessary to take the analysis down to the level of individual programs.

7.3.3 Program-level data on trends in student demand for IT programs

In order to get a better insight to trends at individual program level, the same approach was used as in the previous chapter, of analysing the performance of a representative sample group of IT programs, which were offered throughout the duration of the period.

The rate of change in IT programs throughout the period made it difficult to find a sample which was large enough and sufficiently representative of the different universities and the various types of IT program. It aimed to included a mixture of types of program, including CS, generalist IT, CE, SE and specialist subject areas. Programs offered at regional or provincial campuses were excluded (which meant no programs were included from the University of Ballarat), because their student demographics and admissions standards are often different to those on Melbourne-based campuses; their intakes are usually much lower, and in order to support local communities they may sometimes have significantly lower admission standards than their metropolitan counterparts.

The group which was selected is listed in Table E6(a) in Appendix E. It consists of two IT degree programs from six of the seven universities with campuses in metropolitan Melbourne, and one from the University of Melbourne, which offered only one specialist IT program (apart from its BIS degree) during this period. On the basis of their handbook descriptions the characteristics of these programs remained reasonably stable throughout the period, even though some underwent changes in names and/or VTAC codes. Most of the degree programs were offered throughout the entire period, but as the 'Comments' column in the table shows, even for this set of programs there were some gaps in their data. But overall they provided a sufficient level of consistency and continuity for the purposes of the analysis.

About half the degrees in the sample were also offered in double degree combinations at various times during the period. They are listed in Table E6(b) in Appendix E and were also included in the analysis. As the table shows, over the course of the period there was a good deal of change in these double degree offerings, which also has to be taken into account in interpreting the results of the analysis.

The data items used as measures of levels of student demand for the programs and the quality of their student intakes were the same as those used in the previous chapter:

- Applicant course preferences: The VTAC master files of all applicants for admission to tertiary programs were used to extract all instances where the programs were included in the first four of an applicant's preferences for tertiary places. These were then combined to give the overall total of 1-4 preferences which the programs attracted each year.
- Year 12 student enrolments: This represents the number of students who were offered places in each program on the basis of their Year 12 secondary school results in the previous year. This figure was published in the VATC Guide for every year from 2001.

- Clearly-in ENTER: The Clearly-in ENTER level for a program represents the minimum level of performance which was needed in Year 12 of secondary school to guarantee an offer of a place in the program. That is, all students with an ENTER higher than the Clearly-in ENTER for a given program, were offered places in that program. The Clearly-in ENTERs for all programs have been published in the following year's VTAC Guide since 1997. In a small number of cases for which final round Clearly-in ENTER data were not available, the data for the first round of admissions which were published by VTAC in the newspapers were used instead; typically they are the same or slightly higher than final round figures.

The data for each of these demand indicators are listed for all the sample set of programs in Tables E7-E9 in Appendix E. In deference to the confidentiality provisions for use of the VTAC preference data, only the aggregate number of preferences for all the programs are shown in Table E7. As the data tables show, some of the Year 12 student offer data and Clearly-in data are missing for some programs in some years, either because the program was not offered or because VTAC did not publish the data in those years, or because the institution elected not to publish a Clearly-in ENTER (this may happen when the number of Year 12 students offered places is very small). However, the occurrences of missing data do not significantly affect the overall patterns which the data reveal.

Figures 7.4-7.6 highlight the trends in the data. The graphs of the preference and Year 12 student enrolments show that in aggregate the trends are in line with the broad trends shown by the ASCED data. That is, they show a steady increase during the dotcom boom, reaching a peak around the turn of the century and then declining sharply before flattening out in the last few years of the decade. The trend in Clearly-in ENTER scores followed much the same pattern; the 'quality' of students, as measured by their academic performance at Year 12, climbed in the early part of the period to a peak in 2001, but then plunged over the next five years, before stabilising at a level significantly below the level which had applied in 1998, and far below its 2001 peak. Thus, during the boom years, the cohort of students admitted to IT programs not only increased in size, but also in the academic performance, while during the slump it declined in terms of both these measures. That is, even though universities responded to the slump by substantially reducing the performance standards required for admission, the severity of the decline in the number of Year 12 student applicants meant that their numbers still continued to fall.

The Clearly-in ENTER data need to be treated with some caution. From a marketing point of view universities are often keen to ensure the published Clearly-in ENTER is kept as high as possible, and the method by which it is calculated leaves some scope for universities to manipulate their student admissions to meet this goal. This means that the annual average ENTERs shown in the graph may tend to overstate the 'quality' of the students. However this would apply across the period, so it should not significantly affect the overall trend show by the graph.

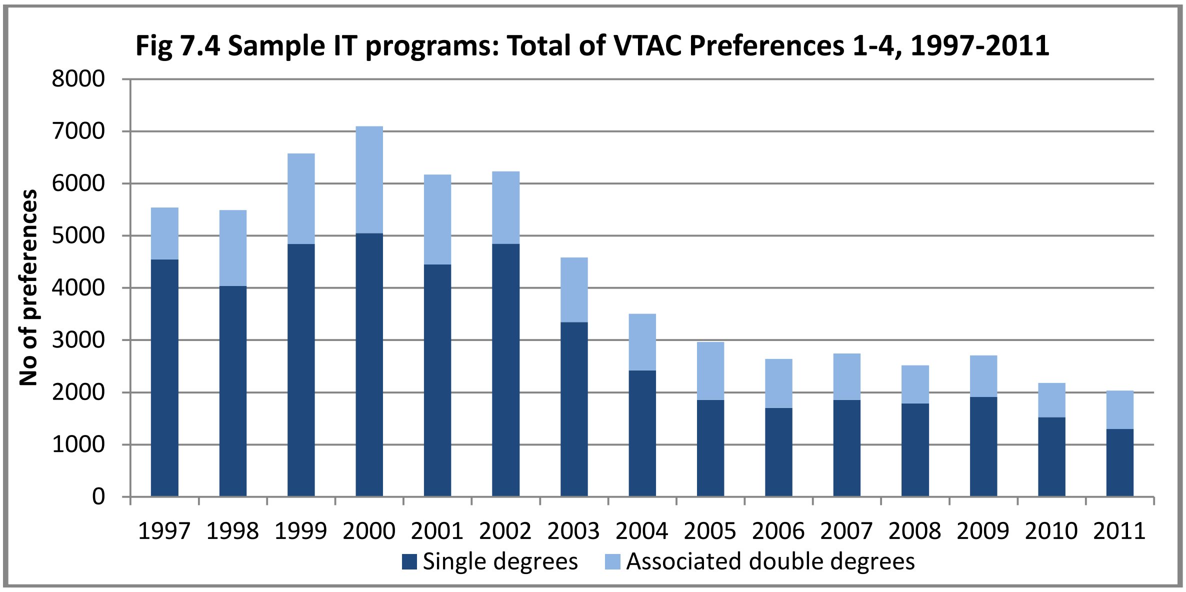


Fig 7.4 Sample IT programs: Total of VTAC Preferences 1-4, 1997-2011
No of preferences
8000
7000
6000
5000
4000
3000
2000
1000
0
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
Single degrees
Associated double degrees

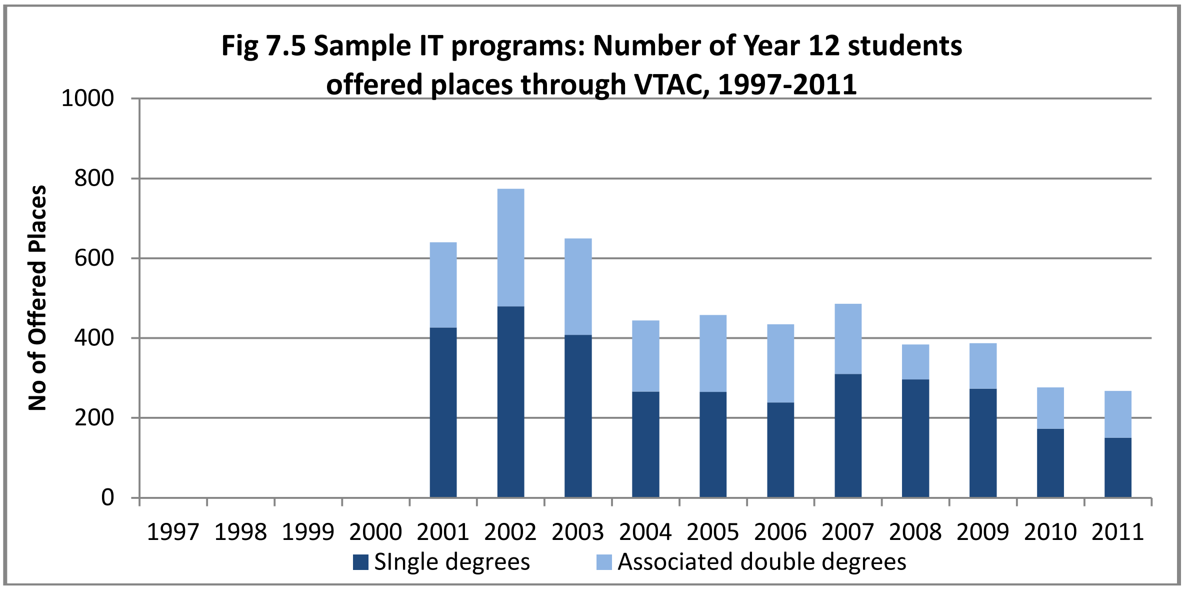


Fig 7.5 Sample IT programs: Number of Year 12 students offered places through VTAC, 1997-2011
No of Offered Places
1000
800
600
400
200
0
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
SIngle degrees
Associated double degrees

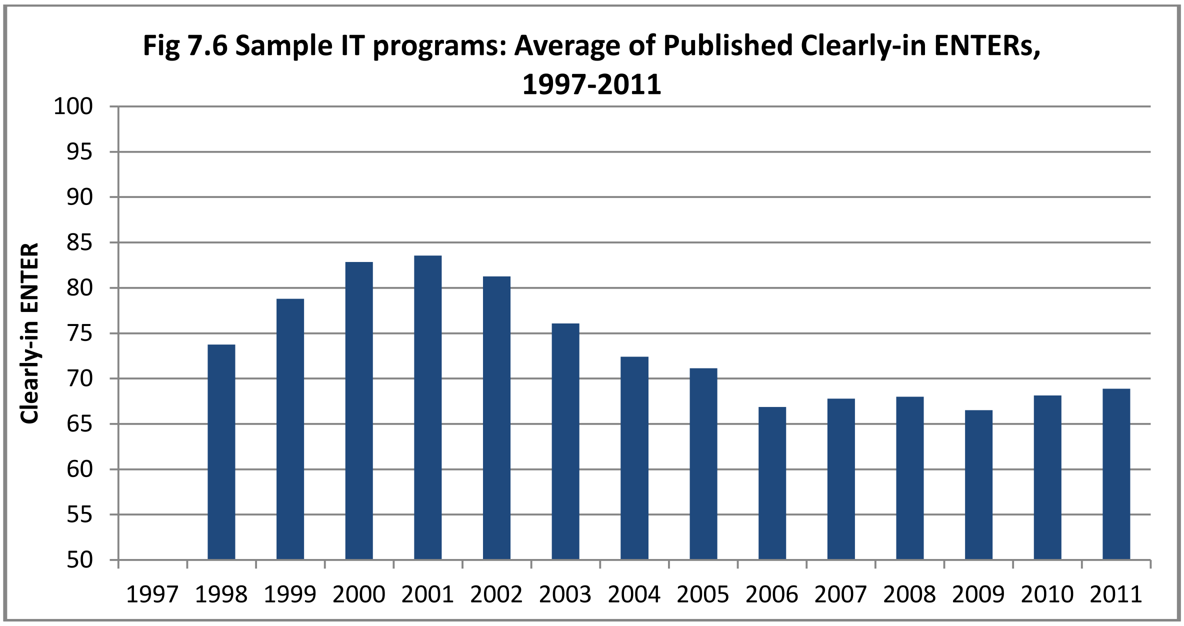


Fig 7.6 Sample IT programs: Average of Published Clearly-in ENTERs, 1997-2011
Clearly-in ENTER
100
95
90
85
80
75
70
65
60
55
50
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

The data show some additional interesting features beyond those shown by the aggregate ASCED data trends. Firstly, Figure 7.4 shows that during the boom period from 1997-2001, the aggregate number of preferences for the single degrees rose by only a relatively small amount – certainly much less than one might expect from the trend line which was shown by the ASCED data. The difference in the trend lines is made even more significant by the fact that the data in Figure 7.4 is for the total of preferences 1-4, not for the number of applicants expressing those preferences; that is an applicant who included 4 different IT programs as his first four preferences would increase the number of preferences in the data by four, whereas the ASCED data was only for 1st preferences, so every preference equated to a single applicant. The greater part of the increase in preferences during this period was due to the increase in the number of double degree programs; more than twice as many of these programs were offered in 2001 than in 1997, and the number of preferences they attracted increased to a similar extent. Double degree programs also contributed to the enrolment numbers in a way which were disproportionate to their contribution to preferences; while they usually comprised less than a quarter of the preference tally, they consistently supplied more than a third of the total enrolments of Year 12 student applicants.

Although the VTAC confidentiality provisions prevent the publication of the individual preference details for each program, the data show that there were marked inconsistencies between them in terms of the trends in demand during the boom years. At least half the programs did not show the pattern of consistent growth in preferences seen in the aggregate demand, and the demand peaks for the group were scattered across the period from 1997 to 2002. However the trends in their Clearly-in ENTERs were more consistent, with most peaking between 2000 and 2002. But while not all programs grew to the same extent during the boom, the downwards trend in preferences, enrolments and student quality during the slum was consistent and clearly evident across all programs.

The complexity of the data and the difficulties in controlling for the ongoing rapid rate of change in IT programs make it difficult to draw conclusions from these data beyond the fact that they confirm the basic pattern of rising and falling demand shown by the ASCED data. However the data for this sample group of programs support a hypothesis that even during the boom years, the level of interest among domestic Australian students in the study of IT in its own right did not rise as strongly and as uniformly as the strength of the growth in the ASCED data may seem to suggest. The hypothesis could be extended to suggest that the increased demand may have been partly due simply to the increase in the availability of programs and to the greater diversity of specialised programs, especially in the 'glamorous' new areas associated with multimedia, the web and electronic commerce.

Undoubtedly the quality of student applicants as measured by their ENTER did improve generally across most programs; that is, IT programs consistently attracted a larger number of higher-performing Year 12 students. But, at an individual program level, the trends in the total number of students giving preferences to IT programs were much more variable, and did not show such a clear and consistent pattern of growth. It is also worth emphasising the extent to which double degrees helped lift the demand levels. That is, the most successful IT programs were generally those which combined the study of IT with some other discipline.

This analysis of trends in IT programs overall is intended only to set the context for the trends for IS programs which are discussed below. Therefore it is beyond the scope of the study to take the analysis further. The speculative suggestions are included here only because it has become commonplace among the IT academic community to lament the loss of a golden age of popularity of IT which is believed to have existed at the time of the dotcom boom; often this is accompanied by at least an implied suggestion that such a golden age might return. The data in this section suggest that the perception of a golden age is at least questionable as far as domestic undergraduate demand for IT is concerned. (Note that these remarks do not apply to international student demand or to domestic demand for postgraduate programs). There is no denying that there was a general upturn in the numbers and 'quality' of domestic undergraduate student demand during the dotcom boom, but the consistency and extent of it is in need of further study. But it is also clear that whatever the peak demand levels may have been at the height of the dotcom boom, the extent of the decline in interest after the dotcom crash is clear and unmistakeable.

The only other minor point which should be noted to complete the picture of demand for non-IS-oriented IT programs is that this sample group makes the trends in demand look perhaps slightly worse than they should, because it excludes a number of the IT programs which performed best in the student market during the worst part of the slump. This is because the sample includes only programs which existed throughout the entire period, and some of these better-performing programs were new programs which were introduced at about the time of the dotcom crash or soon after, in specialist areas like games, IT security, web technologies and applications and the like. But even if the figures could be adjusted in some way to correct for this negative bias in the sample group, the effect would be to give only a minor softening of the very gloomy picture revealed in the data shown above. Even the best-performing of the new programs did not reach anything like the levels of demand which the best-performers in the sample group achieved in the dotcom peak, and in most cases their success was relatively short-lived.

From the point of view of IS as a discipline, the key question arising from this analysis is to what extent did IS programs experience the same peak and decline in demand as that for the IT programs described above. The following section considers them as a group and compares their performance.

7.3.4 Student demand for IS programs

In order to assess the changing patterns in demand for IS programs, the same form of analysis described above for IT programs was used. The analysis was carried out on all the designated IS programs offered at metropolitan university campuses and their associated double degree programs. These programs and the data tables used in the analysis are included as Tables E10-E13 in Appendix E.

The graphs of the data in Figures 7.7 - 7.9 show that at the aggregate level the trends in student demand for IS followed much the same pattern as for the sample group of IT programs. However the graphs show that the IS single degree programs showed even less of an increase in their preferences during the boom than had the IT sample group; at their peak in 2001 the combined aggregate of preferences 1-4 for the IS single degrees was only slightly higher than it had been in 1997.

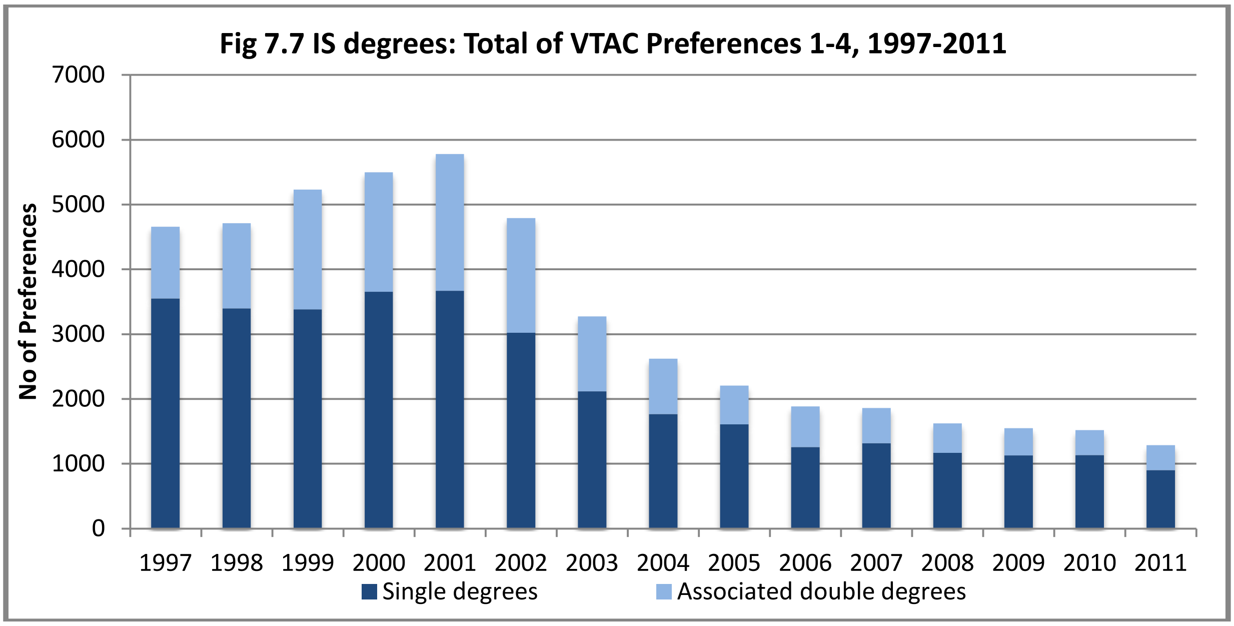


Fig 7.7 IS degrees: Total of VTAC Preferences 1-4, 1997-2011
No of Preferences
7000
6000
5000
4000
3000
2000
1000
0
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
Single degrees
Associated double degrees

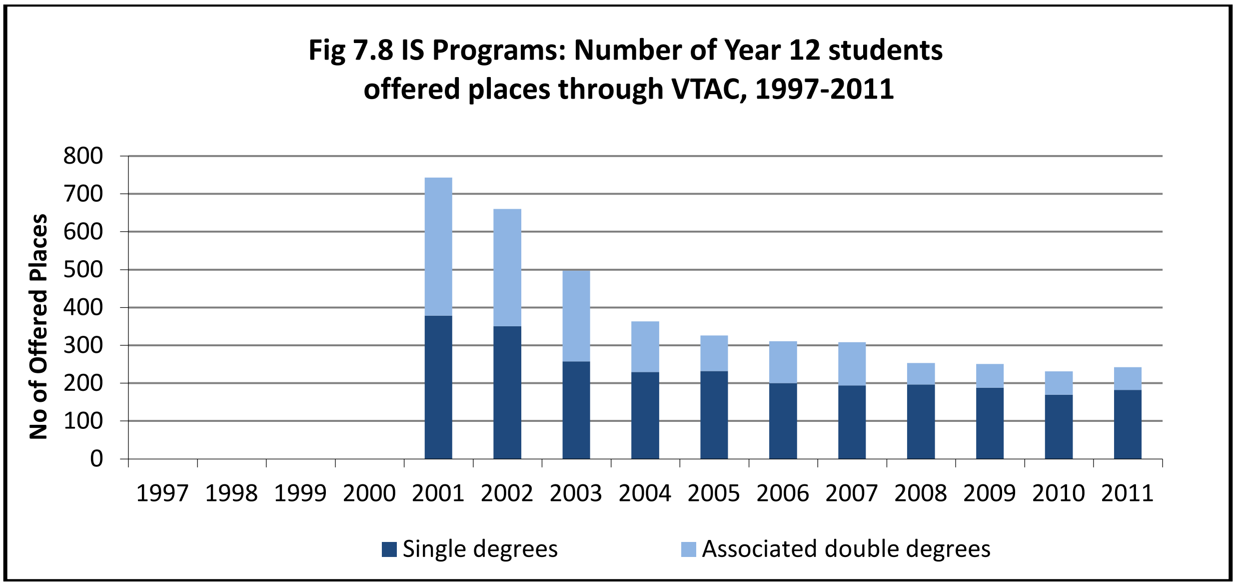


Fig 7.8 IS Programs: Number of Year 12 students offered places through VTAC, 1997-2011
No of Offered Places
800
700
600
500
400
300
200
100
0
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
Single degrees
Associated double degrees

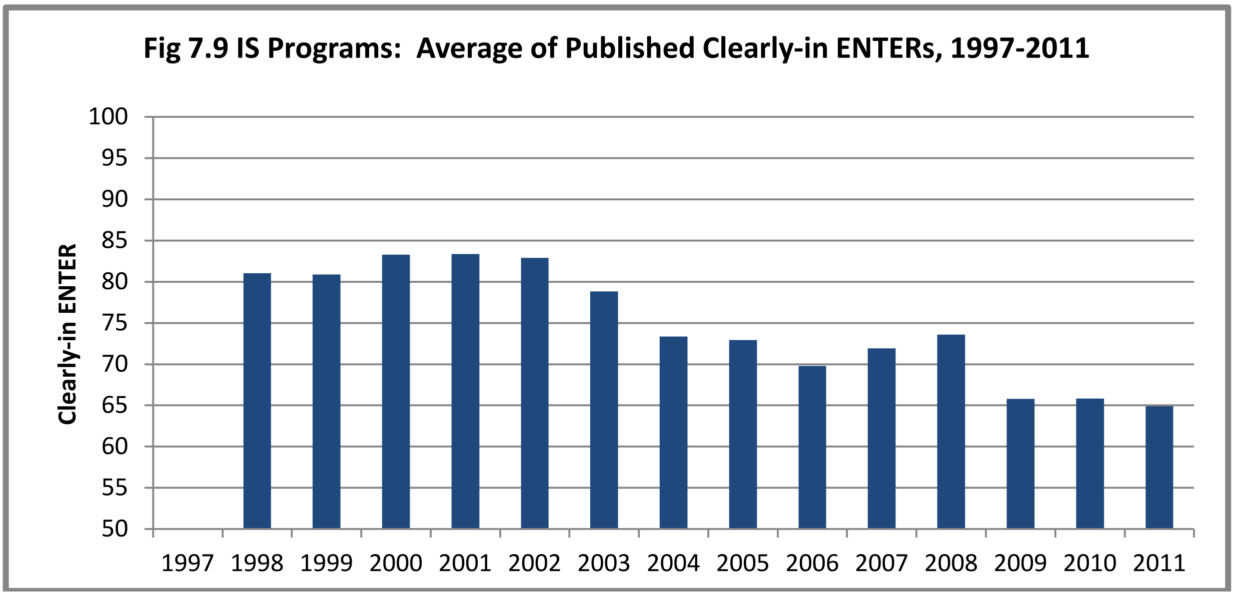


Fig 7.9 IS Programs: Average of Published Clearly-in ENTERs, 1997-2011
Clearly-in ENTER
100
95
90
85
80
75
70
65
60
55
50
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

The graphs also show that the importance of the contribution of double degree programs to student preferences and enrolments in IS programs during the dotcom boom was even more pronounced than for the sample set of IT programs. In the years around the peak of the boom, double degree programs accounted for more than one-third of preferences and just under half the places offered to domestic Year 12 student. The impact on the enrolment numbers of the double degree programs at the University of Melbourne is particularly striking. In the years from 2001 to 2004 the double degrees of IS with Commerce and Science at Melbourne accounted for over 60% of the overall total of IS double degree offers to Year 12 students, and just over 30% of the offers into all IS single degrees and double degree programs combined for all universities.

Analysis of the level of demand for each IS program individually shows the same kind of significant variations in their performance as was shown by the sample IT group. From year to year there were fluctuations up and down in the preference levels for all programs, but overall the new programs which were introduced in the mid-90s (at La Trobe, Melbourne, Monash (Caulfield), Swinburne and VU) recorded an overall increase from the start of the period until the peak year in 2001. By contrast, the older and more established programs (at Deakin, Monash (Clayton) and RMIT) suffered reductions in their preference levels from the mid-1990s. This suggests that although the new programs may have helped increase the total size of the market, they took some of the market share from the previously-established programs

A good illustration of the variability of the demand patterns between programs and also of the significance of double degree programs can be seen in the comparison of the performance of the leading IS programs at the two largest and most prestigious universities, Monash and the University of Melbourne. For most of the period, the BBusiness Systems at Monash's Clayton campus and the BIS at Melbourne vied for the right to claim top place as the most successful IS program in Victoria (and even as the most successful IT program of any kind). At the height of the dotcom boom in 2001 and 2002, they were both far ahead of all other IS programs in terms of both the number of Year 12 offers and in their published Clearly-in ENTER. The data show that Melbourne's degree edged out Monash's in terms of total year 12 student offers (a total of 163 to 152 over the two years), but the Monash degree had a slight edge in terms of its published Clearly-in ENTER (averaging just over 92 over the two years compared to Melbourne's 88.1). But their success was based on their ability to attract high-performing students rather than in attracting large numbers overall. Neither program performed especially well in terms of total preferences, with three other IS programs outdoing them in terms of their combined totals of 1-4 preferences over these two peak years.

Although there was little to differentiate the performance of these two single degree programs, there was an marked difference between them if their associated double degrees are also taken into account. As outlined above, the BIS/BCommerce and BIS/BScience double degrees at Melbourne dominated the market, with the former offering places to 307 Year 12 students, and the latter offering 118 places over 2001-02. By contrast, Monash's BBusiness Systems was paired in two double degrees – with Commerce and with Law - which offered between them a total of only 59 places to Year 12 students in the same period.

But again as with the sample group of IT programs, the slump which followed the dotcom crash was uniformly severe for all programs. From the peak of the dotcom boom until the low point in 2008, the preference totals for every program at least halved and in most cases fell by substantially more than that. Declines in offers of places to Year 12 students fell by similar amounts for most programs, though some were able to contain their losses in student numbers by dropping their admission standards as measured by the Clearly-in ENTER. For the double degree programs, the declines were even more severe than for single degrees. For example, the University of Melbourne's BIS/BCommerce and BIS/BScience double degree programs discussed above offered places to a combined total of 29 Year 12 students in 2007, barely 10% of the 224 places which had been offered into those two programs in 2001. Clearly-in ENTERs for the IS programs also dropped markedly, meaning that the programs were not only taking in far fewer students, but those students had significantly poor academic records in their Year 12 studies.

The low point in demand occurred in about 2008. The graphs make it look like the decline continued for a couple more years, but this is because of the closure of the University of Melbourne single and double degree programs. If the data are adjusted to compensate for the effect of their removal then they show a plateau similar to that for the IT sample group from 2008 until the end of the period.

Thus, the picture of demand for IS programs during the period broadly parallels that of other IT programs. There are too many gaps and variations in the data sets to enable a precise comparison of the performance of the two groups, but the broad patterns appear to suggest that there was little to differentiate between them. The impact of the fluctuations in the student market meant that IS departments and programs were faced with the same issues which caused the instability which Section 7.2 showed was experienced by the IT sector as a whole. The way in which they addressed these issues is discussed in the next section.

7.4 Disciplinary and structural impacts on IS

Within each university, the influence of the changes in the student market was given effect through changes to the status and position which IS occupied in the institution's organizational and disciplinary structures. But at the same time, the nature of these structures also influenced the way in which each university dealt with its student market issues. This interaction makes it difficult to separate the effects of disciplinary, structural and student market influences on the changes which were experienced by IS programs and departments. The complexities of the interactions between these forces also make it difficult to generalise about the nature and direction of the changes in the IS discipline in the way that was done in previous chapters. Just as the blend of factors involved was unique for every university, so too was the blend of actions which each took to cope with the changing circumstances.

The rate and extent of change in IS programs and departments, together with the variability in the patterns of change from one university to another also make it difficult to provide a concise narrative of the course of events at each university. The study of the changes in IS at Monash in Chapter 8 will demonstrate that to do so for even a single university is a substantial undertaking. Therefore, this section will not attempt a complete account of events at every university, but will confine itself to a broad overview of some of the main types of changes which IS departments and programs experienced during the period. This will be enough to demonstrate how issues relating to disciplinary and organizational structures can be seen to have affected the way in which IS evolved within each institution.

Four main types of disciplinary and structural change will be considered, which can be thought of as covering a spectrum, from disciplinary growth and expansion at one end to contraction and closure at the other:

- Formation or up-grading of IS departments or programs: where universities improved the disciplinary standing of IS, by adding new IS programs or organizational units, or by significantly enhancing those which already existed.
- Expansion or diversification of disciplinary scope of IS: where IS departments added new areas of knowledge to their undergraduate IS programs, thereby significantly increasing the scope of their disciplinary coverage.
- Disciplinary mergers of IS: where IS departments and/or their degree programs were merged with other established disciplines, while still retaining (at least in part) a separate disciplinary identity.
- Closure or down-grading of IS programs: where IS programs or academic departments were closed down or significantly reduced in size, or where they were merged with another discipline in a way which caused a significant loss of disciplinary identity.

As one might expect, the first two types of change occurred most frequently early in the period during the boom in student demand, while the latter two occurred more often during the second half of the period, as student demand slumped. But the variations in the individual circumstances of each IS department/program and their performance in the student market meant that this was not always the case. Tables E14 – E17 in Appendix E list the occurrences of each type of change as they affected IS at each university during the period. The following sections 7.4.1 – 7.4.4 discuss each of these groups in turn. Section 7.4.5 then shows their cumulative impact on the IS discipline as a whole, by summarising the state of IS departments and programs at all the universities at the end of the period.

7.4.1 IS department/program formation

Chapter 6 showed that IS departments and programs had become established in almost all universities by the time this period started, but there was still room for some further additions. Five new IS-related programs and/or departments were created during the period, which can be divided into two groups as set out below.

(i) Up-grades to existing programs

This group comprises the straightforward cases at Deakin and La Trobe, in which long-standing IS unit sequences – two designated IS majors at Deakin and a stream of IS units in a generalist computing degree at Bendigo - were enhanced to the status of independent IS degrees. The changes at both universities took place during the dotcom boom.

- Deakin: The changes at Deakin affected both the IS majors which existed at the start of the period in the science and business faculties. The IS major taught by the School of Computing and Mathematics was up-graded to become a BComputing(IS) in 1998, and three years later the IS major taught by the School of Information Systems in the Faculty of Business was similarly up-graded to become a BManagement Information Systems. This left the IS discipline at Deakin in the odd position of being represented by two separate IS degree programs offered in different faculties on different campuses and with substantially different content and orientations.

- La Trobe (Bendigo campus): This new IS degree was created at the peak of the dotcom boom as a result of a decision by the Division of Information Technology at Bendigo to expand its generalist BComputing into three separate specialist programs. The analysis, design and systems development units of the degree became the core of the BComputing(Information Systems), which was offered alongside the more technically-oriented BComputing (Computer Networks) and BComputing(Software Development. At the university's Bundoora campus, the School of CS & CE continued to offer the BIS degree which it had established in 1996, which left La Trobe in a similar state as that described above for Deakin, with two separate and un-related IS programs being offered in different faculties.

(ii) New IS programs

Unlike the programs in the previous group, the new IS programs at Ballarat, Melbourne and La Trobe had no direct predecessors, but were created from scratch. Also unlike the first group, two of the programs were established in the depths of the slump in the IT market, rather than at its peak. Ballarat's new program was relatively straightforward, and its formation ended Ballarat's status as the only university without an IS program. The other two were more significant, because they were both formed as a result of the university's business-based faculty choosing to develop its own IS program, in direct opposition to an existing IS program which was already well-established in a science-based faculty.

- Ballarat: Section 6.3.3 described how, during the previous period, the School of IT and Mathematics had taken over and closed down a previous business-focused IS major which had been taught into the business faculty, and replaced it with a technically-oriented business computing major. Shortly after the dotcom crash, the business faculty replaced the business computing major in its programs with an e-business major, which consisted almost entirely of its own business units, and included virtually no technical computing units. With student numbers in its technical degrees declining, the School of IT transformed the business computing major into an IS program, which it initially named as a BInformation Systems when it was established in 2005. It also struggled to find students, and was twice re-named - first to BBusiness Information Systems in 2007, and then to BIT(Business Systems) in 2009.

- La Trobe (Bundoora campus): La Trobe's decision at the time of the university's foundation to centralise computing under the control of the CS department had caused its computing education programs to focus on computing as a mathematically-based scientific discipline. Although it introduced a BIS in 1997, Section 6.3.2 showed that the program was strongly CS-based and contained little of the business content normally associated with IS. The only programs which the department offered with a business orientation were two double degree programs introduced in 1996: one combining the BCS with a BCommerce and the other combining the BIS with a BBusiness.

These two programs continued to be offered throughout the period, but in 2009, the School of Business in the Faculty of Law and Management introduced its own major in Management Information Systems. It had a much stronger business focus than the CS-oriented BIS, and was taught by a specialist IS group which was established in the Department of Management and Marketing.

- Melbourne: Section 6.3.2 told the story of the battle over the establishment of Melbourne's BIS program in 1994, in which the Faculty of Commerce had fought and lost the right to ownership of the new discipline, which had instead been located in the Faculty of Science. The influence in the commerce faculty in the degree was limited to providing input into the content of some of its units, several of which were included as elective options in the BCommerce. It also created the shared double degree program, BCommerce/BIS, whose success was described in the previous section. It is presumably the performance of this program, coupled with the ongoing increases in the popularity of IT, which encouraged the faculty to make another attempt at establishing its own IS program at the peak of the dotcom boom. The Department of Accounting began to develop and add more IS units to its curriculum in the late 1990s, and in 2001 established two specialist elective majors in the BCommerce, called 'enterprise analysis and systems' and 'enterprise information systems'. In the following year, these were re-named to 'business analysis and systems' and 'business systems', and supplemented with an additional major in e-commerce. The department's aim to claim a stake in IS was further underlined by its decision in 2003 to change its name to 'Accounting and Business Information Systems'.

The formation of the new programs at La Trobe and Melbourne is particularly significant for this study, given that by this time IS was a well-established discipline. At both these universities, the rejection of vocational/applied computing during the pre-Dawkins period had left Computer Science and Computer Engineering as their only computer-focused disciplines. Consequently, the computing content of the universities' main business degrees had previously amounted to little more than one or two data processing units relating to the use of computers in business accounting. The initiatives by these business-based faculties to develop their own IS programs demonstrated their desire to rectify this deficiency in their business curricula, and presumably indicated some measure of dissatisfaction with the ability of the existing IS degree to meet their objectives. The IS majors at Melbourne may also have been partly inspired by a desire to tap into what appeared at that time to be a lucrative and expanding student market, but this could not be said of developments at La Trobe, which occurred at the depths of the slump in demand for IT.

The existence of rival science and business-oriented programs going by the name of IS in the same university was not new; Chapter 6 showed that it already been observed at Monash and Deakin, and the introduction of the BComputing (IS) at La Trobe's Bendigo campus described above added a third example. But those cases could all be explained as historical 'accidents', which occurred because the Dawkins mergers had brought together institutions which already had well-established applied computing programs in their business and science faculties and on separate campuses. These developments at Melbourne and La Trobe appear to have been a much more pointed and deliberate rejection of the existing established IS programs as not meeting their requirements.

7.4.2 Disciplinary diversification and expansion of scope of IS

Section 7.2 highlighted the general pattern of growth and diversification in IT programs which occurred during the period. Similar patterns of growth and diversification were also seen within IS programs, during both the boom and bust phases of student demand.

During the dotcom boom, the increase in diversity was facilitated by the increased revenues from rising student demand for IS and computing programs, and further encouraged by the ongoing development of new areas of IT and its applications. These provided opportunities for IS departments to use their increased income to expand their teaching programs and extend the scope of their disciplinary coverage. This promised to serve the twin purposes of enhancing the discipline's status by increasing the size of the knowledge territories for which it could claim ownership, and also by attracting new cohorts of students who might not have been interested in its traditional themes. The slump in student demand during the second half of the period also encouraged diversification. Departments sought to find ways of reversing their declining revenues, either by finding new topic areas which might have greater market appeal, or by blending their programs with those of other disciplines.

Much of this expansion and diversification took place within the confines of IS degree programs, and becomes apparent only when these programs are examined at the individual unit level. This applied particularly during the period of decline in the student market, when falling revenues made it difficult for most departments to fund developments of a larger scale. Diversification of this kind at the unit level will be discussed in the analysis of curricula in Section 7.5.

The examples of disciplinary diversification which are included in Table E15 in Appendix E are all at the larger scale, where IS departments tried to expand their disciplinary scope through changes in the overall structure of their program offerings. The table shows two main areas by which this expansion was achieved – firstly by the development of new academic majors or degree programs, and secondly by the establishment of double degree or combined degree programs with other disciplines.

(i) New majors or degrees

Most of these initiatives centred around the emerging application areas of e-commerce and multimedia. The IS departments at Deakin, Monash (Caulfield) and VU developed specialist studies in e-commerce, independent of their IS programs, and Monash (Caulfield) did likewise for multimedia. The two Monash programs survived for only a short time under the control of IS (for reasons which are explained in Section 7.4.4), but the e-commerce offerings at Deakin and VU survived for a number of years as significant components of the IS department's academic programs. Other institutions also took a strong interest in these new areas, but without it becoming apparent in their overall program structures; almost all IS programs identified multimedia and e-commerce as major new study areas in their IS programs in the VTAC Study Guides for at least a part of this period.

A point worth noting is that an important constraint on the ability of IS departments to extend their scope in new knowledge areas was the extent to which they had to compete with other disciplines which were also attracted to them. In most universities there was keen competition for ownership and control over different aspects of the technologies and applications associated with them: e-commerce was obviously of interest to business-oriented departments, while multimedia and the web attracted attention from a diverse range of disciplines such as graphic arts, design, media studies, communication studies and other IT-related disciplines. For example, Swinburne developed an integrated set of four programs under the common degree name of BMultimedia, which were owned and taught by different departments according to their different disciplinary emphasises – in Media Studies, Networks & Computing, Business Marketing and Software Development.; in addition to these, other Swinburne departments also offered a BDesign (Multimedia Design) and a BSocial Science (Interactive Media).

Consequently, an IS department's ability to gain 'ownership' of these areas and incorporate them in its academic programs was affected by the department's position within the organizational structure, and its relationships with the other departments which were interested in these areas. For example, the ability of the IS departments at VU and Deakin to gain a major long-term involvement in e-commerce was clearly helped significantly by their location in the Business faculty, where they could easily participate in cross-disciplinary teaching arrangements with the other key business disciplines. By contrast, at Ballarat the School of IT and Mathematical Sciences briefly offered an e-business major into the BBusiness, only for the Faculty of Business to replace it with its own version, based entirely around business units.

(ii) Double or combined degrees:
The second main means by which IS tried to extend its disciplinary scope was through the formation of double or combined degrees, which involved bringing together the core elements of an IS degree with the core elements of a degree in another discipline, at the expense of the normal elective components of each program. Some double degrees with IS had existed previously, but the popularity of IT caused the numbers to grow substantially during this period. The importance of double degrees as a source of student enrolments in IS programs was highlighted in the analysis of market demand in Section 7.3.4.

Table E15 in Appendix E shows the wide variety of disciplines with which IS associated itself in double and combined degree programs. In double degrees, which were the more common version, the program took four years to complete, and students graduated with degrees in both disciplines; combined degrees remained as three-year programs and students graduated with a single degree with the equivalent of at least a major in each discipline. Double degrees in particular tended to attract higher-performing students. To gain entry to them a student normally needed to have achieved an entrance score which was higher than that of either of the two single degree programs; this meant that when the double degree paired IS with a high entrance score program, the average ENTER score of the enrolled students was higher than in the IS program as a single degree. Therefore IS benefited from both the disciplinary connection and the improvement in the standard of its student cohort.

Normally, combined programs included full majors of each discipline, but late in the period the Faculty of Business and Law at Deakin introduced a number of new majors which combined units of IS content with units from a variety of other business disciplines. The number of IS units included varied between the majors. The areas in which they were offered included Health Informatics, Supply Chain Management, Business Security Management, Accounting Information Systems, Quantitative Business Analysis and Interactive Marketing.

7.4.3 Mergers of IS with other established disciplines

Previous chapters have shown how IS programs and applied computing programs in general evolved by a process which Metzger (1987) called 'parturition', where they formed as off-shoots of another discipline, grew, and eventually separated to become independent programs in their own right. A similar process of evolution and separation from a 'parent' academic department was also noted as the most common development path for applied computing departments. In some universities, this period saw a reversal of this process, with IS departments and programs giving up at least some part of their independent status to merge with another academic discipline. Table E16 in Appendix E lists a number of examples of cross-disciplinary mergers of this kind.

It is difficult to determine the relative importance of marketplace, disciplinary and structural issues in the institutional decision-making associated with these mergers, because all three may have played a role. For example, a merger decision might have involved consideration of: marketplace issues relating to the extent to which each department's programs were able to generate the revenue needed to sustain their economic viability; disciplinary issues relating to the perceived convergence of academic interests between departments or the desire to create such a convergence; or structural issues relating to the desire to achieve economies of scale or otherwise address the changing organizational management needs associated with an increasingly corporatized academic environment. The relative importance of these factors may have also differed for each of the departments involved in a merger.

Establishing an accurate picture of the blend of factors driving any given disciplinary merger and the motivations of all parties involved in it is impossible without a detailed study of the circumstances and events which surrounded it. The discussion of one of the departmental mergers at Monash in Chapter 8 will highlight the difficulties involved in separating out the influences of these factors. In the absence of any special insights into the blend of factors involved in each merger, this section will confine itself to noting the basic facts of each merger and the apparent impact on IS undergraduate programs. They have been divided into three groups, according to the nature of the department(s) with which the IS department merged.

(i) Mergers of IS with a non-IT-related discipline
In these mergers, an IS department located in a business faculty merged with another business-related discipline. At both universities the effects of the mergers appear to be predominantly structural in nature, with no signs of any impact on the curriculum content of the undergraduate IS program:

- At RMIT, the IS-based Department of Business Information Technology (DBIT) went through two mergers. The first, with the Department of IM and Library Studies (DIMALS), occurred in 2000 near the peak of the dotcom boom, and appears to have been motivated by the needs of DIMALS rather than DBIT. DIMALS had for several years been in a state of decline, with serious losses in undergraduate student demand for its BInformation & Library Management program putting its survival in jeopardy (Martin, 1999). It responded to the crisis by extending its disciplinary scope beyond its traditional focus on librarianship to include a broader range of information and knowledge management issues. This brought its interests into closer alignment with those of the DBIT, and its merger with that department appears to have been another step towards solving its financial problems. Although the merger had no apparent effect on the Bachelor of Business Information Systems, it led to the re-structuring of the DIMALS undergraduate program into a new BInformation & Knowledge Management degree.

  The second merger, which took place in 2010, combined IS with supply chain management & logistics into a School of Business IT & Logistics. It also seems to have been inspired more by a desire to find a secure home for supply chain/logistics group, rather than from any problems with IS. The teaching of various aspects of supply chain management and logistics had previously been scattered across multiple organizational units, and the merger aimed to consolidate these into a single location (RMIT , 2009).

- At Victoria University, the School of Information Systems was merged in 2010 with its neighbouring Department of Management to form the School of Management and Information Systems. Both the BBusiness(IS) and the BBusiness (Computer Systems Management) continued to be offered after the merger. At the time of writing there were no signs of the merger having caused changes in either program.

(ii) Mergers to form IT faculties/schools

In these mergers, departments which taught IS were re-located from the faculty in which they had originated to merge with other IT-based departments or school to become part of an IT-based school or faculty. Although they usually brought no immediate obvious signs of change to the IS programs at each university, the change of faculty altered the disciplinary environment in which IS was offered:

- Swinburne: In 1998, as the dotcom boom was gathering momentum, Swinburne brought together the university's main IT-based departments together into a single organizational unit. Initially, the School of IS, which had originated in the Faculty of Business joined with the School of Computer Science & Software Engineering from the Faculty of Applied Science to form the School of IT. They were later joined by groups from Electrical Engineering and Astrophysics, and became the Faculty of Information and Communication Technology. This made Swinburne the second Victorian university (after Monash) to have a specialist IT faculty.

  The school/faculty did not have a formal department-based structure, but its staff were organized into academic groups, which generally correlated with the departments from which they originally came. The IS group maintained for some time its traditional affiliation with business, by continuing to offer an IS major into the BBusiness, and requiring its BIS students to take a number of core and elective units from the business faculty. However the number of compulsory business units slowly diminished over time, to be replaced by units from within the ICT faculty, and, as the next section will describe, by the end of the period the IS major into the BBusiness was also closed down.

- La Trobe: This merger was triggered by the final stage in the implementation of the amalgamation of La Trobe and Bendigo CAE, which had taken place as a result of the Dawkins reforms. As indicated in the previous chapter, La Trobe had decided not to carry out a complete organizational integration at the time of the amalgamation, and left the regional Bendigo campus to operate largely as a self-contained multi-disciplinary organizational unit. But in 2005, the university finally brought this interim arrangement to an end, and all Bendigo departments merged fully with their counterparts at the metropolitan Bundoora campus.

  As part of this integration, the IT group in the School of Business and Technology at Bendigo was re-located in the organizational structure to become part of the Department of Computer Science and Computer Engineering (DCSCE) in the Faculty of Science Technology and Engineering. Bendigo's IT group had a long tradition of teaching both business-oriented and science-oriented applied computing programs, but it had always been located within organizational units with a strong business focus. Hence, this merger with DCSCE brought a significant change in its disciplinary environment.

- Melbourne: On the basis of a university-level review in 2010, the University of Melbourne decided that IS should merge with CS and CE to become a single Department of Computing and Information Systems within the Faculty of Engineering from January 1, 2012. One of the noteworthy aspects of this change was that it reversed the university's earlier decision to keep IS away from the influence of the Computer Science department in the Faculty of Engineering (described in Section 6.3.2). At the time of writing there are no indications as to the impact this merger might have on the orientation of the teaching of IS and the future direction of the discipline at the university.

(iii) Mergers to achieve disciplinary convergence of IT-based disciplines
The last set of mergers of IS departments and programs comprises those which occurred at Monash, which caused significant structural and disciplinary change to the IS programs at both the university's campuses. They are described in detail in the Monash case study in Chapter 8.

- Monash - Caulfield campus: At the very beginning of the period, the Department of IS and the Department of Librarianship Archives and Records at Monash agreed to merge to form the School of Information Management & Systems. The two departments were located in the same faculty, and the impetus for the merger initially came from a management desire to simplify the faculty structure. But the two departments also justified their decision to merge on the basis of the perceived convergence of interests of their respective disciplines.

Initially it was intended that the merger would be only a structural one, with the department's two degree programs, the BIS and BIM, remaining separate. However, as a consequence of financial pressures, the new school merged them to create a single new program, the Bachelor of Information Management and Systems (BIMS), which incorporated the key elements of both degrees.

- Monash – Caulfield and Clayton campuses: The second merger affecting IS at Monash came about as a consequence of re-structuring decisions made in response to the declining student market for IT programs. The IT faculty had been hard-hit by the decline, and in 2004 a strategic review recommended major changes to reduce costs and bring about closer integration of the faculty's operations, both in its organizational structures and academic disciplines.

  At the Caulfield campus, the School of Information Management & Systems was merged with the Caulfield-based staff from the School of Computer Science and Software Engineering to form a single multi-disciplinary Caulfield School of IT. Similarly, the faculty's programs in applied computing were brought together into a single Bachelor of Information Technology & Systems. The previous BIS program was reduced to the status of a major within this degree, but, as the next section will show, this turned out to be a step on the path to its eventual closure.

  At Clayton, a similar structural change saw the integration of the School of Business Systems with Clayton-based staff from the School of Computer Science and Software Engineering to form a single multi-disciplinary Clayton School of IT. The School's BBusiness Systems degree underwent substantial modifications to its curriculum, and was re-named as the BBusiness Information Systems. These changes significantly reduced the number and scope of its units, and introduced a set of core units in IT fundamentals which were shared across all the faculty's undergraduate programs.

7.4.4 Downgrading or closure of IS disciplinary program

Section 7.2 demonstrated how the turbulence of the IT education environment during this period was reflected not only in high levels of program creation, but also in a high mortality rate among IT academic programs. A number of IS programs and other programs run by IS departments were among the casualties.

All but one of these program closures/downgradings shown in Table E17 in Appendix E took place during the slump in student demand which followed the dotcom crash. It seems clear that market issues played a major role in most of these closures - either directly, in that they rendered programs economically unsustainable, or indirectly, in that they caused disciplinary and structural changes which subsequently led to closures. The only clearly identifiable exception to this is the closure of the two IS programs at the University at Melbourne, which were due to the change in the university's approach to undergraduate degrees, as outlined in Section 7.2. The program closures/downgradings can be divided into two groups as follows, according to the severity of their impact on the disciplinary presence of IS at the university.

(i) Closures/downgrading with severe impacts:
The most significant program closure/downgradings were the 2010 closure of the IS major at Monash (Caulfield) and the closure in 2004 of the BComputing(IS) at Deakin. Both these closures put an end to long-running IS programs, which, as Chapter 5 showed, had been among the first to be established in Victoria:

- Deakin - Science faculty program: As outlined in Section 7.4.1, the IS major taught by the School of Mathematics and Computing at Deakin had benefited from the dotcom boom by being made into an independent specialist IS program. It became one of an integrated set of IT-related programs of IT-related programs offered by the School – the BComputing(CS/Software Development), BComputing(Information Management), BComputing (Applied Computing) and BComputing(IS). The IS program was always the least successful of the four in attracting students, and the onset of the slump in the student market reduced its intakes to very low levels. In 2004 the School carried out a major review of all its programs, and the BComputing (Information Systems) failed to survive.

- Monash - Caulfield campus: The previous section described how the re-structure in 2004 caused the closure of Caulfield's School of Information Management and Systems as a specialist independent department, and the absorption of its IS program into a generalist IT program called the BInformation Technology & Systems (BITS). The re-structure initially left IS without any explicit recognition as a specific component of the new degree, but concerns over the impact of this decision on the degree's marketability earned it a reprieve, and it was re-established as one of several specified majors in the BITS in 2007. However the IS major failed to attract strong demand, and when the continued low levels of student demand forced the faculty to make more cuts in its unit numbers in 2010, it was an obvious target for elimination. In an attempt to maintain some semblance of IS coverage in the degree it was bundled with units from the IM major which had also been closed own, to form a new hybrid major called Enterprise Information Management.

Before the closures, both Deakin and Monash had offered two IS programs, so neither loss eliminated IS as a discipline from the university's academic offerings – in fact it could be argued that they helped to remove a confusing duplication of names, and to resolve and clarify the picture of what constituted IS at each institution. Nevertheless the losses were significant in eliminating two representatives of alternative visions of what constitutes the IS discipline – at Monash (Caulfield) a view of IS which had system development as its core theme, and at Deakin a view of IS as a technically-oriented science-based discipline closely related to Computer Science.

(ii) Closures/downgrading with minor impacts:
The other group of closures/downgradings were less critical in their impacts on the IS discipline at each university. In all these cases, the loss involved the closure of the enhancements or new programs which had been established by IS departments during

the dotcom boom. Their main impact was in removing the increases in the scope of the discipline which had occurred during the boom, and they appear to have had at most a marginal effect on the original core content of the IS programs at each university.

- La Trobe (Bendigo campus): This closure effectively reversed the expansion of the generalist IT degree at Bendigo described in Section 7.4.1. Under that expansion, which occurred at the peak of the dotcom boom, the generalist Bachelor of IT program had been split into three separate tagged specialist degrees, of which the BIT(Information Systems) was one. In 2008 all these specialist programs were closed down and replaced by a single generalist BIT degree, and IS was reduced once again to the status of a stream of units within that program. It should be noted that this change came about only a couple of years after the merger of Bendigo's IT department with the Department of CS and SE at the main Bundoora campus (described in the previous section). It is not clear to what extent the closure was a direct response to declining student demand or a consequence of the enlarged School's desire to consolidate and simplify its program offerings.

- Monash (Caulfield): Before the School of Information Management & Systems (SIMS) was closed down in 2005 as described above, it had been the only IS department to suffer a significant loss of academic territory during the boom period. This occurred at the end of 2000, as the dotcom boom approached its peak, and involved the termination of the School's involvement in the new BMultimedia and BElectronic Commerce programs into which it had expanded its activities only three years before (outlined in Section 7.4.2). It came about because the Faculty of IT took a disciplinary decision to create a new specialist School of Multimedia Systems to take ownership of all academic programs relating to the web and web-based applications. As a consequence, ownership and control of the BMultimedia and BElectronic Commerce were handed over to the new school. SIMS, which had been a joint owner of the BMultimedia and heavily engaged in the BElectronic Commerce, lost its stake in both programs, and was required to transfer most of the units which it had developed for them to the School of Multimedia Systems. It was permitted to retain a share in a few units whose content had also been integrated into its main BInformation Management and Systems program, but the potential for any further expansion of its interests in these areas was lost.

- Swinburne: Despite its re-location to the new Faculty of ICT described in the previous section, Swinburne's IS group continued for many years to teach an IS major into the BBusiness degree. But this arrangement ended in 2006, when the major was closed down. This closure brought to an end to the connection between IS and the Faculty of Business, in which the IS department and its BIS degree had been originally established.

- VU: As discussed in Section 7.4.1 the School of IS at VU had introduced a BElectronic Commerce which it offered as a single degree in its own right from 2000, and as a combined degree or double degree with a variety of other business disciplines from 2001. Initially, at the peak of the dotcom boom, these electronic commerce programs attracted aggregate levels of student demand comparable to those of the department's flagship BIS degree. But the demand fell very sharply as the slump set in, and most of the combined and double degrees did not survive for more than a couple of years. The single degree and its surviving combined degree combinations lasted until 2008, when they were all closed down.

- Double degrees: Many of the double degree and combined degree programs with IS which had been established during the boom years were also closed down as the student market declined. Although these had no effect on IS programs themselves, they reduced the profile of the discipline, weakened its connections with other disciplines, and eliminated an important source of high-calibre students.

7.4.5 Outcome of changes in IS departments and programs

Table 7.1 shows the final outcome of the disciplinary and structural changes described in this section in terms of the organizational status of the IS discipline in each university at the end of the period. It shows that IS maintained a presence in all universities, but with a significantly reduced profile in terms of its position within their organizational structures. The previous chapter showed that at the start of the period every university except La Trobe and Ballarat had had independent IS departments, but by its end, Deakin was the only university to have one. In all other universities, IS had been reduced to the state of a partner in a shared department with another discipline(s), and in only two of those universities (VU and Melbourne) was the presence of IS acknowledged in the department name.

The Table shows that the changes caused a shift in the balance of disciplinary associations for IS programs. Where the majority of IS departments and programs had originally been business-based and separated from the more technically-oriented computing disciplines, now five of the eight universities had their IS group located alongside them in a science/engineering faculty or in an IT faculty which had a strong scientific orientation. However, the Swinburne and Monash programs which had originated in business-oriented faculties still used the name 'Business Information Systems' for their degrees, even though their departure from their original faculty was now long past (about twelve years in the case of Swinburne, and more than twenty years for Monash).

IS degree programs still remained in place in all universities except the University of Melbourne, and VU continued to offer an additional program in computer systems management. The rationalisation of IT programs had largely eliminated the problem of universities with multiple IS departments/programs; La Trobe remained as the only university which clearly remained in that situation, with its combination of an MIS major offered in the business faculty and strongly CS-flavoured IS degree offered by its School of CS & CE. At Monash, which is the other institution shown with two entries in the table, the Enterprise Information Management major included a combination of IS and IM content; it had enough IS content to be worth including in the table, but it was not strongly identified with IS and therefore did not have a disciplinary clash with Monash's main BBIS program.

<table>
<tr><th>Faculty of Business</th><th>Faculty of Engineering</th><th>Faculty of Science</th><th>Faculty of IT</th></tr>
<tr><td rowspan="2">Deakin:
School of Information Systems:
BBusiness Information Systems

La Trobe:
MIS Group in School of Management:
Major in Management Information Systems

RMIT:
School of Business IT & Logistics:
BBusiness Information Systems

VU:
School of Management and Information Systems:
• BBusiness(Information Systems)
• BBusiness (Computer Systems Management)</td><td>Melbourne:
Dept of Computing & Information Systems:
(no undergraduate program)</td><td></td><td>Monash:
• Clayton School of IT:
BBusiness Information Systems
• Caulfield School of IT:
Major in Enterprise Information Management

Swinburne:
IS Academic Group
BBusiness Information Systems</td></tr>
<tr><td colspan="3">La Trobe:
Faculty of Science, Technology & Engineering
Dept of Computer Science & Computer Engineering:
BInformation Systems

Ballarat:
Faculty of Science, Information Technology & Engineering
School of Information Technology & Mathematical Sciences:
BIT(Business Systems)</td></tr>
<tr><td colspan="4">Table 7.1 IS teaching departments and undergraduate programs in 2011
Source: Institutional Handbooks</td></tr>
</table>

7.5 Curriculum content of IS programs

The pressure of the changes in IT and computing applications, the changing student market for IT-based programs, and the disciplinary and structural changes outlined in the previous section, caused substantial changes in the curricula of many IS programs during this period. As discussed in Section 7.4.2, the ongoing diversification of IT applications tended to encourage diversification and change in program curricula during both the boom and the decline in the student market. During the boom years, the additional income and the positive mood which were generated by the buoyant student market encouraged IS departments to expand their curricula to cater for new forms of IT-based applications and to attract more students. During the slump, the declining student market also stimulated curriculum change, as departments tried either to reduce units and cut costs, or to find new topic areas which might stimulate student interest and reverse the decline.

The following analysis examines the overall picture of the nature and extent of changes in IS curricula during the period. The analysis considers two aspects of curriculum changes: first, how they affected the core units of the IS curricula, and then how they affected elective units and other unit offerings of IS departments. It should be noted that there is an unavoidably subjective element to this assessment. Few of the programs survived the period without undergoing some changes in their unit names, codes and content, and it is not always obvious from the handbook descriptions whether these changes constituted real change to the curriculum content, or just a re-organization and/or minor change in emphasis. However the patterns of change in each institution appear to be sufficiently clear-cut that any errors in judgement for specific units or areas of program content would not affect the overall picture which the analysis reveals.

7.5.1 The core curricula of IS programs

Tables E18-E20 in Appendix E set out the state which the core curriculum of each IS program had reached by the end of the period, and also highlight the ways in which each curriculum had changed over the course of the period. The tables list the units in each program and include a brief summary of the content of the core units, based on their handbook descriptions. To show the major changes, they highlight all new units which had been added to each curriculum, and all those which had been removed since the beginning of the period. The curricula of both the Science faculty's BIS and the Business IS major in the Faculty of Commerce and Economics at the University of Melbourne are included up to the point when they were last offered in 2008. The tables do not include the other IS program which was closed down during the period, the BComputing(IS) at Deakin; its curriculum had remained virtually unchanged from the time it was converted from a major to a degree in 1998 until the time of its closure in 2005.

The grouping of the programs into the three tables has been based on a broad assessment of the level of change in the core components of their curricula:

- programs which underwent few changes and whose core content remained relatively stable;
- programs whose core content changed substantially;
- programs which were created during the period.

The following analysis identifies the programs which belonged to each of these groups, and briefly discusses the nature of the changes which were made to the curricula of the programs in the second and third groups.

(i) Programs with stable curricula

This group comprises the programs at three institutions – RMIT, VU, and the University of Melbourne - whose curricula remained basically the same throughout the period. Table E18 shows that each showed some variations from the earlier version shown in Table D4 in Appendix D, caused by the addition or removal of units or by minor changes in the emphasis given to each topic. But in each case these variations affected only one or two units, and did not alter the overall themes and general orientation of the program.

(ii) Programs with major curriculum change

This group comprises five programs at three institutions – the business-based programs at Deakin and Swinburne, both programs at Monash, and the CS-based programme at La Trobe. Table E19 in Appendix E shows that the core curriculum in each of these programs underwent substantial change over the course of the period. The main features of these changes are summarised briefly below:

- Deakin: Established as an MIS major in 1994, this had been the slowest of the IS programs which were formed in that period to become a full degree, being upgraded to that status only in 2001. Until 2008 it retained a relatively small IS core curriculum of 8-10 units, whose content remained fairly stable. But in 2009, this original curriculum was almost entirely discarded and replaced with a new set of units, only six of which were compulsory, and whose content bore little resemblance to the content of the units they superseded.

  Even where units in the new program continued to cover traditional themes like programming and system analysis, the focus of their curricula was substantially different to that of previous units in those areas. They replaced much of the coverage of standard IS technologies, development techniques and methods with content oriented at a much broader conceptual level. For example, the previous analysis unit which covered structured and object-oriented analytical techniques was replaced by a unit in business requirements analysis which examined the tasks of analysis in terms of general problem-solving techniques, such as brainstorming, mind-maps and the like; similarly, the only programming unit appears to be less concerned with the traditional emphasis on teaching students how to become programmers, and has a broader focus on programming principles and their implications for software in general.

  These changes appear to indicate a significant shift away from the traditional IT/systems development orientation of its predecessor, and towards a much broader focus on business applications.

- La Trobe: The curriculum in the program at La Trobe remained largely unchanged until about 2006, but over the next few years it was given a significant makeover, in which more than half its units changed. The most significant areas of change in the overall orientation of the program were a substantial reduction in its original heavy focus on programming (reduced from five units to two), and the introduction of a suite of units on new specialist topics – three of them based around technologies relating to the web and web-based applications. However, the curriculum continued to draw its units mainly from its neighbouring CS program, with only 2-3 units being clearly identified as belonging exclusively to IS, rather than CS.

  Although it falls outside the study period, it is worth noting that the re-make of the curriculum at La Trobe continued on in 2012, when the program was given its biggest change to date. This involved the addition of a stream of six compulsory introductory units in business, equivalent to the compulsory business core which is typically required in business-based IS programs at other universities. Room was made for these units by expanding the program core to twenty units, almost eliminating the scope for electives; furthermore, in 2012 the range of choice for the remaining four units was restricted to a nominated list of five, four of which were additional business units.

  These recent changes appear to be aimed at reducing the extent of the overlap between the IS and CS programs, and giving the IS curriculum a stronger orientation towards business and away from the technical focus of its CS neighbour.

- Monash - Caulfield: At Monash's Caulfield campus the combined effects of the organizational structural changes, disciplinary changes and market pressures described in previous sections kept the curriculum of the campus's IS program in a state of instability throughout the period. In the first half of the period, the dominant impact came from the attempts to blend the previous separate IM and IS degrees into a single integrated program. This meant that the component of the curriculum which had been previously identified as IS had to be reduced substantially in quantity, and some parts of the curriculum were also changed in form to try to fit with the IM component of the degree.

  The changes which followed the faculty re-structure were even more severe in their consequences. The first aspect of these changes affected IS at both the Caulfield and Clayton campuses of Monash. It involved the introduction of a set of seven faculty-wide 'common core' units in fundamental aspects of computing, which were made compulsory in all Monash IT degrees. Most of the basic topics in IT which they covered had been previously included in the curricula of the BIS/BIMS at Caulfield and the BBusiness Systems at Clayton, but they now had some significant changes in emphasis to accommodate the other technically-oriented degrees which also used them. These necessitated some modifications to other units in the IS curricula.

  But at Caulfield the changes associates with the introduction of the 'common core' were relatively minor compared with the effects of the closure of the discipline-based schools and the creation of a single BInformation Technology & Systems program (BITS) to cover all the university's old applied computing programs. This initially caused a substantial decline in the status of the IS curriculum at the campus, as it was reduced to a small stream of core units in the BITS with some associated electives. It was subsequently re-introduced as a major (separate from the IM major), which enabled some of the core content of the original BIS to be restored, but after only four years both it and the IM major were closed down again, and replaced by a major in Enterprise Information Management. This major sought once more to combine elements of the defunct IS and IM majors, and integrate the basic concepts of both disciplines.

- Monash – Clayton: Monash's IS program at Clayton program retained its core in largely unchanged form until the faculty re-structure in 2004. Although the new BBIS which resulted from this re-structure was based largely around the BBusiness Systems which it replaced, it included several changes to the curriculum. Some of these changes followed as a consequence of the introduction of the 'common core as described in the outline of events at Monash Caulfield. In addition there were several changes in the curriculum's core specialist units relating to the business applications of IT; similar changes were also seen in the topic areas covered by the program's elective units. Finally, in order to accommodate these changes and to meet a university requirement that one-third of the program should comprise electives, the overall number of units in the core of the curriculum was reduced.

- Swinburne: The IS content of the curriculum of the Swinburne BIS had originally consisted of 8 compulsory units, which were spread fairly evenly across the 'standard' themes of applied computing programs, supported by the student's choice of four IS electives. Shortly after the IS department and the program were re-located from Business to the School of ICT, the number of IS units required in the degree was increased from twelve to about 15-16, almost all of which were compulsory. This increase in size led to a significant increase in the range of topics covered in the core, extending well beyond the system development-related topics on which it had previously focused. In the following years both the range of specialist topics in the core, and the relative weighting of the coverage of the themes in the core were constantly being altered slightly. Although sometime the effect of some of these changes was to cancel out the impact of a previous one, their net effect across the period was to change substantially the balance of the program's topics and the range of their coverage.

(iii) New programs
This group comprises the three new IS programs which were established at La Trobe, the University of Ballarat, and the University of Melbourne. Table E20 in Appendix E shows the state of their curricula at the end of the period, and the following analysis briefly discusses the nature of their curricula as compared to the IS programs which were established during the previous period:

- Ballarat: The new IS-oriented program at Ballarat described its emphasis as being on understanding the role of IT and IT-based systems in business, and the needs for management of IT and IT-enabled change. The table shows, its content was substantially different in its emphasis from that of the older IS programs, which had been based so much around systems development. It had few units devoted to the traditional themes covered in those programs, and addressed them mainly in the context of units about specialist topics relating to the business uses of IT. These focussed heavily around electronic commerce, multimedia and the web.

- La Trobe and Melbourne: The IS-oriented majors in the business faculties at La Trobe and Melbourne were similar enough in orientation that they can be grouped together. The most notable feature of their curricula was the almost total absence of content relating to computer technology. They included no units devoted to the traditional themes of computer hardware, database, data communications and programming. Apart from units covering aspects of system development and IS management, their units were otherwise generally focussed on the study of specialist IT-based applications in business, and on issues relating to the role of the IS specialist in organizations. The range of topics covered by these units was much the same as was covered in the new specialist units which were established during the period in the other older IS programs. Their descriptions of these units in the university handbooks also read much the same.

7.5.2 Elective units offered in IS programs

Although the core curriculum is clearly the key indicator of the knowledge domain which is held to constitute the essence of the IS discipline, the range of elective units offered in an IS program is a useful indicator of its disciplinary scope. It indicates those areas of knowledge which are deemed to be outside the central core, but still sufficiently important or useful to be worthy of inclusion in the program. As one would expect, the number of elective units offered tended to increase and diversify during the dotcom boom and reduce in number during the subsequent period of decline in student demand.

Unfortunately the differences in the circumstances of each IS department and its program(s) make it difficult to carry out a comprehensive analysis of the trends in their elective unit offerings, and to assess the significance of the differences between them. For example, policies about program structures and the number and type of electives which they were required to include varied significantly between faculties and between universities; therefore the ability or willingness of a department to offer elective units may have been affected by broader organizational considerations which were beyond its control. Electives could be relatively transient, with institutions adding or removing them from their catalogues of units according to the availability of staff, resources, student enrolments and the like; some units also changed status within the program, moving into or out of the program's core curriculum. Finally, in universities where IS was not an independent department, but was co-located with other IT disciplines, it was common for all units in all programs to be listed as electives for the IS program, making it impossible to tell which of them were intended to be associated specifically with IS. In the light of these difficulties, this section does not attempt a comprehensive study of IS electives, but simply aims to provide only a broad overview of the types of topic areas which can be clearly identified as a part of the discipline.

Table E21 in Appendix E lists and briefly describes the topic areas which appeared most frequently among the IS elective units for the universities as a whole. It divides them into two groups, with the first group consisting of themes which were included among the elective units in almost all programs and the second group consisting of themes which were popular, but not universal. By far the most popular theme was technology, with almost all institutions offering multiple elective units which extended the coverage on technology fundamentals which featured in the core curriculum. Specialist units on development process were a clear but distant second, with business applications the third most numerous group. The more narrowly-focussed themes – electronic commerce, enterprise systems and IS management – were equally widespread among the universities, but fewer in number, averaging only 1-2 units per university.

The themes in the second group in Table E21 were not as universally covered, but were still popular, with each theme being the main focus of an elective unit in at least half the universities. But for most of these themes, that unit was usually the only one; only occasionally did one of themes become the focus of a set of units.

Within these broad patterns of similarity across the universities, there were distinct differences between them in the patterns of elective units offered in their IS programs. The issues identified at the beginning of the section make it difficult to go further than broad comparisons, but the following briefly summarises some of the key differences:

- Deakin: For much of the period, the School of MIS did not identify any specific units as IS electives, but its unit offerings outside the core IS curriculum reflected its academic orientation. During the dotcom boom, the School maintained its traditional disciplinary connection with quantitative methods, through its major in quantitative business analysis, and also strengthened its unit offerings on business-based IT applications, particularly through its majors in aspects of e-commerce. But the number of these unit offerings declined steadily in quantity after the dotcom crash set in, resulting in the eventual closure of these majors. The units which were retained and specified as electives for the IS program continued the focus on aspects of business applications of IS and the management of IS in business.

- La Trobe, Swinburne and the University of Ballarat: The IS programs at these three universities were offered alongside CS programs within schools which had originated as CS departments. The programs at La Trobe and Ballarat did not specify IS electives, which makes it difficult to judge which of the units offered outside the IS core curriculum were envisaged as IS units. However it is clear from the school/ faculty handbooks that the available units were strongly technology-oriented, with very few units relating to themes such as systems development or business applications. At Swinburne, IS's previous long association with business meant its electives initially retained a balance between technology, applications and development process, even after its move to the new School of ICT. But by the end of the period, as its elective unit offerings declined, the focus of the nominated list of IS electives became increasingly oriented towards technology.

- Melbourne: As explained in the story of the establishment of IS at Melbourne in Section 6.3.2, the program aimed from its origins to strike a balance between technology, business and systems issues. Perhaps aided by its location on 'neutral ground' in the Faculty of Science, its elective unit offerings appear to have retained a reasonable balance between these three main themes, until the degree was closed down in 2008. The only notable new theme to emerge during the period was its addition of units in aspects of multimedia.

- Monash: The instability in the core content of the IS program at the Caulfield campus of Monash made for an equally unstable pattern in its elective offerings. At the beginning of the period, the program's electives were focussed largely around the system development process, IS management and decision support; the 'non-technology' definition of IS at the campus meant it was the only program not to offer any technology-based electives. The merger of IM with IS into the BIMS/BIS meant that a large number of specialist IM units were then added to the elective mix, while the department's involvement in multimedia and e-commerce led to significant offerings based around those themes as well. As the IS department and its program's fortunes waned, so too did the strength of its elective offerings. By the end of the period they had been reduced to a handful of units with no strong orientation towards any specific theme.

  By contrast, the only significant change in the nature of the elective offerings at Monash's Clayton campus during the period was in the number of units, with their predominant focus remaining fixed on business applications. The success of the program during the dotcom boom caused a steady increase in the number of units and the diversity of the types of business application which they covered. But after the cutbacks caused by the declines in student demand the number of units was substantially reduced.;

A more detailed outline of the elective units in both these programs is included in analysis of their curricula in Section 8.7 of the Monash case study.

- RMIT and Victoria University: Despite the similarity in the origins of the IS programs at RMIT and VU as mergers of business-based programs in technology-focussed universities (described in Section 6.3.1), the contrasts in the two departments' approaches to the management of their programs was reflected in widely differing outcomes in terms of the range of units they offered. The BBIS at RMIT began the period with a small number of electives which were mainly technology-oriented, but the number of units dwindled to the point that by the end of the period only a handful remained, with no clear identifiable orientation. At VU, the more expansive approach taken to merging the BIS's constituent programs was carried over into the management of its range of elective units. This both facilitated and was facilitated by the School's development of the additional degree programs in computer systems management and e-commerce, both of which acted as sources of elective units into the main BIS program. By the end of the period, the IS department at VU offered by far the largest number of electives of any university. Its units were spread across a wide variety of themes, with technology, development process, IS management and e-commerce predominating.

7.6 Summary

For IT generally this was an extremely turbulent period, in which all IT-based disciplines went through two stages of vastly contrasting fortunes. During the first half of the period, IT disciplines flourished under the influence of a surge of public interest in computers and their applications. This interest was fuelled by the expectations of the dotcom boom, and by the rapid diversification of IT and its applications in areas like multimedia, e-commerce and the web. But the second stage saw a rapid and prolonged collapse in student demand for virtually all forms of IT education, which extended from the dotcom crash in 2001-02 almost to the end of the period. The chapter has shown how this boom and bust cycle in the popularity of IT was reflected in the instability in the number and type of programs in IT education which were offered during the period.

Overall, the performance of IS as a discipline mirrored that of IT as a whole, with growth and prosperity during the boom, and then contraction and decline during the slump. However, the chapter has highlighted how the position which the IS department occupied within the academic organizational structure of each university influenced its ability to take advantage of the opportunities presented by the boom and to respond to the threats posed by the collapse in student demand. Beyond the very broad picture of growth followed by decline, it is difficult to summarise and generalise the experiences of IS departments and programs for the period as a whole, firstly because the two stages presented such contrasting extremes, and secondly because there was so much variation in the way they were addressed at each university. But despite this diversity in the individual experiences of IS at each university, the following features applied generally to the evolution of the discipline during the period:

- Student demand for IS: Despite the hype over IT during the dotcom boom, the increase in the levels of domestic student demand for IS programs (and for IT generally) was relatively modest. Even at the peak of the boom, the increased student numbers for IT overall were a consequence mainly of the increases in the number and diversity of the available programs; individual programs generally did not attract significantly more students than at the beginning of the period. Although there is insufficient data available for this study to draw a definite conclusion, it seems likely that the perceptions of the strength of the IT student market at the time were based more on the rapidly-rising numbers of international students studying IT, than on the state of the domestic student market. The most significant effect of the boom on the domestic undergraduate student market for IT and IS programs was on the quality of student applicants and intakes, with the average ENTER scores of enrolled students increasingly noticeably during the period.

  For IS, the other significant aspect of the dotcom boom was that the increase in domestic demand was associated mainly with double degree programs, where students undertook programs which combined studies in IS with another discipline. If the effect of these programs is excluded, there was little change in the size of the domestic student market for IS, even at the height of the boom.

  On the other hand, the decline in student demand after the dotcom crash was severe and universal in its effects for IS programs (and likewise for IT generally). All programs suffered massive declines both in numbers and quality of students. By the time the decline began to flatten out in about 2007-08, the overall intakes into IS and IT programs had dropped to the lowest levels seen since the transformation of the tertiary education sector brought about by the Dawkins reforms.

- Disciplinary status/recognition of IS: The impact of the changing patterns of student demand on the disciplinary status of IS In terms of undergraduate academic programs, the end of the period saw the discipline in much the same position as at the start. In 2011 only one university – the University of Melbourne - did not offer a specialist undergraduate IS program, and its loss from that university was a consequence of the university's changed approach to undergraduate teaching, rather than a reflection on its attitude to IS. However, although the number of IS programs remained much the same, this was due not to a lack of change, but to the effects of gains (new programs at Ballarat and La Trobe) balancing out losses (at Monash and Deakin).

  The damage caused to the discipline by the slump in student demand was much more evident in organizational structures, with only one university, Deakin, retaining an independent specialist IS department by the end of the period. In the other universities, IS had lost its independent departmental status to become either a partner in a department with another discipline (at

Melbourne, RMIT and VU) or an academic group within a broadly-based multi-disciplinary school (Ballarat, Monash and Swinburne). (At La Trobe, it remained as it had always been in the latter of these two categories).

- Divisions within IS: One of the most striking developments was the addition of the new IS programs at Melbourne and La Trobe, which left both those universities with two IS programs. As discussed in the previous chapter, this had happened previously when the Dawkins mergers had brought together two institutions with their own IS programs; in those cases the decisions to leave the programs separate can be explained on the basis of the differences in the their historical roots and the fact that they were offered at different campuses. But these two new cases appear to involve a deliberate decision by a business-based faculty to develop and introduce its own program in opposition to the degree which had previously represented the discipline.

- Disciplinary associations of IS: The change in the departmental status of IS was also linked with significant changes in the overall pattern of its disciplinary associations. Although almost all IS academic programs continued to use the word ‘Business’ as part of their names, by the end of the period IS departments were most commonly located alongside other IT disciplines in schools or faculties which focussed on IT. Most of the departments which did not join with other IT disciplines became more closely linked with other business-based disciplines as a consequence of departmental mergers.

- Changes in disciplinary scope of IS: During the dotcom boom, IS departments significantly extended their disciplinary coverage into areas such as multimedia, electronic commerce, and new areas of application of IT - particularly those associated with the internet and the web. In several universities the rising general interest in IT was also reflected in the formation of combined or double degrees of IS with other disciplines. However, the slump in student demand in the aftermath of the dotcom crash caused the elimination of most of both these areas of expansion by the end of the period.

- Changes in IS curriculum: The expansion and contraction of the scope of the discipline was reflected in IS curricula, which generally grew in the early part of the period, and then shrank both in size and diversity of content. There was a significant disparity in the stability of curriculum content, with about half the programs retaining much the same general structure and content, and the remainder undergoing substantial change.

Chapter 8: An organizational case study of the evolution of IS and IS curriculum

8.1 Monash University as an organizational case study

This chapter examines the history of the development of IS in a single institution, Monash University. In doing so, it complements the analysis in the previous three chapters of the overall patterns in the evolution of the IS discipline and its undergraduate curriculum across all Victorian tertiary institutions. The detailed analysis of events at Monash will demonstrate how the general patterns described in those chapters can be seen to apply within an individual institution, but will also highlight the individual factors unique to Monash which influenced the specific ways in which those patterns manifested themselves.

The choice of Monash as the case study institution was driven by a number of factors:

- Status of Monash: As the largest university in the country, Monash is an influential force in tertiary education in Australia. It is one of the self-titled ‘Group of Eight’ which includes Australia’s leading universities, and it consistently features prominently in international university rankings.
- Variety of educational influences within Monash: Monash is an amalgam of institutions which came from across the spectrum of the Australian tertiary education system. It was initially established as a major metropolitan university, but as a consequence of the Dawkins reforms it merged with a leading metropolitan CAE (which was itself the product of an amalgamation of a Technical college with a Teachers college), and a small regionally-based CAE. Therefore an analysis of the evolution of the structure of Monash’s academic disciplines and teaching programs illustrates the influences of a variety of educational traditions and philosophies.
- Status of computing/IT as an academic discipline at Monash: Monash and Chisholm Institute of Technology, which was one of the CAEs which merged with it, were pioneers in computing education in Victoria. The university has been one the leading forces in the development of IT-related academic disciplines in Australia.
- Accessibility of data: Monash’s records and archives provide comprehensive coverage of much of the material required for the study. As an academic who has worked at the university since 1991, I have a good working knowledge of the available documents and ready access to most of them.

As was the case in the previous chapters, the early part of this history of events at Monash and its constituent institutions deals with the development of computing generally, and includes consideration of the origins and early growth of computing disciplines other than IS. This is necessary because IS was initially defined in terms of its relationship with these disciplines, and the early stages of its evolution were heavily influenced by them. In the later years of the study, when IS had become better-established, less attention is paid to these other disciplines, and the main focus is confined to Monash’s IS departments and programs.

The case study employs the same theoretical framework which was used in Chapters 5-7, with its main focus being on the way in which the discipline and its curriculum have been shaped by a combination of forces, some of them discipline-based, some structural, and some market-based. Other factors which influenced the course of events are included as appropriate, and are discussed further in the conclusions to the chapter.

As discussed in Chapter 4, the main data sources for the case study were the official organizational records of Monash and the institutions which have merged with it. Some use was also made of several previous historical studies of computing at Monash and at Chisholm Institute of Technology (CIT) prior to its amalgamation with Monash at the time of the Dawkins reforms. The use of these studies has generally been confined to the provision of supporting material to reinforce and complement the evidence of the primary sources. These studies are as follows:

- Pearcey (1979) – Trevor Pearcey was one of the pioneers of computing in Australia and was the inaugural head of the Department of EDP and subsequently the School of Computing & Information Systems at Caulfield Institute of Technology (CaIT), which ultimately became part of CIT. His outline of the history of computing at CaIT from the early 1960s to the late 1970s was written as part of his department's submission to an internal review of the CaIT structure. Its content is based largely on Pearcey's experiences as an employee of CaIT.
- Greig & Levin (1989) – Jack Greig and Pearl Levin taught computing at CaIT/CIT for many years, and occupied senior positions in the School of Computing & Information Systems at CIT at the time of its amalgamation with Monash. Their work is a brief official history of computing at the institution written to celebrate the 25th anniversary of its first offering of a computing course. It is based largely on their own experiences as employees of CaIT/CIT.
- Rood (2008) – Sarah Rood was commissioned by the Faculty of IT at Monash to write the official history of the development of computing at Monash and CaIT/CIT and the events leading up to the formation of the faculty. Her work covers the period from 1960 to 1990, and is based on a combination of organizational records and interviews with staff from the two institutions.
- O'Hanlon (1999): Seamus O'Hanlon was commissioned by the Department of Business Systems to write the official history of the first ten years of the department. His work covers the period from its inception as the Department of Information Systems at Monash in 1987 to the late 1990s, and is based largely on interviews with key departmental staff.
- Tatnall (1993): – Arthur Tatnall's study examined the origins and development of computing programs at a number of Victorian tertiary institutions, and included a brief outline of the history of computing at both Monash and CaIT/CIT from their origins to the early 1990s. His work was based largely on interviews with senior academics who had worked at the institutions.

The chapter follows a similar general approach to that used in Chapters 5-7, in that it divides the study period into a series of stages, and examines the key events associated with the changes occurring within each stage. The time periods used for the stages are the same as those used in Chapters 5-7, with the exception that the period from 1997 to 2011 is broken into two separate stages – from 1997-2004 and 2004-2011, to allow a more detailed study of the changing fortunes of the IS discipline during this very turbulent time. A second difference from the structure of the earlier chapters is that the analysis of the evolution of the IS curriculum has been consolidated into a single section covering the entire period of the study, and separated from the stage-based general description of the growth of the discipline at Monash.

The structure of the chapter is as follows:

- Section 8.2 provides a brief outline of Monash and the key institutions which merged with it as a consequence of the Dawkins reforms.
- Sections 8.3 describes the developments up until the time of the Dawkins reforms in the evolution of computing and IS at Monash, and at the institutions which taught those disciplines and which were to become part of Monash.
- Section 8.4 describes the changes which came about in computing and IS at Monash from 1990 - 1997 as a consequence of the Dawkins reforms.
- Section 8.5 describes the developments in IS at Monash from 1997 to the peak of the dotcom boom in 2002.
- Section 8.6 describes the developments in IS at Monash during the slump in student demand for IT from the peak of the dotcom boom in 2002 until the end of the study period in 2011.
- Section 8.7 analyses the changes throughout the entire study period of the curriculum of the two main IS programs taught at Monash's Clayton and Caulfield campuses.
- Section 8.8 brings the chapter to a conclusion with a brief reflection on the evolution of IS at Monash, and its implications for this study as a whole.

8.2 Monash as an institution

In order to understand the evolution of computing and IS programs at Monash, it is necessary first to understand something of the history of the institution itself, and in particular to understand the nature of the institutions which merged to become a part of Monash at the time of the Dawkins reforms to tertiary education. Figure 8.1 summarises the history of the institutions which merged with Monash at that time, and which have contributed to its computing-based programs on its Victorian campuses.

The origins and evolution of each of these institutions is summarised briefly below. (Note that the diagram and discussion exclude other tertiary institutions which have also become part of Monash, but without significantly influencing its computing programs; it also excludes consideration of the development of Monash's overseas campuses in Malaysia and South Africa which occurred in later years).

(i) Monash University: Monash was commissioned as a new university in 1958 by the Victorian State government, in response to concerns that the University of Melbourne could not cope with the growth in demand for higher education in Victoria (Marginson, 2000). The initial planning for Monash envisaged it as a technology-focussed institution, but the pressure for extra tertiary student places in the humanities caused these plans to be abandoned, and from the time of its opening it operated as a multi-disciplinary university. It took in its first intake of 347 students in 1961 (Davison & Murphy, 2012)

As the second Victorian university, Monash struggled through its formative years to escape the shadow of the State's first university, the University of Melbourne, which had been established more than a century earlier. Monash's inability to match the established history and tradition of Melbourne acted to some extent as an impediment to its growth, but also provided the basis for its competitive positioning (Marginson, 2000). Where Melbourne's longevity gave it a significant initial edge in status and prestige, Monash was able to present itself as being unencumbered by the traditions which caused its rival to be perceived as conservative in its outlook. Monash sought to use this to its advantage in developing a reputation for innovation and willingness to embrace change, which contrasted with Melbourne's reputation for supporting the status quo. By 1990 its student population had risen to over 14,000, which made it the second-largest tertiary institution in Victoria, but it still lagged well behind Melbourne, which had more than 20,000 students (DEET, 1990)

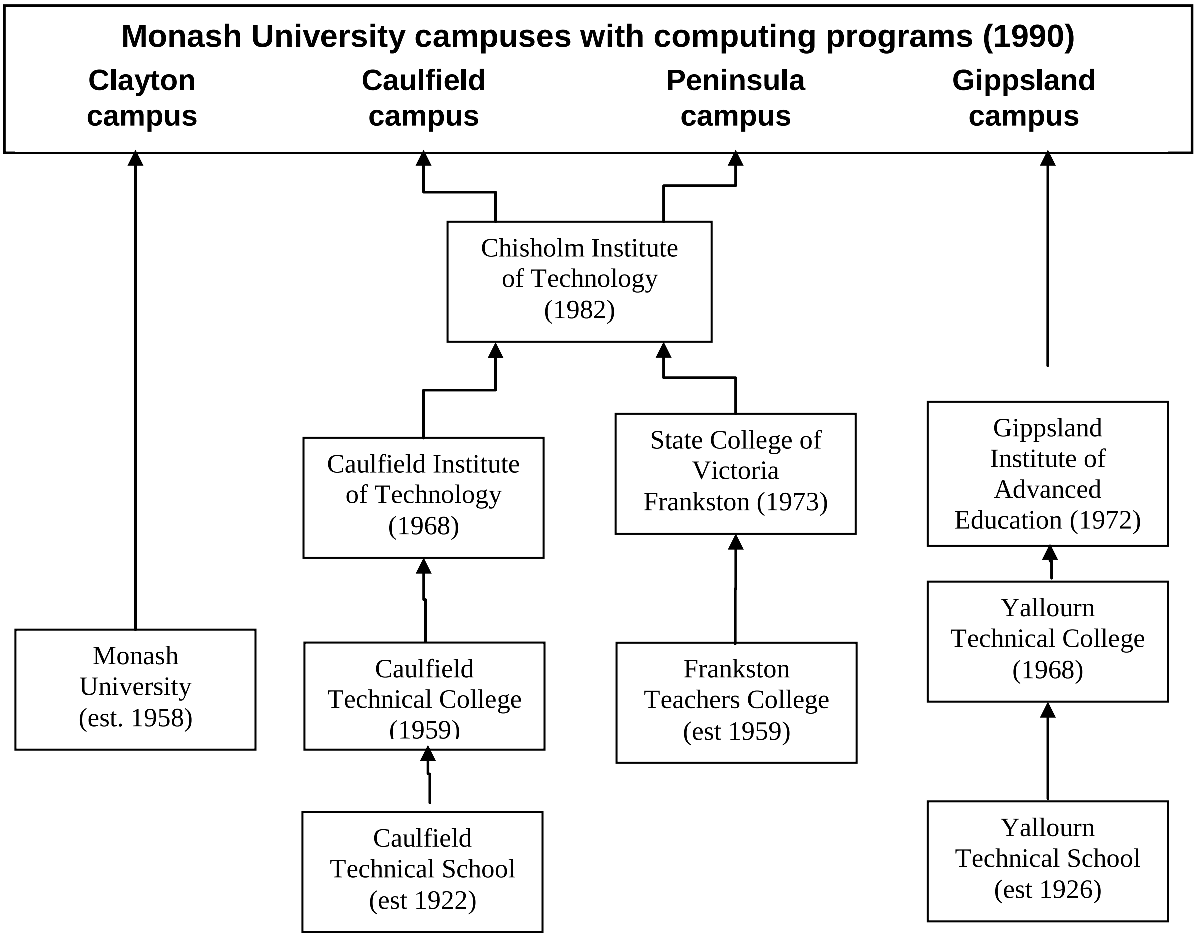


Fig 8.1 Institutional Origins of Monash Computing

(ii) Chisholm Institute of Technology (CIT): CIT was itself the product of an earlier merger in 1982 between the Caulfield Institute of Technology (CaIT) and the State College of Victoria Frankston (SCVF). The CaIT half of this merged organization is the main focus of interest for this study, because SCVF was a teacher training college, with no significant involvement in computer education.

CaIT had its roots in the Caulfield Technical School, a secondary school established in the early 1920s to provide vocational training for tradespeople such as blacksmiths, wheelwrights, farriers and carpenters. After the second world war, it expanded its services to provide diploma level courses in electrical and mechanical engineering to help with the repatriation of returned servicemen. Through the late 1940s and 1950s, the institution's focus gradually changed from secondary to tertiary education, and in 1959 it changed its name to Caulfield Technical College. It continued to teach students at both secondary and tertiary levels, with a 'junior school' teaching secondary school students and a 'senior school' offering certificate and diploma courses (Rood, 2008).

In 1968, after the establishment of the binary system for tertiary education (described in section 2.6), the senior school of Caulfield Technical College split with the junior school and became CaIT. Although its name reflected its origins in technology-based education, CaIT sought to expand and diversify its disciplinary base to equate with those of a university. As part of the rationalisation of the CAE sector, CaIT merged with SCVF from the beginning of 1982 to become Chisholm Institute of Technology (CIT). By the time of its merger with Monash in 1990, CIT was vying for the position of second largest CAE in Victoria, with just under 7500 enrolled students (DEET, 1990).

(iii) Gippsland Institute of Advanced Education (GIAE): GIAE followed an evolutionary path as an educational institution which was similar in some respects to that of CaIT. GIAE had its origins in the 1920s as the Yallourn Technical School, located in a company town built to house the employees of the State Electricity Commission of Victoria, who were based at the local coal mines and power stations in the La Trobe Valley. A major emphasis for the school was the provision of vocational training for this work force. It became Yallourn Technical College in 1968, and was re-named the Gippsland Institute of Advanced Education, when it re-located to its present site in the nearby town of Churchill in 1972 (Meek, 1983).

As the only significant tertiary education institution east of Melbourne, GIAE became a major regional centre for tertiary education, offering a range of courses including engineering, applied science and business. However, its location in a rural area meant that GIAE's student population and its range of academic programs remained relatively small (Meek, 1983). At the time it agreed to merge with Monash, it was among the smallest multi-disciplinary tertiary institutions in Victoria, with a student population of just under 3000 (DEET, 1990).

8.3 1960-1990: From the origins of computing to the Dawkins reforms

This section outlines the origins of computing and IS education in each of the three key institutions which eventually became a part of Monash University in the period prior to the implementation of the Dawkins reforms. Most of the section is devoted to events at Monash and CaIT/CIT, which were the dominant forces in establishing the subsequent structure of computing education at the university.

In keeping with what Chapter 5 showed was the general pattern at Victorian tertiary institutions, IS struggled until late in this period to establish a distinct and clearly identifiable separate disciplinary presence in the computing programs at all three institutions. Therefore the section describes the development of computing generally at each one, before examining the nature and extent of the IS-based organizational academic units and teaching programs which were formed there.

8.3.1 Computing and IS at Monash

Origins – Information Science and Computer Science

In keeping with its original intentions of being a technology-focussed university, Monash took a strong interest in computing virtually from the time it was founded. The university bought and installed its first computer in 1962, and established a Computer Centre to operate it and develop, implement and support computer-based university administrative systems. Staff from the Centre almost immediately also became involved in the teaching of aspects of computing to students in the science, engineering and economics faculties (Rood, 2008).

A key figure in the introduction of computing education at Monash was Cliff Bellamy, who initially worked at Monash as a representative of the computer company which installed Monash's first computer (Rood, 2008). He stayed to become the senior programmer in the university's computer centre, before becoming the officer in charge, and then the first director of the centre. Bellamy's background in the commercial computing world showed out in much of his work with the computer centre. He promoted the use of the centre for teaching vocational aspects of computing within Monash, and in entrepreneurial ventures developing commercial systems for external organizations (Tatnall, 1993).

Bellamy advised the university that it should become involved in computing education, because it was inevitable that the computing industry would need graduates with specialist qualifications in the area. Almost from the time the university opened its doors, he advocated the establishment of an undergraduate program in computing to meet this demand. His vision for computing education and a broadly-based computing discipline appears to have been strongly influenced by his background in industry. In a paper on computers and tertiary education delivered to the Monash Computer Centre Committee, Bellamy noted that the work force required two different types of computing professional – "… systems analysts who are concerned with information collection, processing and distribution, and programmers who are able to code specified systems" (Monash Computer Centre Committee, 1963). But he suggested that in practice there would be no sharp distinction between these two categories, with practitioners drifting from one to another as circumstances required. He used the name 'Information Science' as an umbrella term to cover the emerging computing discipline "…embracing what we know as data processing, computing, control systems, communications, etc" (Monash Computer Centre Committee, 1963).

Bellamy's vision was accepted by the university, despite some reluctance on the part of the Science faculty, which felt that the teaching of computing could be left as the responsibility of the new computer centre. On the basis of his recommendations, Monash resolved in mid-1964 to create a chair in Information Science, for advertisement the following year (Monash Computer Centre Committee, 1964). But the proposed appointment soon became bogged down over the details of the scope of the responsibilities of the position and the appropriate location for it within the university structure. In particular there was uncertainty over whether it should be created as a purely academic position, or whether it should also have some responsibility for the operations of the university's computer centre. The Science faculty, which was the initial proposed home for the Chair wanted the appointment to be deferred for several years, and did not see the need for a new department. The Faculty of Engineering argued that it might be more appropriate to locate it in the Department of Electrical Engineering, and the Faculty of Economics was also mooted as a possible home (Rood, 2008).

As a consequence, when the chair in Information Science was initially advertised in 1965 and then re-advertised in late 1966, it was surrounded by uncertainty about the details of what it represented, where it should be located and what form of departmental support it should have. Advertisements for the position stated that although it was envisaged that the Chair and a new department would be located in the Faculty of Science, these were matters open to negotiation. The advertisements suggested that instead of setting up a new department, "…the appointment might be taken up in another department such as maths or engineering" and that instead of being located in Science, "…it is conceivable that it might be more appropriate to be held within one of the other faculties" (Monash University Archives, 1965). The Engineering faculty argued forcefully that the Chair should be re-named Computing Science, and should be located in Electrical Engineering alongside its programs in Computer Engineering (Monash Professorial Board 7/1966).

These uncertainties about the position definition created problems, not just for candidates, but also for the selection committee; Rood (2008) cited a comment by one member of the committee that he could not judge the suitability of a candidate because "… he found it hard, even impossible, to discover whether Computer Science and Information Science were one and the same thing, or not" (quoted in Rood, 2008, p1.17). One strong prospective candidate who it appears was on the verge of being appointed withdrew his application over disagreements with the selection committee about the role, responsibilities and location of the position (Rood, 2008). Eventually the position of Chair and head of a new Department of Information Science located within the Faculty of Science was filled by Chris Wallace in late 1967, and the first appointments of staff to the new department began in 1968 (Rood, 2008).

Wallace's original academic background had been in physics, and his interests in computing were solely in the area of Computer Science. He soon made it clear that the new department should focus mainly on Computer Science, rather than having the broader scope originally envisaged by Bellamy. In late 1973, he put forward a proposal that the department name to be changed to 'Computer Science' (Monash Science Faculty Board, 1973). He noted that the name 'Information Science' had been originally chosen with the aim of giving the discipline a broad appeal and avoiding too restrictive a view of its scope, but argued that the work of the department had demonstrated that this breadth was no longer needed. There was clearly enough substance in Computer Science to justify it becoming the main focus of the department's attention. Wallace also claimed that the ongoing use of the name 'Information Science' was causing problems for the department because that term had now come to be generally associated with libraries and information retrieval. The impending introduction of library studies at Monash would increase the scope for confusion. Changing the name to Computer Science would more accurately reflect the work which the department was doing and would give the department a clearer identity in the eyes of other such university departments both locally and internationally. The name change was agreed to, and from that point on, the department's direction was clearly established as being that of a conventional Computer Science department, with its interests focussed mainly on that area of the computing field.

But despite its move towards Computer Science, the department continued to support some aspects of commercial data processing in its teaching. When its teaching program was first established, one of the four units was a specialist data processing unit, and this unit retained its place as a core program component for many years, labelled initially as 'data processing', then for a few years as 'data systems' and finally as 'information systems'. Tatnall's (1993) brief outline of this aspect of computing at Monash made extensive use of comments by Tony Montgomery, who was one of the first lecturers to be appointed to the department; he worked there from 1969 until 1982, and towards the end of his tenure acted as departmental head when Chris Wallace was absent on a period of extended leave. According to Montgomery, he was initially appointed to his position in the department largely as a result of advice from Cliff Bellamy to Wallace that it needed a commercial data processing component in its teaching. Tatnall cited Montgomery as suggesting that computing at Monash during the 1970s "… sat somewhere between the Computer Science purists at Melbourne University and the Commercial Data Processing of CAEs like Chisholm [Institute of Technology]" (Tatnall, 1993, p123). Montgomery believed this was partly due to the ongoing influence of Bellamy, who, in his role as the director of the computer centre, continued to encourage the inclusion of data processing in the CS program. Montgomery also felt that although Wallace was a pure research scientist "…he recognised the need for 85% of people to have an idea of the kind of stuff relating to commercial DP" (Tatnall, 1993, p122).

According to Montgomery the main obstacle to the department's ability to teach data processing/information systems was the attitude of the Science faculty, whose senior management were dubious about the status of Computer Science as an academic discipline. Montgomery claimed that the department came under constant questioning as to whether its work constituted science, or whether it was in fact a vocationally-based field like engineering (Tatnall, 1993). To exemplify the faculty's attitude, he described the fate of a Graduate Diploma program which the department developed in the mid-1970s, and which Montgomery believed offered "…exactly the stuff that people out in commercial DP who graduated many years ago or who had never done a formal Computer Science course, would have been interested in." (Tatnall, 1993, p122). It was initially very successful, but was closed down by the dean of the faculty on the grounds that it was the sort of course which belonged in an institute of technology rather than in a university. Montgomery's recollection of events is supported by Rood's (2008) history, which highlights the difficulties which the department encountered during this period, largely as a consequence of the reluctance of its own faculty to respect its disciplinary status.

As a consequence of the pressure from the faculty, the department's coverage of applied computing and the issues associated with the study of information systems steadily diminished as its teaching program expanded throughout the 1980s and the range of its coverage of CS topics grew. The undergraduate CS curriculum retained its single specialist information systems unit, focussing on systems analysis and design, but it was reduced to the status of an elective component of the CS major.

Computing in the Faculty of Economics and Politics

Although the Department of Information Science/Computer Science was assigned primary responsibility for computing education at Monash, some other parts of the university also developed and maintained sequences of units which catered for their specialist interests in computing. Prominent among these were the Faculty of Engineering, which offered units in digital systems and computer engineering, and the Faculty of Economics and Politics, which offered units in data processing and the business use of computers. This latter group of units played a vital role in the emergence the first specialist IS program at Monash.

The Faculty of Economics and Politics (ECOPS) had begun to include some computing content in its programs long before the formation of the Department of Information Science. As early as 1964 the faculty offered a 3rd year computing unit entitled ‘Computer Course A’ which provided an introduction to computers and data processing (Monash, 1964). The unit was re-named to ‘Data Processing’ in 1966 with three main specified topic areas – data processing concepts, data processing equipment and ‘computer programming in the context of administration and management’ (Monash, 1966). Initially the faculty relied on the computer centre to teach the unit, but responsibility for it was eventually taken over by the Department of Accounting & Finance.

Although this introductory data processing unit continued to be offered for many years, the establishment of a Department of Econometrics & Operations Research in 1973 caused a shift in emphasis in the faculty’s involvement in computing. The new department’s computing interests lay less in mainstream accounting/data processing, and more in the mathematical simulation and modelling associated with operations research. The department initially established an introductory unit in computing called Computer Methods in 1980 and added two further units in 1982 (Monash,, 1980 & 1982). The orientation of the department towards computing can be seen in the content of these units, which were described in the following terms in the faculty handbook:

- EO251 Computer Methods: Introduction to computing; programming in Fortran; applications of computers in economics and Operations Research;
- EO352 Computing and Information Systems: Computer techniques relevant to IS including sequential, random and key-sequential files, searching, sorting and merging, data base, info flows in management systems, data acquisition, recording, enquiry and management reporting systems;
- EO353 Management Computing Systems: Application of computers in industrial planning and control. Introduction to computer hardware and software systems in a management context. Stock recording and control, order information systems, production planning and control, manufacturing resource planning.

(Monash, 1982)

There are no indications in the official Monash records as to whether any consideration was given to the possibility of Department of Computer Science involvement in these units; they may have been seen by ECOPS as being too specialised and business-related for that to be possible. But the computing needs of ECOPS and its potential overlap with the work of the Department of CS were raised during a lengthy university review of that department which took place from 1981 to 1983. This review, which was chaired by the university’s Deputy Vice Chancellor, was initiated in response to concerns about issues of resources, staffing and staff morale within the department (issues which were attributable at least in part to the lack of respect accorded the department by the Faculty of Science, as indicated earlier) (Rood, 2008).

The details of these problems and the way they were addressed is beyond the scope of this study, but it is significant for the fact that closer collaboration between CS and ECPOS was proposed as a possible part of the solution. At a meeting attended by the heads of the Departments of Econometrics & Operations Research and Accounting & Finance, the review committee discussed the nature of their computing interests and the computer-related units which they offered. The two departmental heads indicated that although they would like more computing content in the Bachelor of Economics, " …traditionalists within the faculty would not wish to see too much erosion in economics theoretical content (sic), for the sake of material seen as related to specific techniques and tools" (Monash CS Review, 1983a). They noted that the level of interest in computing among ECOPS students was demonstrated by the fact that some of them were already taking the first year computer science unit even though it had not been designed to relate to their needs. The meeting concluded that stronger links should be established between these departments and the Department of CS, and that a new first year CS unit should be developed specifically for ECOPS students, to be taught jointly by the departments of the two faculties.

Despite this agreement, the idea of a shared unit made little progress. The Dean of ECOPS had advised the review committee that he saw the idea as being "…very much in the developmental stage", and warned against any detailed proposal being included in the committee's final report before it had gone through ECOPS's approval processes (Monash CS Review, 1983b). It narrowly won a vote for 'in principle' approval at an ECOPS faculty board meeting in mid-1983, but with much caution being expressed over its content (Monash ECOPS Faculty Board, 1983a). A subsequent meeting of the board emphasised the faculty's reluctance to go beyond this in-principle approval without a specific proposal, but also approved the establishment of a joint liaison committee with the Department of CS to discuss curriculum content (Monash ECOPS Faculty Board, 1983b). A unit proposal developed by this committee was presented to the ECOPS faculty board in June 1984, but without the support of the ECOPS Regulations and Degree Structure Committee, which was "… unable to reach agreement on the desirability of introducing the new [unit]" (Monash ECOPS Faculty Board, 1984). A motion to approve the unit's introduction was defeated, with the minutes of the meeting noting that "… it was suggested that there was need for a review of the structure of the undergraduate degree as a more appropriate response to the question of further computer courses than the one currently proposed." (Monash ECOPS Faculty Board, 1984).

It seems clear that despite their expressed willingness to co-ordinate and combine their computing interests, there was little practical support within ECOPS at least, for the university's attempts to establish a bridge between CS and the computing needs of ECOPS. This would have significant consequences for the development of the university's first specialist IS program, which followed just a few years later.

Information Systems – the BIS and the Department of IS

The initiative which led to the establishment of an IS program at Monash came neither from CS nor ECOPS, but from outside the university. The leading figure in it was the managing director of IBM Australia, Brian Finn, who decided to take action over his concerns that industry needed IT graduates with better business knowledge and experience. Finn felt that mainstream computing courses did not give students enough exposure to business concepts, which meant that new graduates from these courses started their employment with strong IT skills, but little understanding of IT applications in business or of the business world in general (O'Hanlon, 1999).

In early 1987 Finn approached the Australian federal government and the vice chancellors of two universities - Monash and the University of NSW - with an idea for a business IT degree which combined '…elements of existing computer science courses with the information systems teaching usually conducted in business faculties' (Finn, quoted in O'Hanlon, 1999, p9). The course would contain an industry-based learning component and industry sponsored scholarships for students. Finn emphasised that although the program aimed to produce IT graduates whose knowledge was more relevant to the needs of business, it was not intended as narrowly-focussed vocational training. He tentatively labelled it as a Bachelor of Science in Computing and Information Systems.

Finn's proposal received strong support from the federal government, with the rider that the proposal also be extended to institutions in the CAE sector, where it was taken on by the NSW Institute of Technology and Swinburne Institute of Technology (O'Hanlon, 1999, p12). After some initial concerns that the concept might be seen as too commercial and too vocational for a university, it was embraced by Monash. After discussions with Finn, the Monash Vice-Chancellor, Mal Logan, sent a copy of the proposal to Gus Sinclair, the Dean of ECOPS, with a hand-written note suggesting that: "…I was wondering if, in addition to Computer Science, other Departments might be interested; eg there is a strong emphasis on <u>business</u>." [emphasis as in original] (Monash University Archives, 1987a). Sinclair replied positively, suggesting that his faculty was well-equipped to participate in the proposed program. He noted the existing undergraduate computing units offered by the department of Econometrics & Operations Research, and stated that his faculty was currently considering recommendations for two postgraduate programs - a Master of Management and a Diploma of Business Systems – which would include significant emphasis on the use of computers in business (Monash University Archives, 1987b).

A steering committee to develop the program was established comprising the deans, relevant heads of departments and other staff from the faculties of Science and ECOPS, plus industry representatives from IBM and several other large companies. The university wanted to offer the program at the start of the next academic year, so decisions had to be made quickly. The official documentary record of the steering committee discussions is brief, but it is clear that a short but vigorous battle ensued as the Department of CS fought with ECOPS for control over the management and content of the new program. CS argued that since the proposal was for a computing program then it should have control over it; ECOPS argued that since the program would have a business focus then it should control it. Eventually a meeting of the deans of the two faculties with the university registrar on 17 July resolved that "… academic involvement with the matter should now lie with Economics and Politics, although Computer Science will be closely involved." (O'Hanlon, 1999, p17).

Despite this agreement, disputes continued between the two sides over the content of the proposed degree, with each putting forward its own curriculum proposals. Matters reached a head on 11 August when Les Goldschlager, the then Head of Computer Science, sent a memo to the Vice-Chancellor reporting the events of a meeting held between the two sides earlier on that day (Monash University Archives, 1987c). Goldschlager explained that he had tabled for discussion the latest version of Computer Science's proposed curriculum, which he believed was consistent with what IBM and the industry partners wanted. However, "… not much headway was made, as the Dean of Economics and Politics took the view that either his faculty would do the majority of the teaching or else it would withdraw from the course." Goldschlager requested the Vice-

Chancellor’s support, urging that the computing component of the course “… should not be downplayed” (Monash University Archives, 1987c).

This appeal for senior intervention may have helped bring about a resolution, but clearly not in favour of Computer Science, because only a week later at the next meeting of the steering committee (not attended by Goldschlager!) a draft curriculum was finalised, with the balance of teaching tipped heavily towards ECOPS (Monash University Archives, 1987d). Further amendments to the proposal saw its CS content continue to decline. By the time it was submitted to the university’s academic board it included only two CS units, and their removal and replacement with more business and economics content followed within a short time.

From the official records it is impossible to tell whether the failure of CS and ECOPS to reach agreement on a joint program as had been originally envisaged was a consequence of academic disciplinary differences and their consequent impacts on curriculum content, or organizational structural issues relating to power and control over the program. It is interesting to note that, in contrast to the outcome at Monash, the companion program implemented under the same scheme at Swinburne Institute of Technology did result in a joint degree. Swinburne’s Bachelor of Information Technology program was shared between the business-focussed Department of Data Processing & Quantitative Methods and the science-based Department of Computer Science, with each department contributing about half of the curriculum content (Swinburne, 1989).

With battle for control over the new program and its content decided, ECOPS had to decide what organisational structures would be established to support it. In late September 1987, Sinclair wrote to the Vice-Chancellor noting that the new degree program would require the faculty to employ new teaching staff, especially in the area of information systems. He suggested that:

> “… there is now a compelling case to create a new Department of Information Systems by splitting the operations research group from the present Department of Econometrics and Operations Research. Although the new department would be fairly small, I think there would be benefit in explicitly recognising information systems in the faculty and regarding operations research as a branch of it.” (Monash University Archives, 1987e).

Following a favourable response from the Vice-Chancellor, this proposal was approved by the ECOPS faculty board in November 1987 and approved by Monash Council in December. Simultaneously it was agreed that the existing chair in Operations Research would be re-named to a chair in Information Systems. The department formally came into existence in March 1988, and by the time of the merger of Monash with CIT in 1990, it had about 10 academic staff.

The BIS program was offered for the first time in 1988 with an initial intake of 39 students. The emphasis on economics in its curriculum, which was an inevitable consequence of the ECOPS victory in the struggle for ownership, had an unexpected adverse effect early in the program’s development. In 1989, when the second intake of students reached the end of their first year studies, a significant proportion of the students failed so many of their first year economics units that they were unable to progress into the second year of the program (O’Hanlon, 1999). The Department wrote to the Vice-Chancellor advising that these failures put the IBL scheme in jeopardy, because there would not be enough students eligible to fill the industry-sponsored work placements which students had been scheduled to take in their second year of study. The department noted that the students were performing well in the computing components of the program, but that the curriculum was 'over-loaded' with economics units which were unrelated to the program's objective of producing computer professionals. The immediate problem was resolved by offering supplementary passes to enough students to meet the required second-year numbers, but the department argued that a reduction in the number of economics units in the curriculum was needed to prevent the problem recurring (O'Hanlon, 1999).

This incident highlights the tension between diverging disciplinary perceptions of the new degree, and the consequent relative emphasis on the key elements of its curriculum. On the one hand the department saw computing and computer-based business applications as the primary disciplinary focus for the degree, while to the faculty it was important that it still retain the fundamental disciplinary components of a traditional economics degree. The merger of Monash with CIT brought this tension to a head in discussions over the preferred location of the department in the new organizational structure. The conflicting views on this issue and their ultimate resolution are discussed in detail in Section 8.4 below.

8.3.2 Computing and Information Systems at Caulfield/Chisholm

Origins - Data Processing at Caulfield Technical College

Computing was introduced as a specialist area of teaching at Caulfield Technical College by the college principal, Austin Lambert, in 1959 (Pearcey, 1979). Lambert was an engineer, and according to Pearcey (1979) he foresaw that computers would become essential tools for society, though he believed their major use would be in engineering work. He set up the College's first short course on 'Computers in Engineering' in late 1960, employing industry practitioners as lecturers.

The program was sufficiently popular to encourage the development of further subjects, which went beyond technical computing into the commercial world of data processing. It was around this time that interest had begun to grow in Victoria in the use of computers in government, commerce and industry, and Lambert's original focus on engineering was quickly supplanted by demands for business-oriented computing education. Soon the College was teaching short courses covering topics across a wide range of aspects of computing, from systems analysis to programming and computer hardware. The success of these short courses led to the development of formal certificate and diploma courses, and the employment of full-time teaching staff. Throughout the 1960s the department established a suite of certificate and diploma level courses, whose aim and orientation were described by Pearcey as follows:

> "…In the main, the courses were designed to produce EDP graduates for employment in business type applications (sic) in commerce, government, and industry. Some of the courses had, in addition to the business bias, a technical bias." (Pearcey, 1979, p2)

Pearcey stressed the importance of the distinction between data processing, which Caulfield chose to focus on, and computer science, explaining it in the following terms:

> "Computer Science education is usually provided by the universities. It is essentially to do with the study of <u>the computer (its hardware and software) as a system</u>, and how to use the computer in scientific applications. … Data

processing, on the other hand, involves the study of the organization as a system. The emphasis is on the flows of data and information within the organization, and the use of such data for the operational and decision-making needs of the organization. The computer is studied for its usefulness as a tool for problem-solving in the data processing area. The emphasis is not on its physical properties and detailed architecture, but on how it can be used". (emphasis as in original) (Pearcey, 1979, p13)

According to Pearcey (1979), a key feature of Lambert's approach to computing education was that he saw a future for data processing as a discipline in its own right. Pearcey suggested that the usual fate of computing or data processing groups was that they were "… 'mothered' or perhaps 'smothered'" (Pearcey, 1979, p1) within departments of business or mathematics. Under Lambert, computing at Caulfield was set up in a separate Department of Electronic Data Processing (EDP), an arrangement which Pearcey believed gave its courses a unique character and direction. The department favoured a policy of employing computing practitioners from industry as its teaching staff, which further encouraged diversity in the range of academic and professional backgrounds which it encompassed (Rood, 2008). Thus, although the early Caulfield short courses had had an orientation towards accounting that was typical of computing courses in many institutions, the independence of the EDP department enabled it to move away from this early emphasis, and broaden its focus to a wide variety of aspects of data processing (Pearcey, 1979). The independence of EDP from other disciplines was also facilitated by the organizational structure of Caulfield Technical College, which was more akin to that of a high school than a tertiary institution. Departmental heads reported directly to the principal of the college, which meant that there was no requirement for any formal structural association between EDP and any other discipline (Rood, 2008).

But despite its lack of any formal links to business or association with any specific business discipline, the department's orientation was clearly strongly towards the organizational use of computers and commercial data processing. As a consequence of its focus on this area and the strength of its connections with industry, by the late 1960s it had come to be regarded as the pre-eminent provider of commercial data processing education in the State (Rood, 2008).

Caulfield Institute of Technology, the Bachelor of EDP and the School of Computing & IS

The introduction of the binary system in the mid-1960s (described in Section 2.6) caused the separation of the secondary and tertiary education components of Caulfield Technical College, and the incorporation of the latter into the newly formed Caulfield Institute of Technology (CaIT). As a tertiary institute this new organization moved out from under the control of the Victorian Department of Education and became an affiliated member of the Victorian Institute of Colleges (VIC). Lambert stayed on for a short time as principal of CaIT to oversee its transition, but then retired and was replaced in 1970 by Hartley Halstead, who set about transforming it into a form more appropriate to its role as a specialist tertiary education institution (Rood, 2008).

A key element of this change was the establishment of a new discipline-based structure. Halstead adopted a model of disciplinary groupings which conformed to the standards set by the VIC, in which discipline-based academic departments were located within four multi-disciplinary schools – General Studies, Industrial Studies, Engineering and Applied

Science. Halstead was a keen supporter of computing and allowed EDP to retain its departmental status. But, in keeping with his background in mathematics and statistics (prior to coming to Caulfield, he was head of the Mathematics Department at RMIT), he saw computing as a science-based discipline. Therefore, he located the EDP department in Applied Science, alongside departments of Mathematics, Applied Physics and Chemistry (Rood, 2008). When the long-time head of EDP resigned in mid-1972, Halstead chose to replace him with Trevor Pearcey, a distinguished computer scientist whose impressive record of achievement in scientific research and computer development brought prestige to the department, but who had limited background experience of EDP.

The decision to locate the department in Applied Science was the cause of much dissatisfaction to departmental staff (Rood, 2008) and had significant ramifications for degree. It broke the connection with business which EDP had enjoyed for much of the 1960s, and presented an image of the department and its program as being science-based, despite the fact that the curriculum content lacked the mathematical/science focus which was typical of science-based computing. On the positive side (at least as far as its pure computing content was concerned), the move to science meant the degree did not have the obligation to include core business content, which was an almost universal feature of business-based computing degrees. This would later give freedom for the department to enhance the computing content of the degree to a much greater extent than was normally possible. This in turn gave greater scope for the development of sub-disciplinary specialisations within the degree.

CaIT was keen to advance its credentials as a tertiary academic institution, and computing was an obvious area of strength which could be exploited in this regard. When the federal government sought to find tertiary institutions to take over its Programmer in Training scheme (discussed in Section 5.2), Caulfield's reputation helped ensure that it was chosen as one of the Victorian providers. Its selection in turn further enhanced Caulfield's reputation and provided additional impetus to the development of its computing programs and the expansion of the department (Rood, 2008). Halstead pushed for the development of a degree program in EDP, and in 1971 a proposal for a degree named the Bachelor of Applied Science (EDP) was approved by the VIC for offering in 1972. According to Greig & Levin (1989), this was the first commercial computing degree to be offered in Australia.

The establishment of the degree gave a boost to the status of data processing as a field of study within CaIT, and consolidated its disciplinary status. It also increased the scope for expanding curriculum content, and encouraged the growth of specialisations within the department. The 1972 CaIT handbook identified three main areas in which the degree catered for demand for professionally qualified staff within EDP:

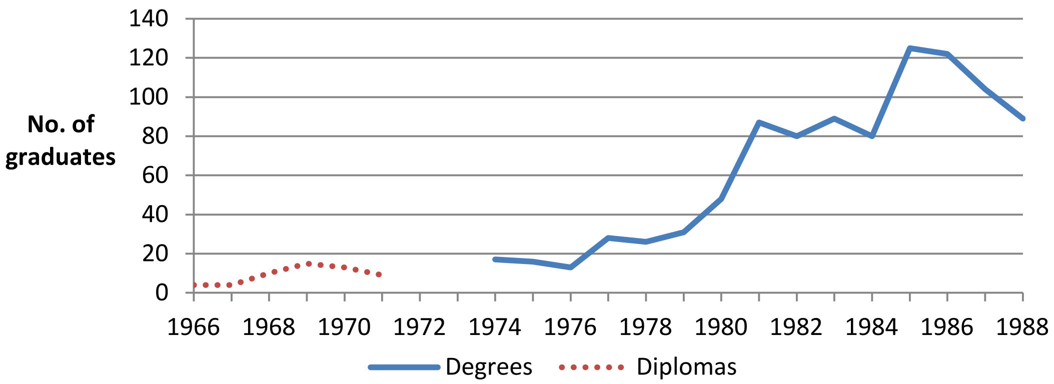
- Systems analysis, dealing with the identification of areas of application for computing in organizations and the design of data processing systems;
- Programming, dealing with the development of the algorithms and the computer code needed by a data processing system;
- Computer operations, dealing with the work required to keep the computer and its peripherals operating and supervising and controlling its processing

(CaIT, 1972)

As will be shown below, this division of knowledge and skills eventually became the basis for the next stage of disciplinary specialisation, when information systems received its first formal recognition within the institution.

Throughout the 1970s, the department's student population and the demand for graduates from its courses continued to grow. Figures on applications for admissions to academic programs are not available, but Figure 8.2 shows the general pattern of growth in the number of students graduating from the Bachelor of Applied Science (EDP) during this period. Pearcey claimed that on average for every graduate from the course there were offers of "… at least two and, in most cases, three positions of employment" (Pearcey, 1979, p5). The strength of this growth helped to support the department's ongoing expansion and ambitions for a greater degree of disciplinary independence.

Fig 8.2: Students graduating from CaIT/CIT applied computing programs: 1966-1988



(Source: Derived from Greig & Levin, 1988)

In the department's eyes, an important stumbling block to these ambitions was its location in the School of Applied Science. As indicated above, the original decision to locate the department there had caused considerable angst among departmental staff. It had broken the association which the department had previously enjoyed with business, and left staff feeling isolated in an unsympathetic academic environment (Rood, 2008). Their neighbouring departments and senior school management saw computing as a technical discipline, and had little understanding of the nature of the commercial data processing which was the central focus of the department's work. An internal institutional review in 1977 noted the department's unhappiness at its location, acknowledged the poor fit of EDP within Applied Science, and recommended that it be re-located to a new specialist computing school (Rood, 2008).

In a report to the CaIT Council, Pearcey (1979) supported this recommendation. He suggested that although locating the department in Applied Science had been "… initially seen as a good move" (p18), it had subsequently had adverse effects on the perceptions of the department and its academic programs. Pearcey highlighted the difference between the study of data processing, which was the department's focus, and computer science which was appropriate to a Science faculty. He suggested that in the eyes of the public, the location of EDP within Applied Science had led to its courses being seen as linked with science. Consequently, Pearcey suggested:

> " … A real problem we have at present [1979] is that the majority of our intake comes from the science oriented secondary students, and only a dribble from the

> commercially oriented students. Had we stayed under the influence of business, no doubt the reverse would have been the case." (Pearcey, 1979, p18)

Misunderstandings about the orientation of the program were evident not only among potential students but also among employer groups:

> "Unfortunately, there is strong evidence that industry, apart from our traditional contacts, tends to believe that our students are educated in computer science rather than data processing, and we must correct this wrong impression". (Pearcey, 1979, p17)

The Council accepted the recommendations for change, and early in 1980, the Department of EDP was removed from the jurisdiction of the School of Applied Science, and became part of a new School of Computing & Information Systems, alongside a newly-formed Department of Robotics & Digital Technology. Although this change had no immediate effect on the curriculum of the department's undergraduate degree program, it enabled a marked increase in its academic staffing levels. CaIT handbooks show that since the time of its formation within the School of Applied Science, the department's complement of academic staff positions had been maintained at about 15; within a year of the move to the new School of Computing & Information Systems, this number jumped to 25. The increase in staffing, together with the enhanced organizational status of computing as an independent school provided the basis for its subsequent partitioning into separate sub-disciplines, as described below.

Chisholm Institute of Technology and the Department of Information Systems

In early 1982, in support of government objectives to rationalise the tertiary education sector, agreement was reached for a merger between CaIT and the State College of Victoria Frankston. These two institutions became the Caulfield and Peninsula campuses respectively of the new Chisholm Institute of Technology. SCV Frankston had previously had no specialist computing units, and the School of Computing and Information Systems was one of the first academic units from CaIT to extend the offering of its undergraduate programs to include the new Peninsula campus.

With the addition of more staff to cater for the extra teaching load imposed by this expansion of its operations, the Department of EDP grew to more than 30 academic staff (CIT, 1985), making it one of the biggest single academic departments at CIT. The increase in departmental staffing levels, together with the previous elevation of computing to the status of a school in the institution's disciplinary hierarchy made it possible to partition of the Department of EDP into sub-disciplinary specialisations.

As indicated earlier, the differentiation between specialist knowledge and skills within EDP had been made clear in institutional handbooks since the early 1970s. According to Greig & Levin (1989), the distinction between these specialist areas had been partially recognised within the Department of EDP for several years, with the department effectively operating with two informal sections – programming and systems. In early 1985 the emerging disciplinary divide was formalized, with the partitioning of the department into three new departments:

- the Department of Computer Technology, which was given responsibility for the hardware side of computing, including hardware architecture, operating systems, database, networking and data communications;
- the Department of Software Development, which took control of all aspects of programming and software engineering; and

- the Department of Information Systems, which was made responsible for the 'non-technical' parts of computing, covering systems theory, systems analysis, design, implementation and the system development process in general.

In order to accommodate these new disciplinary arrangements, the structure and content of the undergraduate computing degree were also changed slightly, with the units in the curriculum being re-organized to reflect the same disciplinary sub-divisions. These arrangements ensured that the compulsory computing units within the program were divided between the departments in a way that gave each department an equal one-third share of the curriculum.

At the time of their formation these three specialist departments were relatively small, with each having about 10 academic staff. But all three grew steadily, and by the end of the period this number had increased to about 15-18 academic staff for each department. At the Peninsula campus, computing units were initially taught by staff visiting from Caulfield, but as the number of units and number of computing students at the campus grew, the three departments began to locate some of their staff there on a permanent basis. However these staff remained attached to their respective Caulfield departments, and there was no attempt during this period to create a separate organizational unit for computing at Peninsula.

Thus, by the time of the merger with Monash, IS had a strong disciplinary presence at CIT, with a specialist department of 16 academic staff and a well-established set of IS undergraduate units focusing on system development process and the role of information systems in organizations.

8.3.3 Computing and Information Systems at GIAE

Computing education at GIAE originated in the Department of Mathematics, which began to offer two introductory computer programming units in the early 1970s. At that time, the mathematics department was located within the School of Business and Social Sciences, but in an organizational re-structure in 1978 it was re-located alongside the technical disciplines - first as part of a combined School of Engineering & Applied Science, and then, when this school was split in 1982, as part of the School of Applied Science. Applied Science had no formal departmental structure, but was divided into two main teaching groups – Physical and Biological Sciences and Mathematical Sciences; Computer Studies was classified as a sub-group of the latter.

The Mathematical Sciences group's main interests in computing initially centred on its use to support the mathematical techniques used in business-related operations research. In 1982 the group began to offer a major in Operations Research and Computing, which was the first program at GIAE to have a significant computing orientation (GIAE, 1982). Throughout the 1980s, the operations research part of this program steadily expanded and became more diversified in its content, but the computing component did not increase as quickly, and became a steadily decreasing proportion of the program as a whole. This decline was reflected in a change of name of the major in 1989 to Operations Research & Information Management (GIAE, 1989).

But while its significance as a part of the operations research curriculum was diminishing, computing steadily increased its standing as an area of study in its own right. Units in programming, software development, information systems, computer technology, data communications and networks were introduced, and developed into specialist computing sequences which were made available within both the Applied Science and Business degrees. This growth in the size and significance of the computing curriculum also earned it increased recognition within the organizational structure. When the Faculty of Applied Science partitioned its component disciplines into two separate divisions, the group previously called Mathematical Sciences became known as the Division of Computing and Mathematics.

By 1990, the computing stream had become large enough to be offered as a specialist program, called the BApplied Science (Computing) (GIAE, 1990). The structure and content of this degree followed much the same pattern of the typical generalist applied computing program offered by CAEs during this period, as discussed in Section 5.9.1. It included a blend of content based around programming, hardware, and systems development, and also required students to supplement their computing studies with a sequence of units in another discipline; approved sequences included maths/OR, digital electronics and various business sub-disciplines such as accounting, marketing, management and law (GIAE, 1990).

As a generalist computing degree the GIAE program offered only limited coverage of IS. Two of the compulsory computing units and one elective computing unit in the program were identified by name as information systems units. The content of these units conformed to the picture of IS as it was practised by the DIS at Caulfield, with the core units covering topics dealing with systems analysis and design, the systems development process, development methodologies and project management, while the elective unit focused on organizational management and uses of IS.

8.3.4 Summary - key influences on computing and IS at Monash Clayton and at CTC/CaIT/CIT

Table 8.1 summarises the main elements of the disciplinary, structural and market forces which combined to influence the formation and early development of the IS discipline in these two institutions before they merged after the Dawkins reforms.

The list of forces shown in the table is not an exhaustive one, but it is sufficient to highlight the key roles which these three sets of influences played in influencing disciplinary development during this period. The broadly equivalent importance of the influence of all three sets of forces shown in the table goes against the general pattern which Chapter 5 described as applying for applied computing programs in most institutions during this period. Under this pattern, disciplinary influences were generally by far the most significant of the three in shaping the early development of the programs from which IS programs ultimately evolved. But the unusual sets of circumstances applying at Monash and CaIT/CIT meant that structural and market influences were arguably equally as important.

For example, key structural decisions were made about the location of the main computing departments and programs in the early stages of their development at both institutions. This ran counter to the normal pattern in Chapter 5, where structural changes tended to occur slowly and to follow as a consequence of disciplinary developments.

	Monash University	CTC/CaIT/CIT
Disciplinary forces	• Early acceptance of Information Science as a broadly-based computing discipline • Narrowing of scope of Information Science; re-naming to Computer Science • Ongoing resistance and disciplinary pressure from Science faculty in opposition to vocationally-oriented education; further narrowing of scope of CS • Development of Operations Research as a distinct discipline within ECOPS with a strong computing component • Decision by the university to grant disciplinary 'ownership' and control of the new IS degree to ECOPS	• Early identification by CTC of computing/EDP as a new field of study separate from other existing disciplines • Recognition by the newly-established CaIT of the importance of EDP as an independent discipline; consequent decision to recognise EDP as an independent specialist department and degree program. • Decision by CaIT to categorise EDP as a science-based discipline, and align it with applied sciences rather than business • Evolution of specialist sub-disciplines within EDP, leading ultimately to the segmentation of the content of the EDP degree program into separate specialist areas (programming, technology, systems)
Structural forces	• Initial decision by the university to locate the new Information Science department within the Science faculty (other options in Engineering and ECOPS considered and rejected) • Decision by ECOPS to create a new IS department to manage and run the new vocational business-oriented computing program, initially staffed largely from Dept of Econometrics & Operations Research	• Initial decision by CTC to allow EDP to operate as an independent unit, to avoid it being aligned with another discipline • CaIT's decision to locate the new EDP department and its programs in the Applied Science faculty; consequent loss of connection with business faculty • CIT decision to grant computing the status of a school, facilitating the subsequent creation of sub-disciplinary specialist departments, including IS
Market forces	• Industry demand for computing professionals as an influence on the perceived need for programs in computing at Monash; pressure for vocational elements in CS programs; (but counteracted by disciplinary forces from Science faculty (above)) • Rejection of approach to take over PIT scheme • Industry demand for computing graduates with business skills; resultant Monash initiative for the development of the BIS	• Industry demand for computing professionals as an influence on the perceived need for programs in computing at CTC/CaIT • Commonwealth Govt decision to allow CaIT to take over the operation of the PIT scheme; impact in encouraging development of specialist computing degree • Impact of perceived marketing issues encouraging re-location of EDP from under the control of the Applied Science faculty

Table 8.1 Key influences on the evolution of IS: 1960-1990

Both institutions had relatively unusual levels of exposure to special influences from market forces. Chapter 5 described the normal impact of market forces in this period as constituting nothing more than a broad general encouragement for the development of computing programs, but both Monash and CaIT/CIT were targets for specific initiatives from industry, which led to formation of important degree programs at both. The impact at Monash was particularly significant, because it led directly to the formation of the Department of IS and its BIS program.

It should be noted that the outcomes of these influences were often not a consequence of any single one of these sets of factors, but rather the result of the net effect of the combination of them all. Sometimes this combination saw different factors working in the same direction, but sometimes they worked in opposition to one another; in the latter case it was the relative weight of the influence of the opposing forces which determined the outcome.

8.4 1991-1997: IS at Monash after the Dawkins reforms

Chapter 6 showed that for all tertiary institutions this period was dominated by the need for organizational mergers and structural change which had been brought about by the Dawkins reforms. In examining the consequences of these changes for IS at Monash, this section starts with a general outline of the way in which the Dawkins mergers affected computing across the university as a whole. It then describes the impact of the changes on each of the Monash academic departments which included the teaching of IS as a significant element of their undergraduate teaching programs.

8.4.1 The Dawkins mergers and the formation of the Faculty of Computing and IT

After the Dawkins reforms were announced, Monash conducted negotiations with a number of tertiary institutions, before reaching merger agreements with GIAE and with CIT in the first half of 1989. A ‘heads of agreement’ to merge CIT and Monash was signed by the councils of the two institutions in May 1989. An implementation committee with representatives from both institutions met for the first time in June 1989, and established working parties to sort out the details of the merger, which took effect from 1 July 1990 (Davison & Murphy, 2012).

In the negotiations over the details of the CIT/Monash merger, the working party responsible for academic programs and structures put forward an initial draft structure which included a proposal to combine the computing expertise of the two organizations into a single Faculty of Computing and Information Technology (FCIT). The proposal suggested that this faculty should bring together:

- CIT’s School of Computing & Information Systems (comprising the Departments of Computer Technology, Information Systems and Software Development) and the Department of Robotics & Digital Technology;
- Monash’s Department of Computer Science from the Faculty of Science;
- Monash’s Department of Information Systems from the Faculty of Economics and Politics;
- Monash’s computer engineering group from the Faculty of Engineering.

Cliff Bellamy was appointed as the inaugural Dean of the new faculty.

Apart from the computer engineering group, whose staff elected to stay as part of Engineering, all these organizational units agreed to the proposal, and were incorporated into the new faculty at the time of its foundation. To avoid duplication of departmental names, the Monash Department of Information Systems adopted the new name of Business Systems. A further organizational unit was created within the faculty shortly after the merger, when the Peninsula School of Computing was formed to accommodate the staff from the Caulfield departments who were now permanently stationed at the Peninsula campus.

The merger between Monash and GIAE started earlier than that with CIT, but took longer to be implemented fully. The two institutions announced their intention to merge in January 1989, but the merger process was carried out in stages over a period of years. Initially GIAE remained separate as a university college affiliated with Monash, before different parts of the two institutions merged progressively. It was not until 1993 that GIAE made the transition from university college to become a fully integrated part of Monash, and the mergers of some of its departments took even longer to complete (Davison & Murphy, 2012).

The Division of Computing and Mathematics initially remained a part of the School of Applied Science within the Monash Faculty of Science. A representative of the Division, who attended an FCIT Faculty Board meeting in March 1992, advised that the computing staff from GIAE wanted to stay as a part of Applied Science for everyday operational and administrative matters, but were willing to report to FCIT on all academic matters relating to the operation and management of teaching programs and their curricula (Monash FCIT FB 1/1992). This structure of divided reporting responsibilities lasted until the beginning of 1995, when the Division was finally brought fully under the jurisdiction of FCIT as the Gippsland School of Computing and Information Technology.

The final impact on IT of the structural changes associated with the Dawkins reforms was felt in 1994, when the Department of Librarianship Archives and Records (DLAR) joined FCIT. This department had originated at Monash in the early 1970s as the Graduate School of Librarianship located in the Faculty of Arts. In the re-structure associated with the merger, it was initially placed in a newly-formed Faculty of Professional Studies, as one of a mixed collection of vocationally-oriented programs, which included Police Studies, Art & Design, Nursing and Social Work (Davison & Murphy, 2012). As was widely expected at the time, this odd combination of ‘loose ends’ did not survive for long (Davison & Murphy, 2012); its closure after only 3 years left DLAR without a home. When the Dean of FCIT was approached by the Head of DLAR to ask if he could help, he agreed to take it on as a new department in FCIT (Monash FCIT FB 3/1993).

Figure 8.3 shows the structure of the faculty as it stood at the end of this period, when all these changes had been fully implemented. Of the six degree programs shown in the diagram, four were in existence throughout the entire duration of this period - the exceptions were the Bachelor of Information Management, which was established in 1995, after DLAR joined the faculty, and the Bachelor of Information Systems, which was established in 1996.

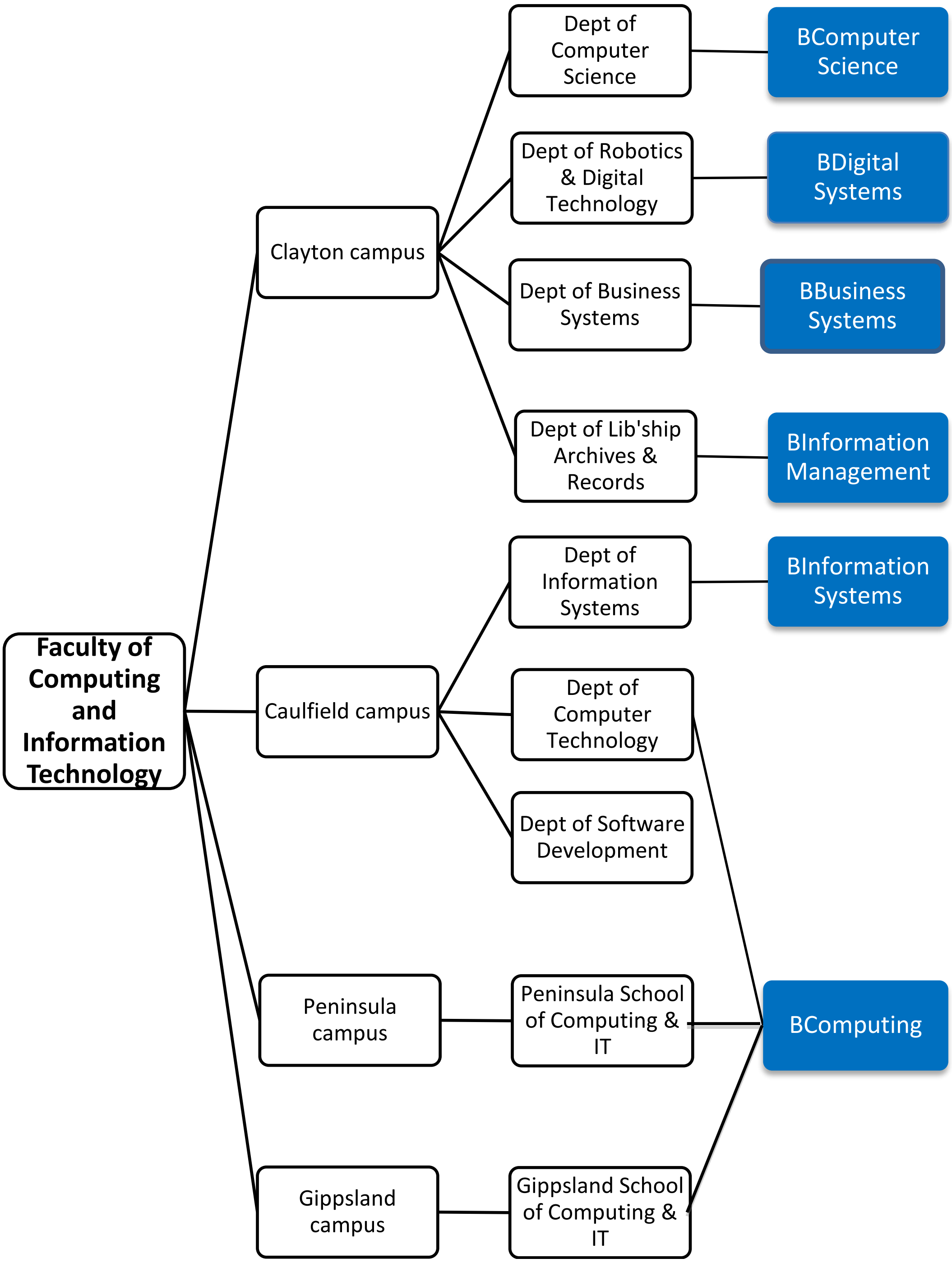


Fig 8.3 Organizational Structure of Monash FCITafter the Dawkins reforms

(Source: Monash FCIT, 1997)

The Bachelor of Computing programs at the Peninsula and Gippsland were separate degrees to the Bachelor of Computing at Caulfield, but for the purposes of this study they are essentially the same kind of degree, so the diagram does not distinguish between them; the specific features of the Gippsland and Peninsula programs are outlined briefly in Section 8.4.4. A number of double degrees, which combined these single degree programs with degrees from other disciplines, were also formed during the period.

Figures 8.4 - 8.6 show the key characteristics of the faculty's single degree programs over the course of the period:

- Figure 8.4 show for each year of the period, the combined tally of preferences 1-4 which the faculty's single degree programs attracted from applicants using the VTAC admissions system;
- Figure 8.5 shows the combined total enrolments for all the faculty's single degree programs from applicants through the VTAC admissions system;
- Figure 8.6 shows the weighted average ENTER of all the Year 12 students who took up full-time places in the faculty's programs on the Clayton and Caulfield campuses (programs at Peninsula and Gippsland were excluded from this analysis, because, as smaller regionally-based campuses, they adjusted their intakes and entry scores to cater for local community needs

The data for the graphs are included in Tables F1, F2 and F3 of Appendix F.

The trends in demand shown in the graphs are similar to those for the IT sector as a whole as seen in Section 6.4 of Chapter 6: the overall number of preferences shown in Fig 8.4 followed a roughly cyclical pattern with only a slight overall increase over the period; total enrolments in Fig 8.5 showed stronger growth, with double degree programs providing a substantial contribution. However, when one takes into account the fact that the number of preferences and enrolments in the later years were boosted by the addition of the new BIM degree from 1996 and the new BIS degree in 1997, it is clear that the there was only a slight overall increase in demand during the period. Figure 8.6 shows that there was also no consistent pattern of change in the quality of students as measured by the ENTER scores of the main cohort of student enrolments who were admitted on the basis of their results in their Year 12 studies. The overall average ENTER shown in the graph fluctuated between the high 70s and mid-80s, which was a little below the level of the BComputer Science and BBusiness Systems at the Clayton campus and a little higher than the levels achieved by programs at the former CAE campuses at Clayton, Peninsula and Gippsland.

These numbers were of great importance to FCIT, as it sought to demonstrate its economic viability as a new faculty. As the figures show, the level of undergraduate domestic demand, which was expected to be the main source of funding for the faculty, was relatively stable, but showed no signs of significant growth. Patterns of market demand and their impact on the faculty's budget were a constant focus for attention for faculty management. Early in the period, in a submission to a Federal Government-sponsored discipline review of computing (DEET, 1992), the Dean of FCIT noted that computing suffered from a poor image in secondary schools; despite the fact that industry demand for graduates was high, computing courses struggled to attract good students (Monash FCIT, FB 2/1991). The ongoing difficulties involved in attracting large numbers of good students to computing courses was a constant theme in the Dean's reports to Faculty Board throughout the period (for example, see Monash FCIT FB 4/1991, FB 1/1992, FB 1/1993, FB6/1993, FB 3/1995 and FB 5/1995). For all departments in the faculty, the ability of their existing and proposed academic programs to sustain a satisfactory level of performance in attracting students was a major issue.. The consequences of this will become apparent in the discussion of the developments in IS which follows.

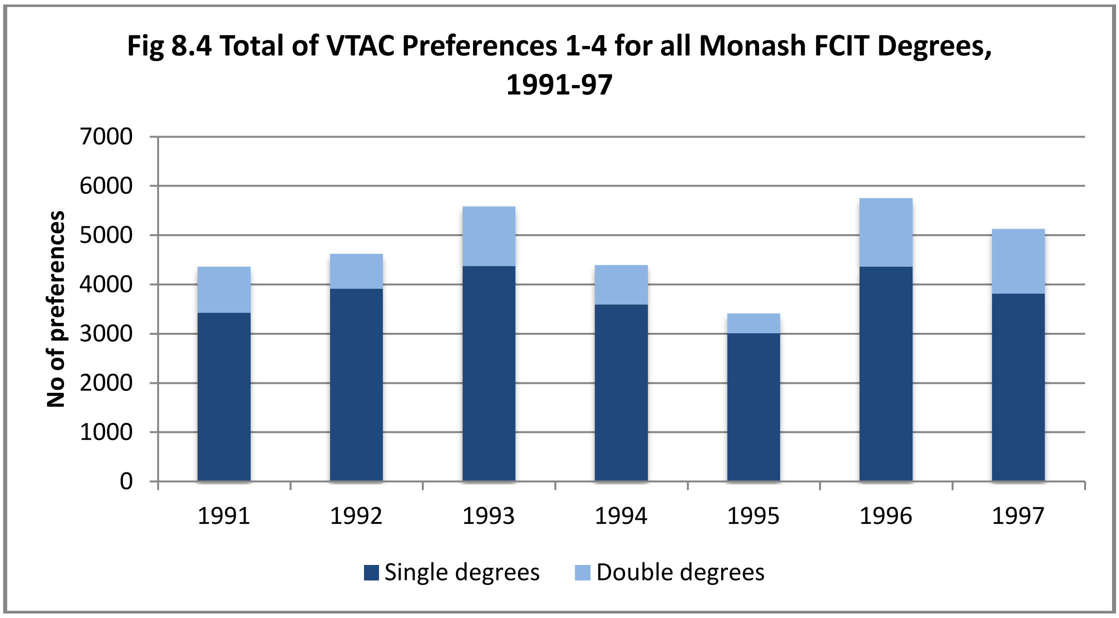


Fig 8.4 Total of VTAC Preferences 1-4 for all Monash FCIT Degrees, 1991-97
No of preferences
7000
6000
5000
4000
3000
2000
1000
0
1991
1992
1993
1994
1995
1996
1997
Single degrees
Double degrees

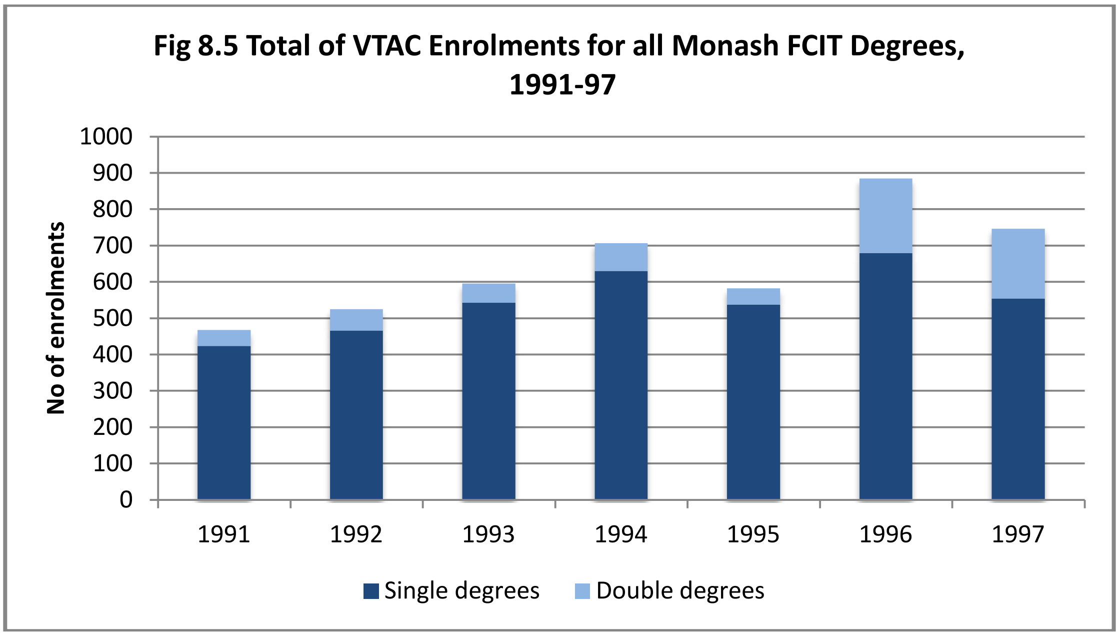


Fig 8.5 Total of VTAC Enrolments for all Monash FCIT Degrees, 1991-97
No of enrolments
1000
900
800
700
600
500
400
300
200
100
0
1991
1992
1993
1994
1995
1996
1997
Single degrees
Double degrees

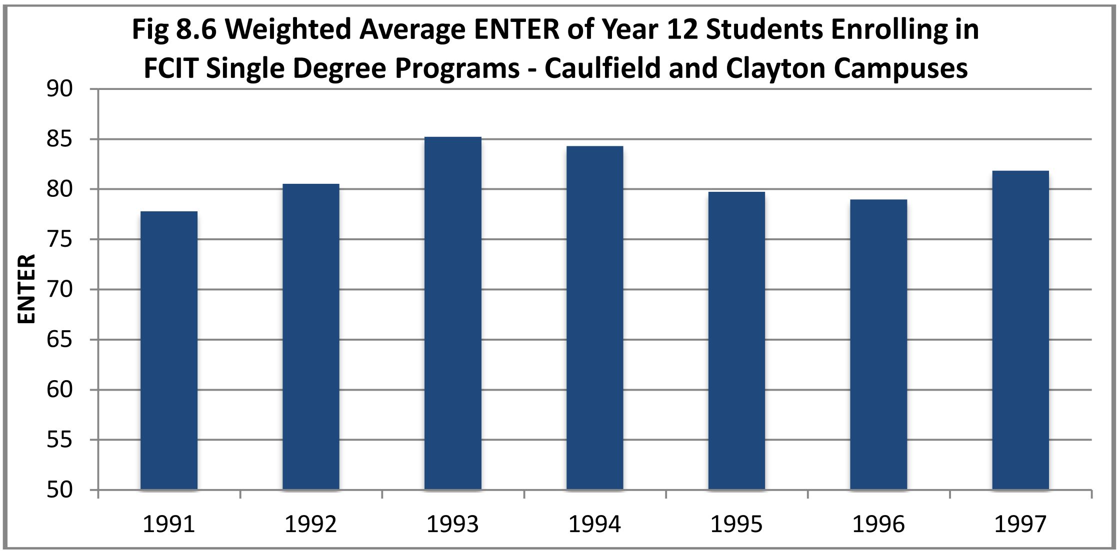


Fig 8.6 Weighted Average ENTER of Year 12 Students Enrolling in FCIT Single Degree Programs - Caulfield and Clayton Campuses
ENTER
90
85
80
75
70
65
60
55
50
1991
1992
1993
1994
1995
1996
1997

Of the organizational units shown in Figure 8.4, four included the teaching of IS as part of their undergraduate programs – the Department of Business Systems at Clayton, the Department of IS at Caulfield, and the Gippsland and Peninsula Schools of Computing. The following sections describe the evolution of IS in each of these departments/schools in turn. A separate section also outlines the history of the Department of Librarianship Archives and Records, both prior and subsequent to it joining the faculty. The arrival of this department as part of FCIT had little immediate impact on IS during this period, but as the Section 8.5 will show, this would change in the years that followed.

8.4.2 IS at Monash Clayton – The Department of Business Systems and the Bachelor of Business Systems

For the Department of IS at Monash's Clayton campus, the most significant decision about its future came at the very beginning of this period, when it had to decide where it should locate itself in the new organizational structure. As indicated above, the Monash/CIT amalgamation working party recommended that the department should join the new computing faculty, but it did not initially adopt this suggestion.

The Dean of the Faculty of Economics & Politics argued forcefully against the department's proposed re-location, suggesting that its recent creation within his faculty represented

> "… a recognition of the close relationship of computer studies to management education. The history of a separate computer department at Monash and other universities has been one of neglect of business applications of computers in favour of computer science and technology. Proximity to management studies is essential for the effective development of the area."
> (Monash University Archives, 1989a)

The dean went on to state that although his remarks were specifically about the Department of IS, they also carried with them

> "…an intended implication … that the creation of a faculty of Computing and Information Systems (sic) would not be appropriate. The various fields of study involving computers do not comprise a coherent academic unit. Computer applications derive their significance from the area to which they are being applied. Necessity (sic) that the study of management information systems be contained totally within a structure of management studies is one important example of this." " (Monash University Archives, 1989a)

The staff in the Department of Information Systems did not share their Dean's antagonism towards the idea of a computing faculty. Senior staff from the department participated in discussions with the heads of the other computing departments which were joining the faculty, and maintained a cordial relationship with them. However, they initially acknowledged that they would prefer to stay within a business-based faculty, rather than joining FCIT. Early in August 1989, the head of the Department of IS and the head of the Department of Accounting and Finance at Monash made a joint submission to the amalgamation working party, arguing that their two departments plus the Caulfield Department of Accountancy should be combined in a new Faculty of Commerce, separate from the rest of the economics and business departments (Monash University Archives, 1989b). They contended that there was a synergy between them based on their shared interest in various aspects of management information systems.

The final decision over the place of the DIS remained in doubt for several months. As late as 22 September 1989, senior departmental staff wrote to the head of the working party, advising him that at the departmental meeting on that day, staff had agreed that their first preference was still to join with Accounting & Finance and Administrative Studies in a Faculty of Commerce (Monash University Archives, 1989c). If no such faculty was formed, then their second preference was to join FCIT. Shortly after this, it became apparent that their preferred structure for a Faculty of Commerce would not eventuate, and on 29 September the head of the department, wrote to the Deputy Vice Chancellor indicating that the DIS was now committed to joining FCIT (Monash University Archives, 1989d).

An immediate obvious difficulty created by the department's decision was that the faculty already had a Department of Information Systems from CIT. A decision was made that the Chisholm department would be allowed to retain this name, and the Monash (Clayton) department would be re-named to the Department of Business Systems, and its degree program would become the Bachelor of Business Systems.

The re-named department experienced hard times in its early years in the new faculty. The reliance of the BBusiness Systems on industry involvement as a key component left it, and therefore the department, particularly susceptible to the impact of a recession which affected the Australian economy in the early 1990s. The IT industry suffered severely from the effects of this economic downturn; for example, according to Brian Finn, the then managing director of IBM Australia, his company retrenched about 1200 people, or nearly one-third of its workforce in 1991 (O'Hanlon, 1999). In this difficult business climate, IBM and many other companies were reluctant to maintain their commitment to the industry scholarships which were an integral part of the BBusiness Systems. The withdrawal of companies from the scheme not only created significant problems for the department in finding sufficient industry placements for students, but also caused severe financial difficulties due to the loss of sponsorship money (O'Hanlon, 1999).

In order to insulate itself from such problems in future, the department introduced a non-scholarship version of the BBusiness Systems, which covered the same coursework units as the original, but included additional coursework units to replace the industry-based learning component (Monash FCIT FB 4/1991). Students who performed well enough in the non-IBL stream could apply for admission to the IBL version. The program was promoted as meeting the needs of students who wanted "… to complete a degree with a strong business flavour, but who would otherwise take courses in either computer science or programming/systems analysis." (O'Hanlon, 1999, p48). The introduction of the non-IBL stream to the program provided an extra source of funds, and gave the department greater flexibility to adjust the number of students in the IBL stream to fit the number of places available.

Figures 8.7 - 8.9 show the trends in demand for the BBusiness Systems relative to the other faculty degrees at the Caulfield and Clayton campuses throughout the period. (The data are contained as part of Tables F1(a), F2(a) and F3(a) in Appendix F).

Fig 8.7 Total of VTAC Preferences 1-4 for IT Degrees at Monash Clayton and Caulfield Campuses, 1991-97

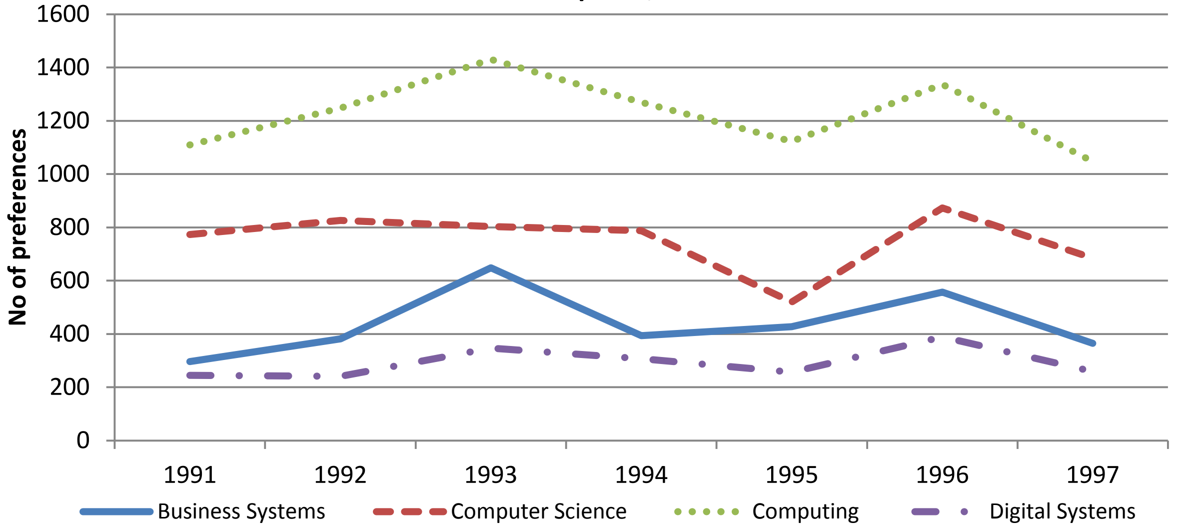


Fig 8.8 VTAC Enrolments for IT Degrees at Monash Clayton and Caulfield campuses, 1991-97

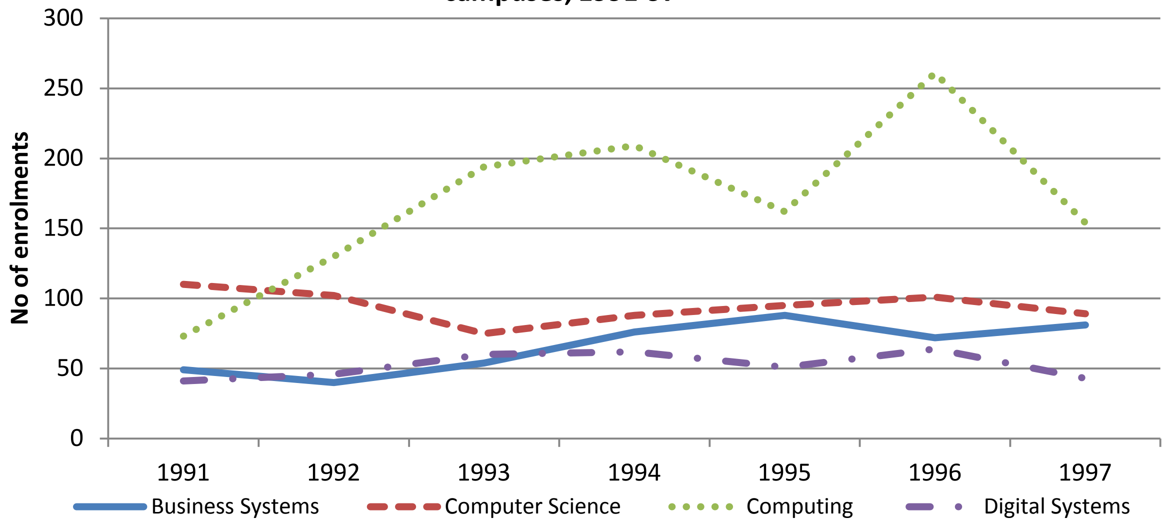


Fig. 8.9 Average ENTER of Year 12 Students Admitted to Monash IT Programs at Clayton & Caulfield campuses, 1991-97

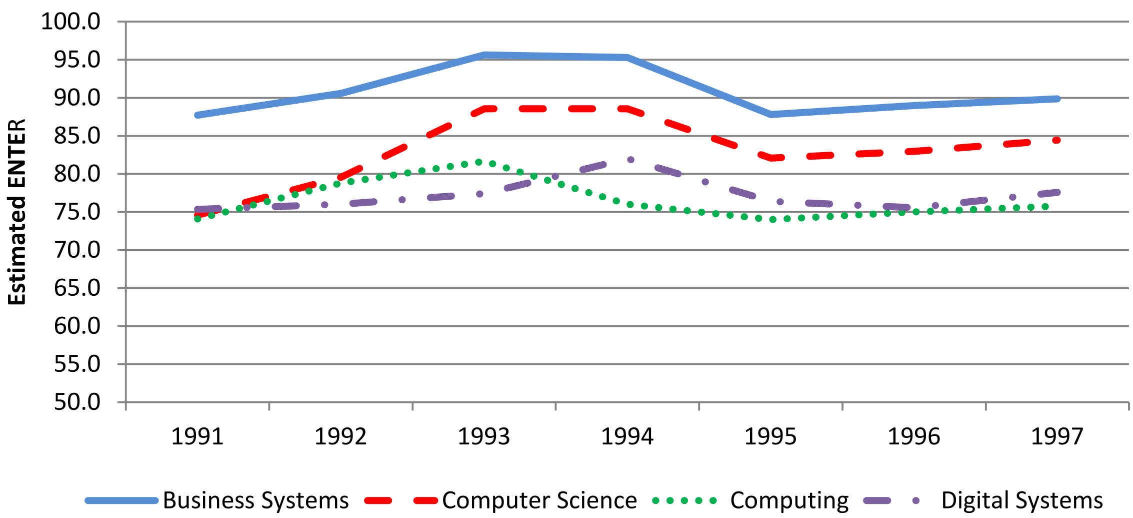


Figure 8.7 shows that in terms of overall applicant preferences, the BBusiness Systems performed only moderately in relation to the other degrees. It maintained its comparative position, but remained well behind the BComputer Science at Clayton and the BComputing at the Caulfield campus. The number of preferences it received fluctuated from year to year, but over the period as a whole it showed only a small increase. Figure 8.8 shows that its intakes of domestic students were initially relatively small, and dropped to be the lowest of the four degrees in the recession in the early part of the period. But they grew strongly through the middle party of the period to the point where the degree began to close-in on Computer Science as the program with the second highest intake in the faculty.

The ENTER scores in Figure 8.9 explain the apparent contradiction between the program's comparatively low rate of preferences and its growing student intakes. They show that the BBusiness Systems consistently attracted a significantly higher-performing applicant cohort, as measured by their Year 12 school results. Thus, a relatively small applicant pool was still able to provide a significant number of students who met the required entry standards. The consequent growth in domestic enrolments, supplemented by an increasing intake of international students, meant that total enrolments in the BBusiness Systems rose substantially throughout the period, as shown in Table 8.2.

	1991	1992	1993	1994	1995	1996	1997
Total enrolments	149	n/a	219	254	301	321	386

Table 8.2 Total enrolments in BBusiness Systems Degree
(Source: Monash FCIT Business Systems, 1992-1997)

The success of the program in attracting strong student demand was particularly important in the context of the faculty's on-going concerns over its ability to build a sustainable financial base. As a consequence of the strong performance of the degree, the Department of Business Systems was able to more than double in size during the period, ending it with 28 full-time academic staff (Monash FCIT, 1997). Financially, it was the second best performing department in the faculty, with an operating surplus of well over a million dollars in 1997 (Monash FCIT Annual Report, 1997). The department's size and financial strength, its good relationship with industry, and the increasing reputation of its BBusiness Systems as arguably the best-performing degree in the faculty were important assets in dealing with the organizational pressures which were to come at the start of the next period.

8.4.3 IS at CIT/Monash(Caulfield) – the DIS and the BIS

The structural changes associated with the formation of FCIT made little initial difference to the operations of the Department of IS and the other computing departments at CIT, which were already part of a specialist IT-based school. The Department of Robotics and Digital Technology moved to the Clayton campus to form closer ties with CS and the computer engineering part of the engineering faculty, but the other departments based at the Caulfield campus were left in much the same state as before. However the DIS used the re-structure as an opportunity to loosen its connections with its neighbouring computing departments at Caulfield, and establish a more independent disciplinary status.

A key element of the department's quest for disciplinary independence was the expansion of its undergraduate curriculum. At the time of the merger, the BComputing, which was department's sole outlet for undergraduate teaching, had its curriculum content shared equally between the three specialist departments at Caulfield - IS, Computer Technology and Software Development. Each department offered six core units within their specialist area and contributed to a capstone final year project. The degree was tightly integrated, with a relatively fixed structure that gave little scope for elective units. Its curriculum was managed by a committee, which included representatives from all three departments. The merger provided the spur for the DIS to try to loosen these restrictions, diversify its curriculum, and in so doing enhance its disciplinary status.

The first signs of the department's ambitions appeared in a discussion paper which it submitted to the faculty Undergraduate Studies Committee meeting in August 1991 (Monash FCIT USC, 2/1991). The paper noted that the department had adopted a British Computer Society definition of Information Systems, which identified its core topic areas as comprising information systems planning, systems analysis, systems design and the management of systems implementation. It claimed that the discipline was expanding rapidly in terms of its academic content, in the range of types of application system which it aimed to support, and in levels of industry demand for the specialist skills it taught.

The paper argued that the structure of the BComputing program severely limited the ability of the department to augment its undergraduate curriculum to cater for this ongoing expansion. The fixed course structure limited IS to six core units of teaching, and although the department had tried to keep updating them, "…trying to force material into six compulsory undergraduate subjects is no longer desirable or viable." The paper proposed that the degree structure should be changed to accommodate a re-structuring of its IS units. Under the proposed revision, there would only three compulsory IS units, with the other three becoming electives which students could choose from a nominated set. The content of the three compulsory units would be derived from the existing units and would cover a core set of fundamental knowledge requirements for the discipline; the elective component would enable the department to offer additional units covering a wider range of content. In a follow-up report, the department set out its re-structured major and a set of supporting electives, which it noted could change from year to year to suit student demand and staff availability and to accommodate the ongoing expansion of the discipline (Monash FCIT USC, 3/1991).

This DIS proposal helped precipitate a lengthy review of the BComputing degree, and ultimately the adoption in 1993 of a majors-based structure in which the contributions of all three departments to the degree were revised in line with the proposed DIS model. The core content of the degree was reduced to three units from each department plus the capstone project, and students were required to complete a major in at least one of the specialist IT fields. In its final report documenting the new structure, the review committee justified it on the basis that the changing nature of the computing profession meant that the degree needed to accommodate a wider range of graduate skills, more flexibility in student choice of units outcomes, and the expansion of the amount of material within the IT disciplines (Monash FCIT USC 2/1993).

Although the new structure ultimately won the support of all three Caulfield departments and the faculty as a whole, DIS was clearly its most enthusiastic advocate. The clarity and strength of its vision of its status as an independent discipline appear to have been greater than was the case for the other departments, both of which feared that the dismantling of the tightly integrated structure of the BComputing would damage its reputation in the student marketplace. The relative levels of enthusiasm among the departments for the change can be gauged from the speed with which they developed and introduced the new elective offerings which the new degree structure enabled: the 1994 handbook shows DIS offering fourteen electives, whereas the Department of Software Development offered six and the Department of Computer Technology only three (Monash FCIT, 1994).

The new structure acted only as a stepping stone in the DIS's ambitions for full disciplinary independence for its IS program. In October 1994 the department put forward a proposal for the establishment of a new specialist degree in IS (Monash FCIT USC 5/1994). The proposal described the degree as "…Essentially a renaming of the current major in Information Systems within the Bachelor of Computing". It retained the compulsory technical computing components of that degree and included the IS major as compulsory. Students would be required to take at least two business units, and complete a minor stream of study in a non-computing discipline.

The proposal claimed that the new degree would enable IS to differentiate itself from the technical computing emphasis of the BComputing. The proposed degree would share the same first year as the BComputing, which combined studies in IS, programming and computer technology, but would attract students who did not enjoy the technical side of computing:

> "The discipline of Information Systems is distinct from technical computing and is attractive to a different cohort of students. … In contrast to technical computing, information systems lays greater emphasis on English skills and less on mathematics and science. … The Bachelor of Information Systems will be able to support [its] computing component with studies in disciplines which most closely complement information systems. These disciplines are in business, humanities and the social sciences". (p1 of course proposal).

The degree would prepare graduates for careers as specialist systems analysts and business consultants.

The proposal also highlighted market-based issues as an important motivation for the program. It claimed that the DIS was currently "… pre-eminent in Victoria and … one of the top departments in Australia" (p2) However this position was under threat from the proposed establishment of an IS department and degree at the University of Melbourne: "…It is important that Monash does not let a new well-resourced competitor quickly erode its position." The notes of a subsequent discussion on the proposal also referred to the need to compete with Swinburne University's initiatives with IS (Monash FCIT, FEC 1/1995)

Initially the proposed BIS met with strong resistance from other parts of the faculty, with objections being raised on a variety of grounds. Academic arguments against it questioned whether IS had reached the level of disciplinary status required for it to be assigned its own degree. This was backed by concerns over whether the market would support such a program. For example, the Dean of the faculty noted the long historical inter-dependence between IS and the hardware and software elements of the BComputing, and expressed doubts about the merits of a specialist IS degree which did not contain strong technical computing content. He suggested that it was not clear how strong the market demand was for graduates from a purely IS-focussed program, which may make it difficult for them to get jobs (Monash FCIT, FEC 1/1995). Pragmatic arguments focused on the effects which the degree might have on the faculty's finances, with concerns being expressed that either too much or too little student demand could be damaging. On the one hand, if the new degree attracted too small a market share it would not be economically viable and would become a drain on faculty resources; on the other hand, if it was too popular it might draw students away from the BComputing, thereby damaging the finances of the departments of Computer Technology and Software Development, which relied heavily upon it as their revenue base. As a consequence of these concerns, this first proposal for the BIS was rejected by the faculty board in March 1995 (Monash FCIT, FB 1/1995).

But DIS continued to argue its case for the degree. To support its assertions about the disciplinary legitimacy of a specialist IS degree, it cited the growing body of IS academic literature and the development of the IS95 model curriculum. To alleviate concerns that the degree was too 'low-tech' to be viable, the amount of technical computing content of the curriculum was increased, at the expense of some business units which had been compulsory in the original version. The department also proposed that these extra hardware and software units should be taught by the other Caulfield departments, which helped alleviate their concerns over the possible impacts of the degree on their finances. A revised BIS proposal, which incorporated these changes but maintained the same core IS content, was put forward in late 1995, and this time it won approval to be offered for the first time in 1997 (Monash FCIT, FB 5/1995)

To further consolidate its position, the department then carried out a major review of its entire suite of teaching programs at undergraduate and postgraduate levels (Monash DIS, 1997). It described this work as "… the first comprehensive review of information systems teaching at Monash" - though interestingly the document made no reference to the Department of Business Systems and its academic programs which had so recently also borne the IS name. Although this review resulted in relatively minor changes to the structure and content of the BIS, its significance lay in the way in which it sought to confirm and validate the legitimacy of the department's claims to the status of an independent discipline. The report noted that the department was one of the largest IS departments in Australia, and took great pains to justify the content of the re-structured program by reference to Australian and international IS curriculum development work, such as Arnott et al (1996), Underwood & Maynard (1996) and Couger et al (1995).

Thus, by the end of the period, the DIS had confirmed and enhanced its position and that of its academic programs as representative of the IS discipline at Monash. The department could claim a roster of over 20 academic staff, a portfolio of more than 20 undergraduate units covering a wide range of topic areas, and its own specialist undergraduate IS degree. In doing so, it had completed the process of separation of IS from technically-based computing, and firmly established its status as an independent computer-based discipline.

8.4.4 Computing and Information Systems at the Gippsland and Peninsula campuses

These were the two smallest of the university campuses to offer computing programs at the post-merger Monash. At both campuses a generalist computing program was established, which included relatively small unit sequences in IS. With IS-related departments and programs having already been established at the Caulfield and Clayton campuses, there was not much scope for either the Peninsula or Gippsland Schools of Computing to have a significant impact on the structure of IS education at the university.

At Peninsula, the school's broadly-based Applications Development major was built around a blend of the content from the specialist information systems, computer technology and software development majors which were offered at Caulfield. Hence, the School continued to offer the basic elements of the core content of the IS major at Caulfield (focusing mainly on development process and systems analysis and design). Late in the period the School began an attempt to establish its own distinct disciplinary focus by replacing the BComputing (Applications Development) with a new degree based on computer networking. The subsequent introduction of the BNetwork Computing in 1998 resulted in the almost complete elimination of IS from the campus.

Gippsland's modified degree offered a similar blend of technology, software and IS to the Caulfield-based BComputing, and was labelled as the BComputing(Systems Development). As at Peninsula, the content of the small stream of IS units comprised themes relating to systems development processes and systems analysis and design, together with some coverage of topics in IS management. In later years, two more majors were added as options in the degree structure: a major in Business Systems was offered from 1997, and one in Multimedia Technology from 2001 (Monash FCIT, 1997 and 2001). The development of the Business Systems major reflected the school's historical association with operations research. The major focused on similar general themes to those on which the BBusiness Systems at Clayton was based, and its name was derived from that association. Over time there was some sharing of units between the two programs, but in general they remained largely independent of one another. The development of the multimedia technology major brought the School into conflict with the attempts of the Department of IS at Caulfield to expand the disciplinary scope of its field in multimedia. This will be discussed in detail in Section 8.5.3.

8.4.5 DLAR and the Bachelor of Information Management

The origins of DLAR can be traced back to the establishment of the Graduate School of Librarianship in the Faculty of Arts at Monash in 1974. This school had been formed after a protracted round of discussions which began as early as 1964 about the advisability of Monash offering librarianship education (Monash University Archives, 1964). The main source of library education in Victoria had originally been 'in-house' vocational training offered by the State Library of Victoria. When the State Library decided to wind down its training programs, CAEs were seen as the most appropriate providers of a replacement service, and several of them established librarianship programs in the 1960s and 1970s. Monash's Graduate School aimed to complement these programs by providing more theoretically-oriented postgraduate study, backed by research into library practice. (Monash University Archives, 1970)

During the discussions prior to its establishment, it had been suggested that the proposed new school could develop a close relationship with the (then) Department of Information Science in order to do joint research into the application of computers to library processes and information retrieval systems. However there are no indications that this proposed connection was ever pursued with much enthusiasm. (In fact, as noted in Section 8.3.1, one of the reasons given for changing the name of Information Science to Computer Science was to alleviate concern that its original name implied too close a connection with library programs).

By the late 1980s, it had become clear that the study of librarianship alone was not sufficient to sustain the school, and it needed to expand and diversify its offerings. In 1988 it established a postgraduate degree program in archives and recordkeeping, and put forward a proposal for a first degree in that field to run in parallel with its introductory Librarianship stream. In a memo to the Vice-Chancellor in September 1989, the Chair of the School stressed the urgency of the need for the school to further extend its interests into these areas (Monash University Archives, 1989e). She pointed out that the University of Melbourne, Monash's major competitor, had 'inherited' programs in these areas from its merger with Melbourne College of Advanced Education, and warned that if Monash did not get involved quickly it risked being left behind. A memo from the Dean of Arts to the Deputy Vice-Chancellor in October 1989 in support of the need for action noted that "… the situation of Librarianship is precarious. There seems to be a desperate need for them to modernise and change direction" (Monash University Archives, 1989f).

One immediate effect of the change in direction was a change in the name of the school. It was initially proposed that its new name should be 'Librarianship, Records and Information Management' (Monash Arts Faculty Board, 1989), but this was opposed by the Chair of the recently-formed Monash (Clayton) Department of Information Systems. He argued that the use of the term 'Information Management' was liable to cause confusion about the nature of the department's work:

> "… Whilst within tertiary institutions there may be very clear distinctions between such phrases as 'Information management', 'Information Systems' and 'Information Technology', I do not think any such distinction exists in the wider community, including government. …. I think the title 'Information Management' is too close for comfort to 'Information Systems' and 'Information Technology'." (Monash University Archives, 1989g),

In deference to concerns such as these, the school's name was modified to the Graduate School of Librarianship Archives and Records (GSLAR).

Under its new name the school identified its disciplinary focus as being "… the place of graphic and other forms of record in civilizations of the past, the present and the future", and its aims as being "… to improve the understanding of the purpose and problems of libraries, record-keeping and other information agencies". Its teaching was described as being "…oriented towards an understanding of the theoretical and practical bases of the professions covered in its courses. It places emphasis on historical studies as a necessary pre-requisite to further analysis of the purposes and problems of information provision" (Monash, 1990). As might be inferred from these descriptions, there was little coverage of any aspects of computing in its academic programs.

In the post-Dawkins organizational re-structure, the school was initially re-located from the Arts faculty (which was perceived to have become too big as a consequence of Monash's mergers with CIT and GIAE) to join the newly-formed Faculty of Professional Studies. This faculty brought together a number of vocationally-oriented professional disciplines in diverse fields such as Art and Design, Police Studies and Social Work. It proved to be an unsatisfactory arrangement, and by 1993 Monash decided to disband the faculty and distribute its component parts throughout the university (Davison & Murphy, 2012).

With no prospect of a return to the Arts faculty, the department sought help from FCIT as a possible new home. In May 1993, the Dean of FCIT notified his faculty board that the head of GSLAR had approached him asking for support for this move (Monash FCIT FB 3/1993). The Dean indicated that he felt that FCIT was "… a more logical home … than any other faculty at Monash", and that there were possibilities for developing complementary research and teaching activities. Against this he noted that there were concerns which would need to be resolved about the department's existing financial position and its ongoing financial viability. By September, agreement had been reached that GSLAR could become a department of FCIT from the start of 1994, on condition that the university helped sort out its existing financial problems and allowed it to develop and offer a new undergraduate degree program which could provide a sounder financial base for its future operations (Monash FCIT FB 5/1993).

A proposal for this new undergraduate degree, to be called the Bachelor of Information Management (BIM) was submitted to the FCIT Board in mid-1994, and approved for offering in 1995 (Monash FCIT, FB 2/1994). The degree proposal described information management as a "… pervasive and therefore largely invisible core process of the modern enterprise" (Monash DLAR, 1994, p1), and noted the increasing work force needs for graduates with skills in the management of information. The degree would be broad-based and aim to provide generic skills rather than being oriented towards a specific professional qualification, but its third year units and honours year program would be designed to enable students to gain accreditation from professional bodies such as the Australian Society of Archivists, the Records Management Association of Australia and the Australian Library and Information Association.

Staff from the DLAR itself taught a little over half of the compulsory core of the BIM, comprising units which focused on the nature of information and techniques for information management. The remainder of the compulsory content of the degree comprised supporting units in computing, which were taught by other FCIT departments. Two of these computing units – an introductory unit in basic computer principles and an introductory unit in programming - were taken from the BBusiness Systems, while the remaining computing units were offered by the Department of Computer Technology.

Whatever its merits from an academic viewpoint, the BIM was only partially successful in meeting its objective of attracting enough students to provide a sound ongoing financial base to support the department's operations. Table 8.3 shows that in terms both of numbers and overall student quality (as measured by cut-off scores for each intake) it performed relatively poorly in comparison to the faculty's other main programs at the Caulfield and Clayton campuses (compare with data for other programs in Fig 8.7-8.9).

Year of Offering	Number of VTAC Preferences 1-4	Number of applicants admitted through VTAC	Average ENTER score of admitted students
1996	315	35	75.8
1997	351	44	76.5
1998	228	42	78.7

Table 8.3 Measures of student demand for BIM, 1996-98
(Source: VTAC admissions data)

In addition, the teaching arrangements for the degree meant that the department derived revenue only from the half of the curriculum content which it taught. Even this extra income was offset somewhat by the costs involved in taking on the extra staff required to do the development and teaching of the program; DLAR's staffing roster had expanded significantly since the launch of the BIM, increasing to 10 full-time and 9 part-time academic staff by the end of 1997 (Monash FCIT, 1997). Consequently at the end of the period, DLAR remained the only academic unit in the faculty to be running at a loss (Monash FCIT Annual Report, 1997).

The history of DLAR and its attempts to re-make itself is an interesting research topic in its own right, but its details are beyond the scope of this study. However, there are three points which are worthy of emphasis because of their significance for the next stage in the evolution of IS at the Caulfield campus, which will be described in the following section. These relate to the department's disciplinary orientation, its organizational location and the marketability of its undergraduate academic program.

The first of these key issues was the need for expansion of the department's disciplinary scope from its initial focus on librarianship to the broader field of information management. Although DLAR wished to retain its traditional disciplinary interests, it was clear that its long-term survival was dependent on its ability to broaden its disciplinary base. Hence its adoption of the name 'Information management', which had begun to gain currency at this time as a catch-all term which could encompass the traditional disciplines of librarianship, recordkeeping and archives, while also incorporating a broader focus on the use and impact of computer technologies on information and the information professions. However there was still a good deal of uncertainty about the definition of this term, the extent of its scope, and the lines of demarcation between it and existing disciplines such as Information Systems.

A second and related issue for DLAR was its ongoing struggle to find a secure permanent place in the university's organizational structure. The uncertainty surrounding its disciplinary associations was reflected in the fact that it had been located in three different faculties over a period of five years. Although the department had found a place within FCIT, its staff came almost exclusively from non-computing backgrounds and had little interest in the technical aspects of computing. Unless it could overcome this disciplinary divide and develop relationships with the other departments in the faculty, the department risked becoming as isolated there as it had been in its previous faculties. To this stage its closest connection to other parts of the faculty had been with the Department of Computer Technology, which taught most of the technical content (computer hardware, database and networks) into the BIM. However, the focus of that department's interests on the technology itself suggested that there was little scope for the relationship to develop much further.

The final point worthy of note is that, despite its efforts, DLAR's financial difficulties remained largely unresolved. It still lacked a reliable source of undergraduate students to provide it with the regular income stream needed to fund its operations, and the early years of the BIM suggested that it was not likely to provide a long-term solution. At a time of ongoing uncertainty about university budgets and the impacts of government funding cuts on faculty finances, this put DLAR in a potentially vulnerable position.

The combined effect of these three issues which confronted DLAR at the end of this period played a major role in determining the department's response to the round of changes which affected the faculty at the beginning of the next period of the study.

8.4.6 Summary of developments in IS in this period

Table 8.4 summarises the key influences shaping the evolution of IS at Monash during this period. In keeping with what Chapter 5 showed for most universities, it shows that the dominant force was the need for disciplinary and structural changes which accompanied the implementation of the Dawkins reforms.

<table>
<tr><th></th><th>Clayton campus</th><th>Caulfield campus</th></tr>
<tr><td>Structural/ disciplinary forces</td><td>• Creation of specialist faculty of IT as part of the institutional merger
• Decision by the DIS at Clayton to join FCIT, rather than staying in the Faculty of Business & Economics
• Re-naming of IS department and degree program at Clayton campus to "Business Systems"
• Closure of Faculty of Professional Studies and subsequent re-location of DLAR to FCIT; pressure on DLAR to introduce a stronger computing orientation to its programs</td><td>• Pursuit of independent disciplinary status for IS – first as a major, and then as a separate degree; impact in further separating IS from technical aspects of computing</td></tr>
<tr><td rowspan="2">Market forces</td><td>• Initial impact of declining work force needs for graduates during the recession, requiring the development of the coursework stream of the BBusiness Systems
• Impact of subsequent success of BBusiness Systems in the student marketplace, enabling stability and growth for Dept of Business Systems
• Market force pressure on DLAR to modify its undergraduate teaching program to attract enough students to make it financially viable; consequent establishment of degree program in Information Management within DLAR</td><td>• Perceived importance of marketability issues for BIS and market reaction to it:
o concerns over employability of BIS graduates in the work force;
o concerns over level of student demand for it, and the impact of demand on faculty programs</td></tr>
<tr><td colspan="2">• Concern over ongoing lack of domestic student demand for IT, and consequent market pressure on all faculty programs to find a reliable source of student enrolments to secure their financial position</td></tr>
<tr><td colspan="3">Table 8.4 Key influences on the evolution of IS: 1990-1997</td></tr>
</table>

As discussed in Chapter 5, it is difficult to separate the effects of structural and disciplinary pressures from one another. The decision to create the new computing faculty appears to have been more a discipline-based initiative by the computing schools which recognised the similarity in their disciplinary interests; while the decision by the Monash IS school to leave ECOPS and join FCIT appears to have been based more on structural grounds, given that School's initial preference was to stay with its roots in business. However, in both cases it seems clear that there were aspects of both disciplinary and structural imperatives involved. Therefore they have been combined under a single heading in the table.

The influence of market forces was generally outweighed by the requirements for disciplinary and structural change caused by the Dawkins reforms. However, the table highlights the emergence of student demand as an important aspect of market force pressures. The market-related issues for IS programs across the two campuses were equally as concerned with the need to attract students as the need to accommodate industry demands for IT graduates. This was the pre-cursor to the rise of student demand as the dominant influence on developments in the next period.

8.5 1997-2002: Expansion and growth

Chapter 7 showed that this was generally a period of rapid growth for IT and for IT-based educational programs. Like all other Victorian tertiary institutions, Monash enjoyed a surge in applications and admissions for its IT-related academic programs, spurred by the developments in multimedia, the world-wide-web and the dot.com boom. In its outline of events, this section follows the same approach as that used for the previous period, starting with a broad overview of developments within the IT faculty at Monash as a whole, and then examining the way in which they affected the development and growth of IS programs at the Clayton and Caulfield campuses.

8.5.1 Overview of developments in IT at Monash

The previous section showed that at Monash the structural changes associated with the Dawkins reforms had all been implemented and bedded-down by the mid-1990s. However, the beginning of this period saw a new round of structural changes in IT, some of which had profound effects on IS.

The immediate cause of these changes was the retirement in late 1996 of the Dean of FCIT, Cliff Bellamy, and his replacement by John Rosenberg, a graduate and former lecturer from the CS department at Monash. Even before his appointment to the position, Rosenberg indicated that he believed that the faculty needed to make changes to its departmental structure. In a discussion paper provided to faculty staff shortly after taking up his post in mid-1997, Rosenberg noted that the faculty structure still reflected the departmental divisions which had existed prior to the merger from which the faculty was formed in 1990. As such it was "… more an accident of history than the result of a careful planning process." (Monash FCIT, FB SC1/1997). He argued that a new structure was needed for a variety of reasons relating both to administrative issues of operational efficiency, and also to academic concerns about the need to reduce overlap of departmental interests and to improve inter-departmental co-operation.

Soon after his arrival, Rosenberg held a day-long meeting with the heads of each department and staff representatives to discuss options for a new structure. His discussion paper set out a range of alternatives which had been considered for the faculty structure, and indicating his preferred model (Monash FCIT, FB SC1/1997). This new structure was subsequently endorsed by the faculty Board and the university academic board, and approved to take effect from 1 January 1998 (Monash Academic Board, 1997). Figure 8.10 shows the revised structure together with a subsequent change which followed in 2001, which is described below.

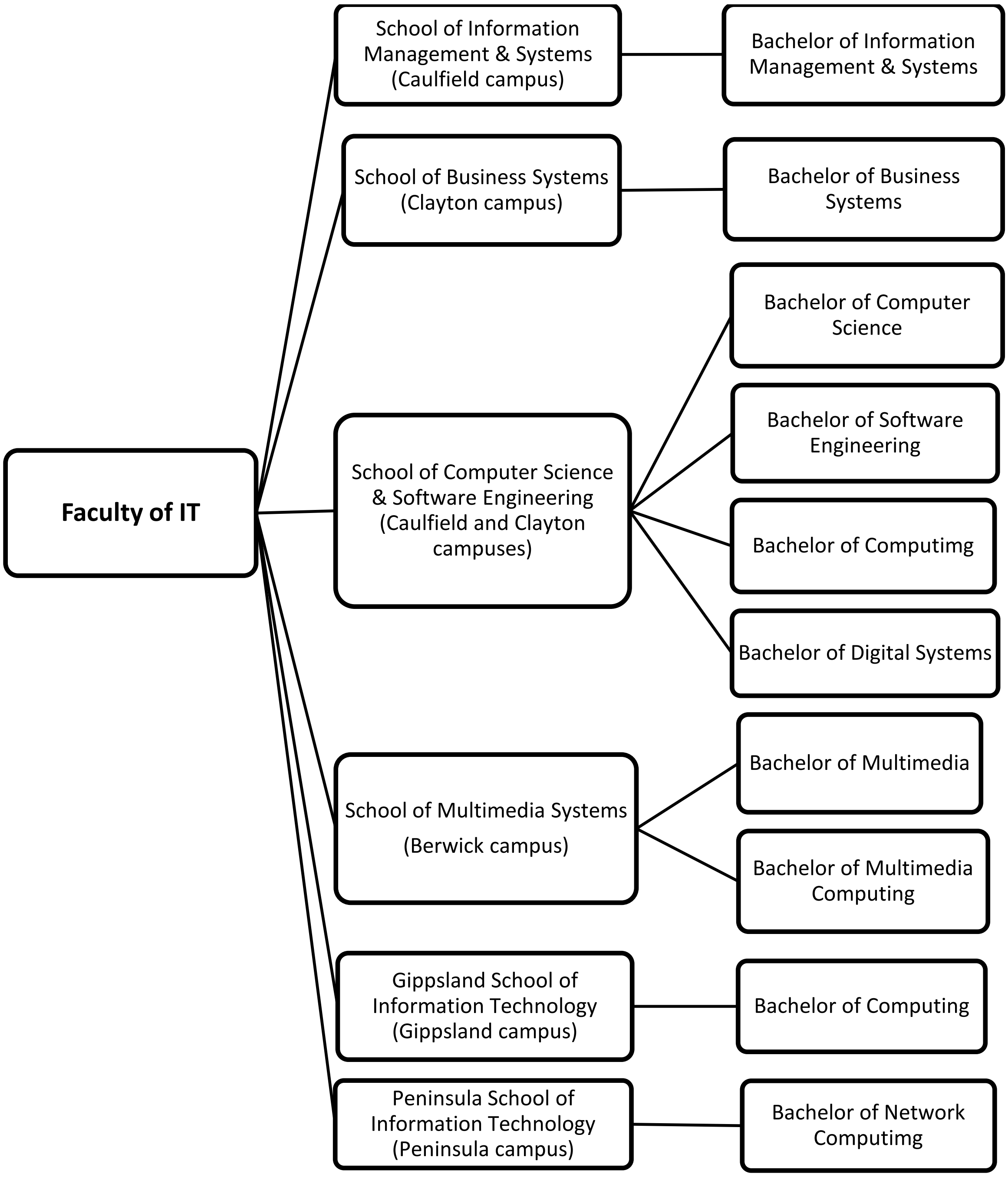


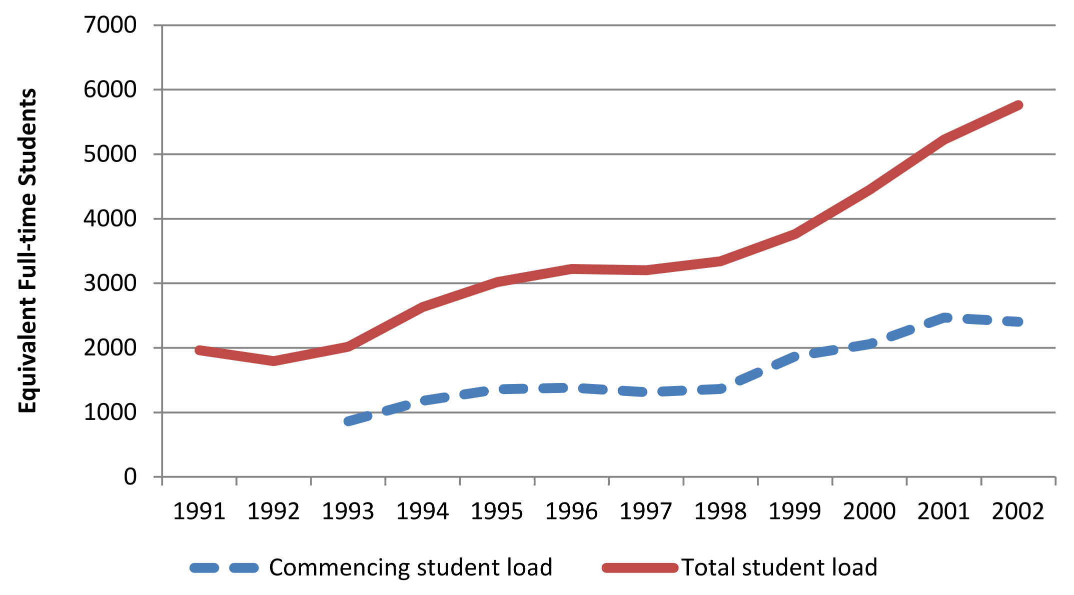
Figure 8.10: Faculty Structure in 2002

(Source: Derived from Monash FIT, 2002

The most important features of the re-structure were the consolidation of the technical computing departments from Caulfield and Clayton into one large multi-campus School of Computer Science & Software Engineering, and the merger of the DIS at Caulfield campus with the DLAR to form a new School of Information Management and Systems. The further change, which followed in December 2001, was the creation of a new School of Multimedia Systems at the Berwick campus. Other cosmetic changes included the removal of the word "Computing" or its replacement with the term "Information Technology" in the names of all organizational units; for example, the faulty itself was re-named from FCIT to FIT. Likewise all academic organizational units were named as schools rather than departments.

As the first specialist IT faculty in Victoria, FIT was particularly well-placed to benefit from the boom in interest in IT which characterised this period. The faculty saw sustained growth in the overall numbers of applications and enrolments in its courses at both undergraduate and postgraduate level. From 1997 to 2002, the faculty's overall annual student load increased by about 80% as shown in Figure 8.11 (the data on which it is based in Table F4 in Appendix F).

Fig 8.11 Trends in Monash FIT Student Load : 1991-2002



But much of this increase came through increases in enrolments in postgraduate and international student enrolments. In keeping with the trends which were shown in Chapter 7 to apply generally for IT and IS programs throughout Victoria, demand for undergraduate programs grew relatively slowly. This is shown in Figures 8.12 and 8.13, which plot the trends in preferences and enrolments in all Monash IT single and double degrees. In addition, Figure 8.14 plots the weighted average of the ENTER scores of students admitted to the faculty's single degree programs on the Caulfield and Clayton campuses; programs at the other three campuses are excluded because their admission standards were more susceptible to adjustment to meet local requirements. The data for the graphs are included in Tables F5-F7 in Appendix F.

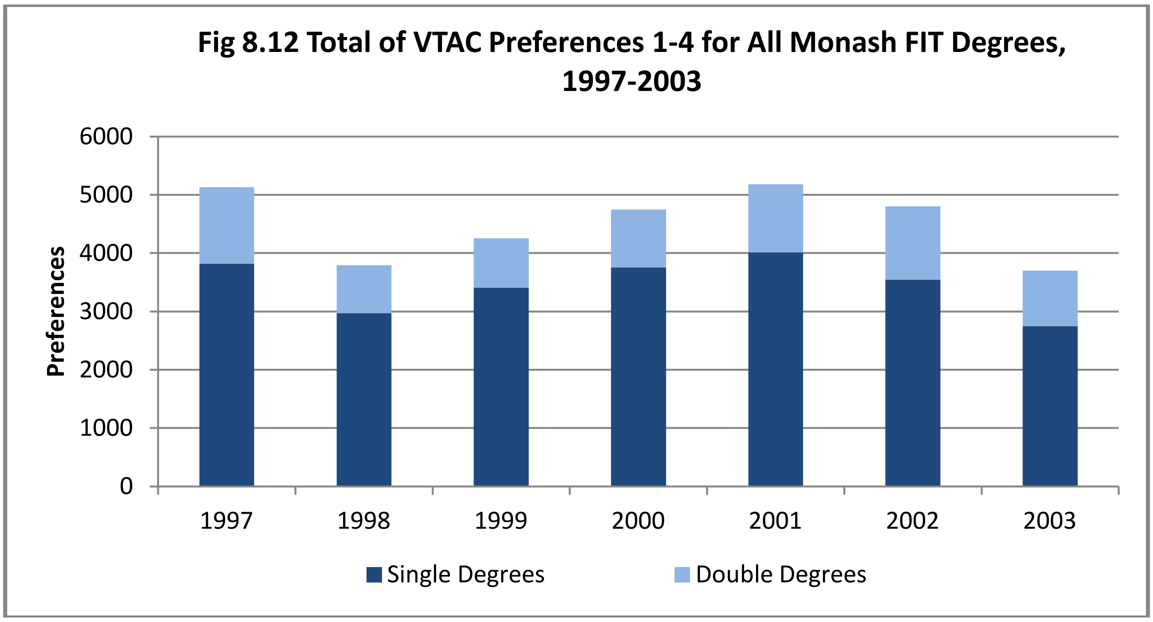


Fig 8.12 Total of VTAC Preferences 1-4 for All Monash FIT Degrees, 1997-2003
Preferences
6000
5000
4000
3000
2000
1000
0
1997
1998
1999
2000
2001
2002
2003
Single Degrees
Double Degrees

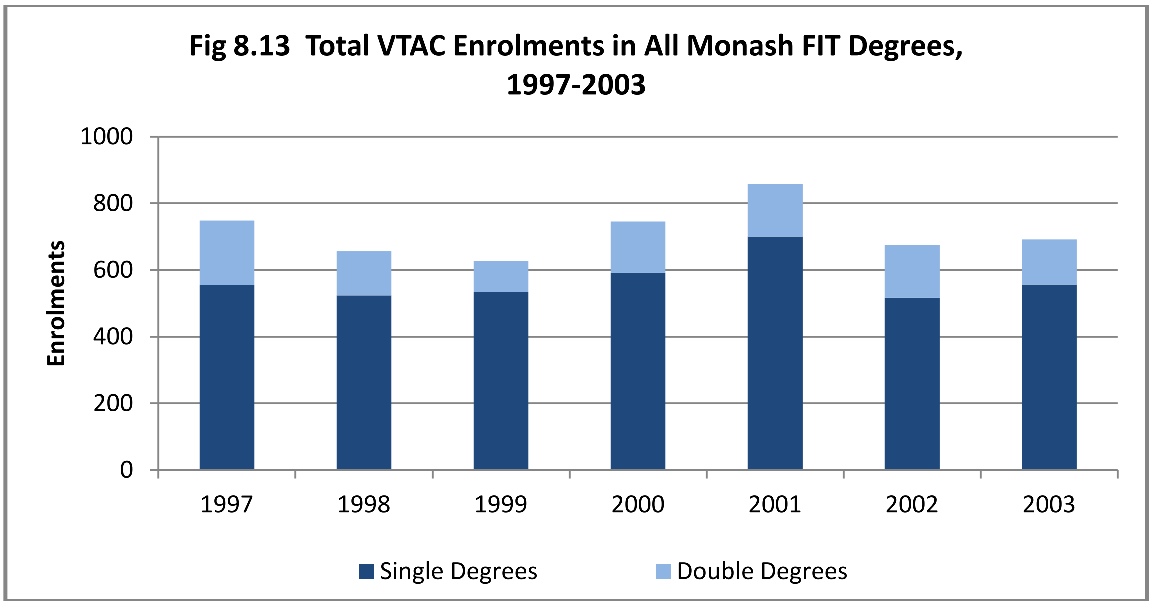


Fig 8.13 Total VTAC Enrolments in All Monash FIT Degrees, 1997-2003
Enrolments
1000
800
600
400
200
0
1997
1998
1999
2000
2001
2002
2003
Single Degrees
Double Degrees

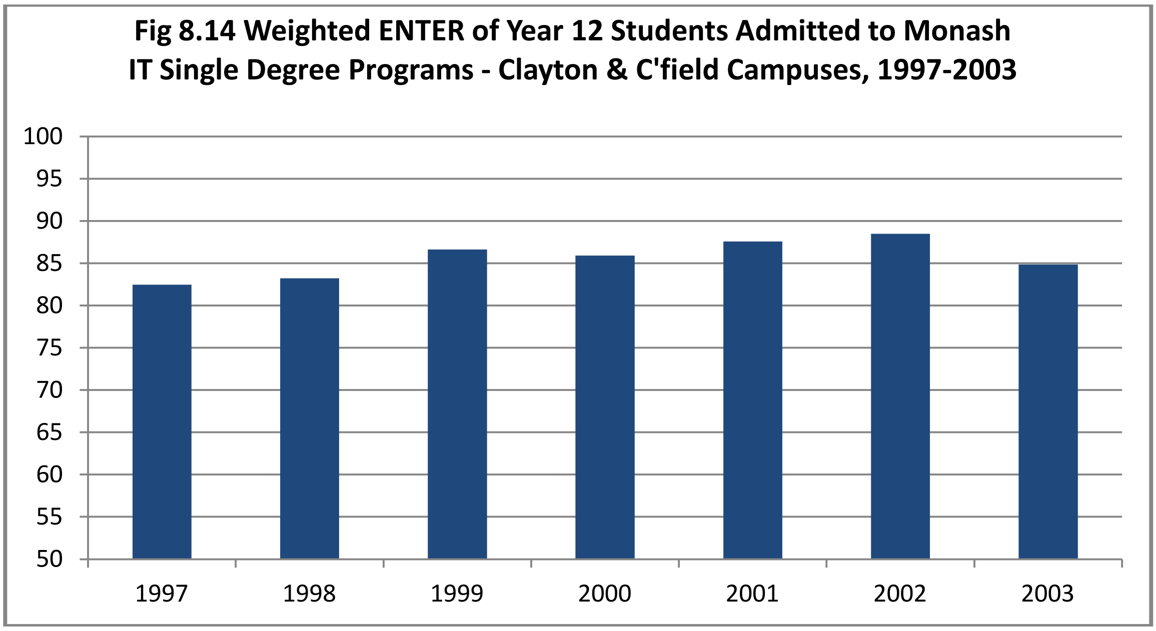


Fig 8.14 Weighted ENTER of Year 12 Students Admitted to Monash IT Single Degree Programs - Clayton & C'field Campuses, 1997-2003
100
95
90
85
80
75
70
65
60
55
50
1997
1998
1999
2000
2001
2002
2003

The graphs show that despite the interest in IT generated by developments in multimedia, the web and the dotcom boom, the total number of preferences for the faculty's undergraduate programs barely increased from their 1997 level. Enrolments showed more of a rise, but still only a relatively modest one. However the trend in ENTER scores for Year 12 students enrolling shows more significant signs of improvement. Together, these data indicate that the absolute levels of demand for IT did not change much, but the quality of applicants as measured by their Year 12 results improved.

The effects of these changes were not felt uniformly by all schools during the period. In particular there was a significant disparity in the experiences of the two schools in the faculty which had at different times in the past been known as the Department of Information Systems. The remainder of this section examines the events in both these departments, focusing mainly on the DIS at Caulfield campus, which underwent the most dramatic change.

8.5.2 Business Systems at the Clayton campus

The Department of Business Systems was scarcely affected by the structural changes initiated by Rosenberg. At the start of the re-structure discussions, departmental staff voted against the idea of merging with any other part of the faculty (Monash FCIT, FB 3/1997), and it seems clear that there was little serious consideration give to disturbing its independent status. As Section 8.4.2 showed, the ongoing strength of student demand for the BBusiness Systems helped it to maintain its position as the strongest and most stable department in the faculty in financial terms. Rosenberg's discussion paper on the re-structure included one structural option which showed a merger between the department and DIS, and noted that there had been suggestions of such a merger at times in the past. However the paper dismissed the idea, concluding that "… Although on the surface there are similarities in these disciplines, over the last few years there has been a deliberate separation of interests." (Monash FCIT, FB SC1/1997). Hence, the only effect of the restructure on the department was to change its name from 'Department' to 'School' - a change which was of no academic significance, but was done simply to maintain consistency with the names of the faculty's other organizational units.

For the remainder of the period the school's flagship BBusiness Systems program continued to maintain and even enhance its status as one of the best-performing computing degrees in Victorian universities. Table 8.5 summarises some of the key indicators of its performance in the domestic student market during this period. The table shows that the IT boom did not have any noticeable effect on the overall number of students applying for the course, and its annual intakes were kept at much the same levels throughout the period. But the quality of students in the degree's applicant pool, as measured by their performance in their year 12 studies, continued to climb, making it the best-performing IT-related single degree in Victoria. (Although, if associated double degree programs are taken into account, the BIS at the University of Melbourne performed better).

As a consequence of this continued strong performance the School of Business Systems was able to further increase in size, with its roster of academic staff reaching the low-mid 30s by the end of the period. This enabled the school to increase the number and variety of units offered as part of the BBusiness Systems, as will be shown in the discussion of curriculum in Section 8.7.

Year	Number of VTAC Preferences 1-4	VTAC enrolments	Average ENTER of VTAC Year 12 enrolments	Published Clearly-in ENTER
1997	365	61	89.85	n/a
1998	302	54	90.77	89.6
1999	352	57	93.43	91.05
2000	408	67	94.24	93.05
2001	371	69	94.29	92
2002	350	64	94.44	92.3

Table 8.5: Measures of Student Demand for BBusiness Systems, 1997-02
(Source: VTAC Admissions data and VTAC Guides)

8.5.3 IS and Information Management and Systems at the Caulfield campus

In contrast to the picture of stability presented by the School of Business Systems at Clayton, this was a period of major transformation for the IS department and the IS teaching program at Caulfield. Organizational structural change, changes in disciplinary structures and the influence of the IT student market all played significant roles in bringing about drastic changes to the department and its academic program.

Structural change – the formation of SIMS

The first and most far-reaching of the changes was caused by the changes to faculty structure outlined above, which saw the DIS merge with the DLAR. In response to Rosenberg's initial stated intention to re-structure the faculty, the heads of these two departments carried out their negotiations over this merger and had it ready to be put into effect before he even took up his appointment. At departmental meetings in mid-June, staff of both departments agreed to the proposed merger. Separate memos to this effect by the two departmental heads were tabled at a meeting of the faculty board in late June, just before the new dean's arrival (Monash FCIT, FB 3/1997). The memos suggested that the new merged department should be known as the Department of Information Management and Systems (this was subsequently changed to School of Information Management and Systems (SIMS), in line with Rosenberg's decision to designate all faculty academic units as schools). They proposed that the leadership of the merged school should be rotated between the heads of DIS and DLAR on a triennial basis, with the current head of DIS being made the inaugural head on the basis of his longer period of service at Monash.

In his memo, David Arnott, the head of DIS justified the merger on the grounds that:

> "… The academic areas of the two departments have been converging for a number of years. Together, the departments occupy the 'humanities' end of the information technology spectrum and are addressing a new discipline that is concerned with the development, use and societal impact of information systems in the broadest sense." (Monash FCIT, FB 3/1997)

He cited the formation of the School of Information Management and Systems at the University of California Berkeley as a model for the proposed merged department.

This vision of disciplinary 'convergence' between DLAR and DIS was supported by the head of DLAR, Don Schauder, although he also expressed a desire to maintain the connection which DLAR had established with the Department of Computer Technology (Monash FCIT, FB 3/1997). But despite his stated commitment to the new disciplinary vision, Schauder noted that DLAR staff wanted assurances that the professions of librarianship, archives and records management with which DLAR had been associated must "… continue to be unequivocally supported" by the new department. Furthermore, the work of DLAR was underpinned by "… a recognised distinction in disciplinary emphases between the librarianship (with teacher librarianship as a focus in its own right), and the recordkeeping aspects of our educational and research agenda" (Monash FCIT, FB 3/1997). Schauder emphasised that it was important that these disciplinary distinctions continue to be respected by the new school.

The purported disciplinary convergence had little apparent effect on the initial plans for the new department's undergraduate teaching programs. In his models of the proposed new faculty structure, the dean showed the BIS and BIM continuing as two separate degrees within the newly-created SIMS (Monash FCIT, FB SC1/1997). This separation was maintained in a discussion paper prepared by Arnott in November 1997, setting out the proposed long-term vision of the new school's undergraduate teaching (Monash FCIT, FB SC2/1997). The paper included a suggestion that the BIS and BIM should be re-designed to have an identical first year, but the motivation for this convergence in degree content came at least in part from the faculty's desire to have a greater level of compatibility and commonality in the first year content of all its degree programs. Thus, Arnott's support for a common BIS/BIM first year was accompanied by the suggestion that its content should also aim to maintain a high level of compatibility with that of the first year of the Bachelor of Business Systems at Clayton (Monash FCIT, FB SC2/1997).

The paper mentioned briefly the idea of a new degree called the Bachelor of Information Management and Systems (BIMS), which would combine content from both the BIS and BIM degrees. But it was described as a double degree program with no direct path of entry from secondary school. This meant it could be taken only by students who had already enrolled in either the BIS or BIM, and was intended to enable them to study both degrees in their entirety.

Market forces and disciplinary consolidation - the birth of the BIMS

Although the merging of the departments was not in itself sufficient to bring about a union of the BIS and BIM, the intrusion of market forces soon had this effect. Almost immediately after its formation in 1998, the new SIMS came under financial pressures which drove it to seek ways to cut back on its costs and rationalise its undergraduate programs. It is beyond the scope of this study to examine the department's internal financial problems in detail, but it is important to include some consideration of them to explain the impact of market forces on the school's IS program.

Under the faculty's funding model, the major proportion of each school's budget allocation was calculated on the basis of student enrolments in the units which it taught. Therefore, undergraduate student enrolments were usually the biggest contributor to a department's budget entitlements. As indicated earlier, DLAR and its predecessors had struggled financially for many years because of low student enrolments in its academic programs, and the BIM had not yet attracted the level of student enrolments needed to guarantee its long-term financial survival. By contrast, DIS had always enjoyed a much more stable financial base. Its main source of income from undergraduate enrolments came from the units which it taught into the generalist Bachelor of Computing degree. This degree had the highest level of student enrolments of all the faculty's undergraduate degree programs, and was one of the most popular IT-based programs in Victoria. The IS units in the core curriculum of the degree, together with the popularity of its IS major and elective units among BComputing students had ensured a secure income stream for DIS.

But the introduction of the BIS and the changes in the faculty structure changed the financial picture for DIS. Under the new structure, the ownership of the BComputing degree was given to the new School of Computer Science and Software Engineering. In response to the establishment of the BIS as a separate degree, that school decided to give the BComputing a much stronger technical focus. The majors were eliminated from the program structure, and the size of the technical computing core curriculum was increased. Only a small core of introductory IS units on system development was retained, and the scope for students to take further IS study was substantially reduced. Consequently, there was a significant drop in the projected income stream flowing to SIMS from the BComputing, and the school's financial viability became heavily dependent on the ability of its BIS and BIM degrees to attract students. (The school also obtained income from student enrolments in its other academic programs, but at this time the core undergraduate degrees were seen as its most important long-term income source).

It quickly became apparent that the existing level of student enrolments into the BIM and the BIS would be unable to generate enough income to maintain the school's financial viability. As the school itself noted in its submission to a subsequent faculty review of its operations in 2001, its consequent financial problems required it to undertake "…a difficult change management process, involving the downsizing of academic staff, the rationalisation of teaching offerings and the redevelopment of teaching and academic programs" (Monash SIMS, 2001, p6).

The rationalisation of teaching offerings involved the immediate disestablishment of both the BIM and BIS, and their replacement with a new degree called the Bachelor of Information Management and Systems (BIMS) as the school's sole undergraduate degree program. Arrangements were made for existing BIS and BIM students to be able to complete their degrees, but wherever possible they were encouraged to transfer into in the BIMS, which was introduced from the beginning of 1999. Substantial reductions were made to the number and variety of undergraduate units offered in the new program, as will be seen in the discussion of curriculum in Section 8.7.

The speed with which this change was introduced reflected the urgency of the need to address SIMS's looming financial problems. As indicated above, until as late as November 1997 the School's proposed strategy was to keep the BIS and BIM separate. The suggestion that this strategy might have to change was raised at the School's annual retreat in late January, and the proposed integrated degree was approved by the faculty Executive Committee in mid-March (Monash FIT FEx, 4/1998), in advance of the submission of the formal degree proposal which was submitted to the faculty Education Committee at the beginning of April (Monash FIT, FEC 2/1998).

The course proposal documents for the BIMS made no reference to the influence of financial issues on its introduction, but focussed on the theme of disciplinary convergence, which had provided the rationale for merging DIS and DLAR. The proposal was accompanied by a new mission statement for the school, which read as follows:

> "The mission of the School of Information Management and Systems is to advance through teaching and research, the organization, management and use of information and information technology, and enhance our understanding of the impact of information on individuals, institutions, and society.
>
> This mission has both a technical component, concerned with the design and use of information systems, services and products, and a social sciences component, concerned with understanding how people create, seek, obtain, evaluate, use, and categorise information." (Monash FIT, FEC 2/1998)

In justifying the rationalisation of the BIS and BIM, the proposal claimed that:

> "…The convergence of the School's disciplines means that over two thirds of the core material in the existing degrees will be common. To nurture this convergence the merger of the existing degrees is the highest priority of the new School."
> Monash FIT, FEC 2/1998)

The proposal indicated that it would aim to structure the degree in such a way as to maintain accreditation from all the professional bodies which had accredited the BIM and the BIS, including the Australian Computer Society, the Records Management Association of Australia, the Australian Society of Archivists and the Australian Library and Information Association (Monash FIT, FEC 2/1998)

A similar process of rationalisation was also undertaken at postgraduate level, with almost all existing postgraduate programs in IM and IS being phased out and replaced by a single Master of Information Management and Systems (MIMS), which aimed to combine the key components of both disciplines.

The cut-back in SIMS's academic programs was accompanied by reductions in staff numbers. These focused first on not renewing contracts for a number of non-tenured academic staff, and then on initiating a program of voluntary redundancies. These measures led to SIMS's roster of academic staff falling from a peak of 38 (9 of them part-time), immediately after the formation of the school in January 1998 to only 20 (all full-time) just over twelve months later, in February 1999 (Monash SIMS Retreat, 1998 and 1999).

Market forces and disciplinary diversification – the BMM and the BEC

At the same time that it was wrestling with the problems of integrating the BIS and BIM into the new BIMS degree, SIMS was also heavily involved in establishing and teaching two new degrees – the Bachelor of Multimedia (BMM) and the Bachelor of Electronic Commerce (BEC). The initiative for these degrees came from a Monash corporate planning exercise in 1997, which identified them as potential new strategic areas for innovation and growth. From their inception the university designated them as inter-disciplinary degrees which would encourage cross-faculty collaboration: the BMM was to be shared between FIT (as the lead faculty) and the Faculty of Art and Design, and the BEC was shared between Faculty of Business & Economics (as the lead faculty) and FIT. SIMS was at the centre of the FIT contributions to both these new degrees.

The stories behind these two programs are too complex to be explained in detail here. As will be shown below, neither turned out to be of great long-term significance for the content of the School's IS teaching. However, for several years they functioned as offshoots of IS, and appeared to offer possibilities for new directions for the discipline at Monash. The following brief outline aims not to give a complete history of these programs, but merely to highlight the connections with IS and their impact on the discipline's evolution on the Caulfield campus.

The BMM owed its origins to the emergence of multimedia as a potential field of study in the mid-1990s. This field had attracted the attention of a number of parts of the IT faculty, and by 1997 undergraduate units in aspects of multimedia had been developed and offered by the Gippsland and Peninsula Schools, the Department of Business Systems and the Department of Computer Science. The Gippsland School had included multimedia technology as a key research area for several years, and in 1997 had announced its intention of seeking approval for the appointment of a professorial chair in multimedia computing. Meanwhile, the Faculty of Art & Design had also developed an interest in the field, responding to the increasing sophistication of computer hardware and software capabilities for graphics and graphic design by adding a number of computer studies units to its graphic design program. The BMM was seen as a suitable vehicle for bringing together these separate disciplinary influences of IT and creative design within one degree program.

The initial spur for the involvement of SIMS in the BMM can be attributed largely to the influence of the DLAR, whose interest in the field was inspired by the potential impacts of multimedia on digital publishing and digital libraries. The department had developed a proposal for a digital publishing stream to contribute to the new multimedia program, and Don Schauder, as head of DLAR, had lobbied for it to take a lead role in the faculty's involvement in the degree. In his memo supporting the proposed DIS/DLAR merger, Schauder noted that the model of a new structure for the faculty circulated by the acting Dean (in anticipation of the new Dean's arrival) had shown responsibility for the new BMM degree as resting with the proposed merged department. Schauder suggested that the new department's mission statement should emphasise its commitment to the "creative dimension" which was an essential element of multimedia (Monash FCIT, FB 3/1997). Although the official record includes no formal statements by Rosenberg on the matter, it seems clear that from an early stage he agreed to this idea that DLAR should lead the initial joint FIT/Art & Design multimedia program. In each of his proposed alternative models for the faculty structure, ownership of the degree was assigned to the organizational unit which included DLAR (Monash FCIT, FB SC1/1997).

But despite this association with DLAR, it was staff from the DIS side of SIMS who were assigned the responsibility for establishing and running the new School's share of the content of the BMM. Under the joint teaching agreement with the Faculty of Art & Design this amounted to half of the core content of the degree. This contribution was oriented heavily towards multimedia technology and to the development process issues which had traditionally been the disciplinary focus of DIS; it included none of the DLAR interests in digital publishing and the like.

Although SIMS had won ownership of this first multimedia degree, the strength of interest in multimedia was such that the school was not able to establish exclusive disciplinary ownership of it as a field of study. With the BMM identified as belonging at the generalist "arts-based" end of the computing spectrum, other parts of the faculty were keen to lay claims to the technology end. In particular the Gippsland school, which had tried unsuccessfully to win the right to teach the technology components of the BMM, went ahead with its plans to expand its interests in the field. In 1998 it was permitted to establish its new professorial chair in multimedia technology (Monash FIT FEx 1/1998), and it began the development of a technology-oriented undergraduate degree to be called the Bachelor of Multimedia Computing. Other schools also continued to develop offer multimedia units at both undergraduate and postgraduate level, further increasing the confusion over disciplinary ownership of the field.

Development of the BElectronic Commerce (BEC) proceeded more slowly than the BMM. Like the BMM, the BEC was also proposed as a multi-disciplinary degree which could unite previously independent efforts to develop what was seen to be an important growth area for teaching and research. Throughout the mid-1990s academic units in both the IT and business faculties had established initiatives in electronic commerce, and in April 1997 the Vice-chancellor wrote to the deans of the two faculties noting his concern at the fragmentation of these efforts (Monash FCIT FB 5/1997). A review conducted on behalf of the two faculties in response to Vice-chancellor's comments concluded that Monash "… should focus on the non-technical end of the electronic commerce spectrum", addressing areas which spanned across the boundaries of IT and business. Electronic Commerce should be designated as a cross-faculty field of study, and a professorial chair should be established to run a jointly-funded Centre for Electronic Commerce, with the BEC as its main undergraduate offering (Monash FCIT FB 5/1997).

Within the IT faculty, several departments had become involved in teaching electronic commerce: the Gippsland School had proposed that electronic commerce be designated as a major focus of its activities as far back as 1995, and the Department of Business Systems also cited electronic commerce as a major research and teaching area. SIMS's claims for involvement in the BEC clearly came solely from the former DIS half of the school. The deputy head of DIS before its merger with DLAR was Paula Swatman, who claimed to have completed the first PhD in Electronic Commerce in Australia in 1993. She had introduced significant teaching and research streams in e-commerce to DIS after she joined the department in 1994. Her research Group within DIS was identified in the proposal to establish the electronic commerce chair as the university's only formal academic research group in electronic commerce (Monash FCIT FB 5/1997).

The initial proposal for the appointment of the new professorial chair and the establishment of the Centre for Economic Commerce implied that they would take place almost immediately, but progress on both was slow. As an interim measure, Arnott, as head of SIMS was given joint responsibility with a professor from the Faculty of Business and Economics to oversee the development of the BEC program, to ensure it was ready by its proposed starting date in 1999. A proposal for the new degree was presented by Arnott to the FIT faculty board in September 1998 (Monash FIT, FB 4/1998), and approved by a specially-convened meeting of the faculty executive committee three weeks later (Monash FIT, FEx 7/1998). Not surprisingly, the program description stressed its focus on systems development, which had also been the dominant focus of the DIS and its programs under Arnott's leadership. The IT half of the program's content made significant use of existing IS units from SIMS and also from the BBusiness Systems.

But SIMS's association with the BMM and BEC lasted only until the end of 2000, when it was brought to an end by another structural change within the faculty. In November, Rosenberg announced the formation of a new School of Multimedia Systems (SMS) at the university's Berwick campus, to take over the management and operations of the faculty's involvement in the BMM and the BEC (Monash FIT, FB 5/2000). In addition, the Bachelor of Multimedia Computing, which had just been approved for offering by the Gippsland School was transferred the new school. A number of staff from SIMS and the Gippsland School who had been involved in running and teaching these programs were offered positions in the new school.

Most of the SIMS units which had been taught into the BMM and BEC were transferred to the School of Multimedia Systems. SIMS argued that the content of some of these units lay within its area of disciplinary responsibility, but it was unable to win the argument that this entitled it to retain ownership of them. Instead, an agreement was negotiated which allowed it to maintain its own versions of some of the units, which it continued to offer in its undergraduate and postgraduate programs (Monash FIT, FB 2/2001). Through these units SIMS was able to continue to include some aspects of multimedia and electronic commerce within its teaching, but it was not able to extend its coverage, or use them as the basis for more significant re-design of the curriculum of its undergraduate program.

Stabilisation and disciplinary consolidation

The reduction in costs associated with the 1998 round of staff reductions and program rationalisation, together with increased student enrolments (particularly for its postgraduate MIMS program) enabled SIMS to recover quickly from its financial difficulties at the beginning of the period. After posting operating losses in 1998 and 1999 it achieved a healthy budget surplus in 2000, and, despite the setback caused by the termination of its involvement in the BMM and the BEC, the school's financial position remained strong for the remainder of the period (Monash SIMS Annual Retreat, 2001-2003). This enabled it to re-build, gradually replacing the staff and teaching units which had been lost in the cutbacks. By the end of 2002, the school's academic staffing roster had reached 29, up from its low of 20 at the start of 1999, and the number and variety of its undergraduate unit numbers had also been substantially restored (Monash SIMS Annual Retreat, 2003).

A major problem which SIMS encountered in this re-building process was the need to deal with the issue of disciplinary convergence, which had provided the original official rationale for the formation of the school and the subsequent rationalisation of its academic programs. Despite the introduction of the BIMS and MIMS, the academic organization of the school had initially retained significant elements of the disciplinary divisions of the pre-merger days. This can be seen in Table 8.6, which shows how the school's internal academic structure divided staff and teaching units into six sub-disciplinary groups (Monash SIMS Retreat, 2000). Although the allocation of staff and units across these groups was at times somewhat arbitrary - some staff taught across several areas, and some units could have been classified as belonging to more than one group - the table shows that the traditional disciplinary specialisations still persisted two years after the merger.

The most significant attempts to return to the theme of disciplinary convergence began in mid-2001 when Arnott's period of tenure as head of school ended, and he was replaced by Sue McKemmish. (Schauder was suffering from ill-health which meant it was not possible for him to take on the role as he and Arnott had originally planned). McKemmish's background was in recordkeeping, and much of her own research work had focussed on attempts to unify the disparate IM disciplines. In particular she had been involved in work by the Monash IM group on the development of the concept of the ‘information continuum’, which had been used initially as a conceptual framework to eliminate the disciplinary divide between records and archives. Within the IM group it was hoped that this concept could be extended to perform a similar function for other information-related disciplines.

Academic group	Number of academic staff	Number of undergraduate units taught*	Number of postgraduate units taught*
IS Development	4	6	5
Decision Support Systems	5	5	7
IT Management	4	5	4
Multimedia	5	13	3
Library and info science	3	2	6
Records continuum	3	3	5
* Some other undergraduate and postgraduate units which were classified as cross-disciplinary and were not assigned to any academic group are not included in the table			

Table 8.6 SIMS Academic structure, staffing and teaching in February 2000
(Source: Monash SIMS Retreat, 2000)

Shortly after the announcement that McKemmish would take over as head of school, the internal organizational arrangements for SIMS underwent a re-structure, which halved the number of academic groups from the six shown in Table 8.6 above to three – information systems development, information technology management and knowledge management. McKemmish was also a driving force behind the formation of a broad-based SIMS research group called the Enterprise Information Research Group, which aimed to act as an ‘umbrella’ under which other more narrowly-focussed specialist research groups within the school could operate.

In its submission to an internal faculty review of its operations in the second half of 2001, the school described its mission and philosophy in the following terms:

> “The philosophical basis of the School lies in the notion of unity in diversity, in the multidisciplinary and multicultural nature of SIMS, and the recognition that a major strength of the School lies in the integration rather than assimilation of its constituent parts. …. The unifying focus of all the School’s teaching, research and community activities is information in society. … the School’s core teaching and research business relates to building and managing all types of information systems, services and products for organizations and communities … The School community brings to these activities the multidisciplinary perspectives, knowledge and skills of information systems development, decision support systems, information technology management, knowledge management, library and information science, electronic recordkeeping and archival science.” (Monash SIMS, 2001, p7)

The submission described a debate within SIMS which had been inspired by the faculty review, concerning “… whether the current name of the school accurately reflects its identity and nature”. It indicated that the vast majority of school staff favoured a name change, and that the preferred new name was the ‘School of Information Systems and

Knowledge Management'. The submission's first recommendation to the review was that this name change be implemented "… and that the term 'The Monash Information School' be used in conjunction with the name of the school in promotional marketing and publicity material" (Monash SIMS, 2001, p8). This recommendation was not accepted by the faculty, but, in combination with the mission statement, it highlights the mixed disciplinary aspirations of the school – on the one hand to create a new sense of cohesion under the unifying banner of 'Information', while on the other hand to continue to acknowledge the diversity of the different disciplinary roots from which it had been formed.

The difficulties involved in achieving greater disciplinary unity were compounded by the way in which changes in the school's teaching responsibilities had further increased the breadth of disciplinary skills and interests of its staff. The first problem of this kind came from SIMS's involvement in teaching the multimedia and electronic commerce degrees. This had led to the appointment of academic staff who were specialists in these areas, and had no strong links with the disciplinary traditions of either of the departments from which the school had formed. In addition, SIMS had recruited a number of staff with technical computing backgrounds in programming and computer hardware to help break its traditional reliance on other schools in the faculty to teach the technically-oriented computing content of its degree programs. Like the multimedia/electronic commerce specialists, these staff had no close affiliation with either IM or IS. Their arrival enabled the school to develop its own technology-based units, but added further to its problems of disciplinary diversity.

The BIMS, as the school's flagship undergraduate degree program, became a major focal point for the attempts to bring about disciplinary convergence. After its hasty initial establishment in early 1998 (described as having taken place in a "…time-critical environment"), the degree underwent a major review and was re-launched with substantial modifications in 1999 (Monash FIT FEC 3/1999). Further changes were considered by a curriculum review committee which was established in late 2000 to examine the overall objectives and philosophy of the degree, and recommend directions for the future development of its curriculum. The committee identified a number of areas of uncertainty which needed to be resolved, relating to key issues such as the level of integration which should be established between the units of the degree, the graduate and career outcomes it should aim to support, and the forms of information and information usage upon which it should focus (Monash SIMS Annual Retreat, 2001).

The level of success which was achieved in these attempts to create the BIMS as an integrated degree blending IS, IM and its supporting IT content remained a matter of debate within SIMS throughout this period. There were clearly some topic areas in which enough points of commonality were found to enable genuine integration of the IM and IS disciplinary traditions - knowledge management was a clear example of one such area. However, subsequent events showed that the claimed similarities in disciplinary interests in information and the use of technology to manage and use it were relatively superficial, and were far outweighed by the differences in the fundamental orientation of the disciplines towards these objects of study. Therefore the degree functioned as an awkward hybrid, with roughly half its content focussed on IS and half on IM, with few signs of the supposed disciplinary convergence evident in its curriculum.

Market forces and the return to BIS

The issue which triggered the eventual demise of the BIMS was that of market demand for the degree. Although the school's financial position had improved significantly, there were still concerns that the BIMS was not performing as well as it should in attracting domestic students (see Table 8.7). In particular, it was perceived to be failing to attract high-performing secondary school students. Concerns about the BIMS became a major topic of discussion at the SIMS annual staff retreat in February 2002 (Monash SIMS Annual Retreat, 2002)

Year	Number of VTAC Preferences 1-4	VTAC enrolments	Average ENTER of VTAC Year 12 enrolments	Published Clearly-in ENTER
1997	405	27	79.9	n/a
1998	342	42	86.7	88.85
1999	273	48	83.8	80.6
2000	491	54	83.8	85.1
2001	491	60	85.9	84.55
2002	365	36	85.4	83.65

Table 8.7: Measures of market demand for BIMS/BIS, 1997-02

(Source: VTAC Admissions data and VTAC Guides, 1997-2003)

The immediate outcome of this discussion was a submission by the school to the Faculty Education Committee proposing that the degree be re-named to Bachelor of Information Systems (Monash FIT FEC, 2/2002). In a report setting out the justification for the proposed change, the School identified its major competitors as being the IS degrees offered by other universities. It provided evidence that in most other universities IS degrees were out-performing their CS program counterparts, but at Monash this was not the case for the BIMS. Since the replacement of the BIS by the BIMS in 1999, the level of domestic student demand for the degree had declined slowly but steadily, causing both the intake levels and the clearly-in ENTER scores required for entry to drop. By comparison, its main IS competitors at other universities had increased both their intakes and Clearly-in ENTERs over the same period

The submission described anecdotal evidence and the findings of some admittedly informal surveys which it believed indicated that the name of the degree was causing some confusion in the market place. They showed that many students and schools career counsellors inferred from the name that the degree was a management or business degree, and failed to recognise it as an IT-related degree. Consequently the school was believed to be losing good quality students to its IT competitors (Monash FIT FEC, 2/2002).

Although the submission focussed on issues relating to the name rather than the content of the degree, its passing references to the orientation of the degree highlight the problems which the school had had in addressing the disciplinary differences between IM and IS. In giving the background to the original choice of the name 'Information Management and Systems' to the degree, the submission noted that the name had been chosen to "… help cement the merging of two disciplines into one" (Monash FIT FEC, 2/2002). On the other hand, it subsequently described the degree as being "… an IS degree with a strong information management stream", and indicated that the degree would continue to maintain this stream after the name change, "… as it continues to have an important place in the program" (Monash FIT FEC, 2/2002). An obvious implication which could be drawn from these comments is that the initial aim of "merging the two disciplines into one" had not been achieved, and that the re-naming of the degree was in fact an acknowledgement that the degree remained an IS degree with a separate IM stream.

Although the approval of this proposal by the faculty changed only the degree name, it inevitably led to a further review of the degree content, to ensure that it aligned with the School's perception of what an IS degree should include. The review aimed to provide a comprehensive overhaul of the degree. All the school's academic staff were encouraged to participate, and most of them became members of specialist teams, which were set up to focus on specific areas of content (Monash SIMS Annual Retreat, 2003). Regular meetings involving all available staff were conducted throughout the first half of 2003, to try to establish a consensus view of the degree. Meetings were also held with selected representatives of industry and with students to get their input.

This lengthy process culminated in a submission to the faculty of a proposed revised degree structure, comprising a completely new set of units for the degree (Monash FIT FEC 3/2003). The IM stream of units was retained within the degree, but there was insufficient room left for it to enable it to be offered in a form that met the accreditation requirements of the Australian Library and Information Association. Consequently, SIMS also put forward a proposal for a special version of the degree which would be called the BIS(Information Management) to cater for students who wanted this accreditation (Monash FIT FEC 3/2003).

The new version of the BIS was approved by the faculty (Monash FIT FB, 3/2003), but the specialist BIS(Information Management) was rejected (Monash FIT FEC 3/2003), largely on the grounds of insufficient student demand. However, the intervention of external events outside the control of the school meant that the new version of the degree was offered only for one year. The continuing collapse of the student market led to dramatic changes in the structure of the organization of the faculty and its academic programs, which will be discussed in the next section.

8.5.4 Summary of developments in IS during this period

Table 8.8 highlights the complexity of the blend of disciplinary, structural and marketplace pressures which combined to shape the evolution of IS at the Caulfield campus during this period, and contrasts it with the relative tranquillity of the situation for IS at Clayton. The difference between the fortunes of the discipline at each campus can be attributed largely to the influence of market forces. At Clayton, the strength of the Business Systems degree in maintaining and enhancing its place in the student market ensured that this was a period of stability and prosperity for the School of Business Systems. It was the only school on the two campuses which remained untouched by the new Dean's structural changes at the beginning of the period. At Caulfield, the comparatively weaker position of the DIS and its BIS made it more vulnerable, which significantly contributed to its decision to seek disciplinary change, first through its merger with DLAR, and secondly through its expansion into multimedia and e-commerce. (Much the same could also be said of DLAR to explain its willingness to join with DIS).

	Clayton campus	Caulfield campus
Disciplinary forces	• School's determination to retain disciplinary independence; impact on school's ability to resist pressures for structural change in the faculty	• Perceptions of disciplinary convergence as a factor in encouraging the merger of DIS and DLAR to create SIMS • Emergence of multimedia and e-commerce as disciplinary areas; early involvement of SIMS in both areas • Continued expansion of disciplinary scope of multimedia and e-commerce; decision to recognise them as specialist disciplinary area by creating School of Multimedia Systems; impact on SIMS involvement in these areas • IS separation from IM • Change from BIMS back to IS
Structural forces	• Decision to allow School of Business Systems to retain its independence as an organisational unit	• Impact of pressure for changes in faculty structure on decisions of DIS and DLAR to merge and form a single department • Impact of decision to create a new School of Multimedia Systems in reducing scope for SIMS to include multimedia and e-commerce in its undergraduate programs
Market forces	• Impact of ongoing stability/strength of market demand for Business Systems: o Financial stability as a factor in the School's ability to resist pressures for structural change o Impact on ability of School to continue to strengthen and expand its undergraduate curriculum	• Influence of market force pressures in encouraging merger of DIS and DLAR • Lack of student demand for BIS and BIM as a factor in the financial problems which led to the integration of the BIS and BIM into the BIMS • Impact of perceived market demand (student and work force) for multimedia and e-commerce on developments in these areas • Impact of perceived marketplace attitudes on decision to change BIMS back to BIS

Table 8.8: Key influences on the evolution of IS: 1997-2003

Although it was marketplace influences that provided the main pressures for change, the specifics of the changes were influenced by both structural and disciplinary factors. It is reasonably easy to separate out the main disciplinary and structural forces as shown in the table, but it is difficult to determine the strength of their relative contributions to the actions which were taken. For example, despite the use of 'disciplinary convergence' as the official justification for the decisions by DIS and DLAR to merge with one another, the lack of evidence of any such convergence suggests that structural factors played a more significant role. Similarly, it is difficult to separate the relative contributions of the disciplinary and structural factors involved in the creation of the School of Multimedia Systems, and the consequent loss of these disciplinary areas from the jurisdiction of SIMS.

8.6 2003-present: Decline and program closure

Chapter 7 showed how the aftermath of the dot.com crash saw a dramatic decline in the student market for IT programs of all types across all Victorian universities and in the secondary education system. The decline struck most severely between 2002 and 2007, but continued, albeit at a slightly slower rate, throughout most of the rest of this period.

There is no clear evidence that IT at Monash performed significantly better or worse than at other institutions, but as a specialist IT faculty, FIT at Monash was particularly susceptible to the downturn. All its programs – both undergraduate and postgraduate - suffered substantial declines in applications and enrolments, and the faculty had no programs in other disciplinary areas to cushion their effects. The faculty's ability to cope with the downturn was also hampered by the fact that it had to comply with a Monash directive that all the university's degrees must retain a published Clearly-in ENTER score of at least 70. This limited FIT's scope for following the strategy employed by some other universities of lowering their entry standards to try to maintain their enrolment numbers.

In view of the significance of the faculty's overall position and its impact on IS, this section gives a longer and more detailed examination of the events within the faculty as a whole, before examining developments in the IS-related programs on the Caulfield and Clayton campuses.

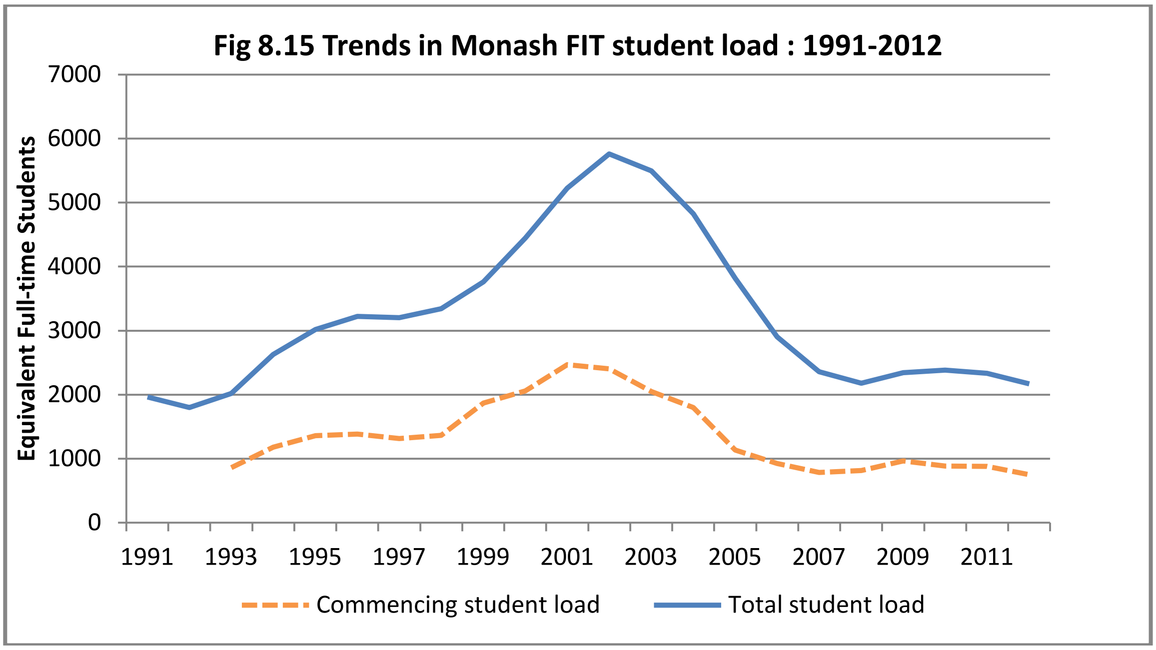
8.6.1 Overview of developments in IT at Monash

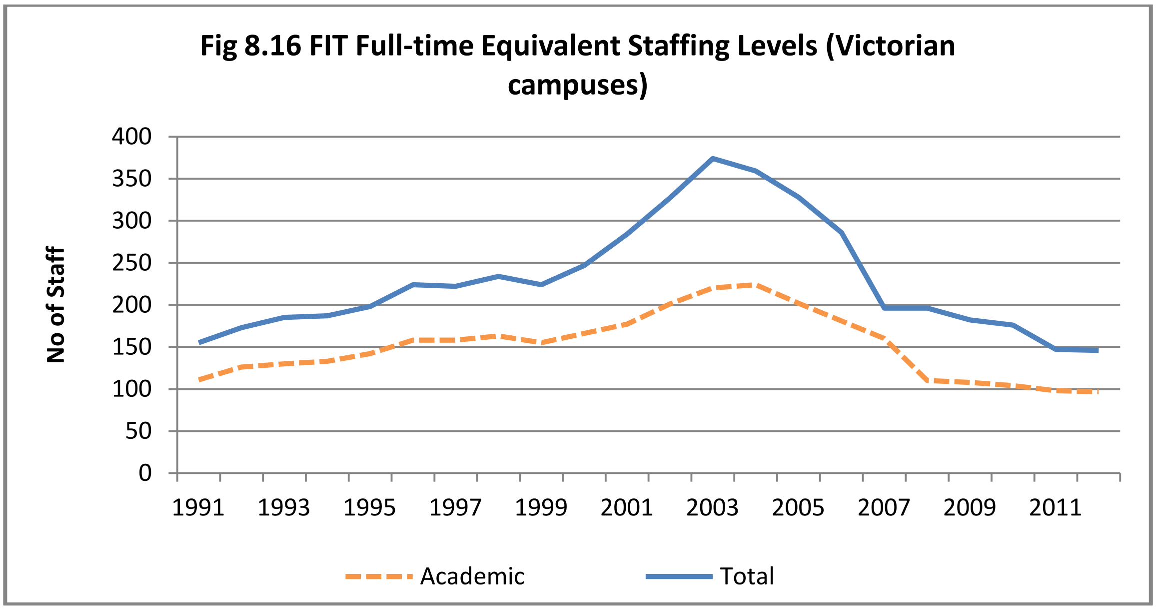
Overall dimensions of the downturn and its impact on Monash IT

Figure 8.15 shows the market downturn in this period in the context of the long-term trends in student enrolments in the faculty's programs. (The data on which the graph is based are included as Table F7 in Appendix F).

The graph highlights the speed of the onset of the downturn which struck FIT at the beginning of this period, its severity, and its persistence throughout the rest of the period. It shows how the long-term pattern of increasing student enrolments and the trend of sustained rapid growth since 1997 suddenly reversed into an equally rapid decline, which continued virtually unabated until 2007. From there it flattened out, but the subsequent years have shown few signs of any significant sustained revival in student demand. The falls were felt with only minor variations in their severity across all sectors of the student market – domestic and international, undergraduate and postgraduate. They were of similar magnitude across all fields of IT and all faculty programs. By the end of the period, the commencing student load and total student load for all programs had declined to levels comparable to those which existed at the time of the formation of the faculty twenty years earlier.

As a consequence of the downturn in student numbers, the faculty had to shed staff both to cater for the reduction in its teaching load and to save costs. Figure 8.16 shows the sharp reversal in the long-term upward trend in both academic and administrative staffing numbers, before they began to stabilize in 2008 in line with the plateau-ing of student numbers. (The data on which the graph is based are included in Table F7 in Appendix F). Inevitably this reduction in staffing levels had significant ramifications for the faculty's organizational structure and its spread of disciplinary expertise.





When the decline in student demand began, it was widely perceived within the faculty either as a 'correction' from the highs of the dot.com boom, or as simply a cyclical downturn which would soon reverse itself. When it became clear that this was not a short-term phenomenon, and was creating a financial crisis for all FIT schools and their programs, the faculty responded by adopting a more centralised approach to the management of its operations and academic programs. The remainder of this section outlines a number of strategic initiatives which were launched in an attempt to deal with the effects of the downturn.

The 2004 re-structure: the faculty review and its organizational and disciplinary impacts

John Rosenberg resigned as dean of the faculty in late 2003, and was replaced by Ron Weber, one of the world's leading IS scholars, who had been based for many years at the University of Queensland. When Weber took up his appointment in February 2004, FIT was due for its 5-yearly review under a Monash program of regular faculty reviews. Weber decided to use this as an opportunity to go beyond the usual academic review process and conduct a major strategic review, which could address the structural changes which were needed in the faculty to respond to its changing circumstances.

The review was led by a Steering Committee made up of a mixture of senior academic and administrative staff, most of whom came from outside Monash. It was chaired by Professor David Pennington, a distinguished academic and former Vice- chancellor of the University of Melbourne. Members of the Steering Committee supervised a number of project teams staffed by members of the faculty, which engaged in a faculty-wide consultation process. The project teams developed a set of options and recommendations for the faculty's strategic vision, its academic programs, its organizational structure and governance. These were used by the Steering Committee as the basis for its final report and recommendations, which were published in October 2004 (Monash FIT Strategic Review, 2004a). The Dean's response, which was disseminated to faculty staff the following month, accepted the key recommendations of this report, and established an implementation process which ran through 2005 (Monash FIT Strategic Review, 2004b).

The Steering Committee's report and Weber's response to it identified several key issues which drove the main recommendations for change:

- Cost reduction: The review noted that the decline in enrolments meant that the faculty's financial position was unsustainable (the operating deficit for 2004 ultimately came to $11 million). Remedial action which had already been taken had reduced the losses somewhat, but more action was needed if the faculty was to return to surplus in 2006. The review noted that the university was steadily increasing pressure on all organizational units to operate profitably, and FIT must structure itself and its activities in a way which ensured this was possible. Weber noted that the university had indicated its willingness to subsidize the faculty in the short term, but only if there was a demonstrated willingness by the faculty to take appropriate steps to turn its fortunes around.
- Structural integration: The Steering Committee recommended that the existing faculty structure based around discipline-based schools should be replaced by a 'strategic/operational' model. Under this model, overall management and control should rest with the faculty, and schools should provide operational-level support and advice to assist with strategy development. In a vision statement released shortly after the review, Weber set out two contrasting models of faculty organization – an 'independence' model in which schools and disciplines had primacy and the faculty played a secondary role, and an 'integration' model in

which these positions were reversed. He acknowledged that both models (and hybrid forms combining the two) had their merits, but came down in favour of the integration model as the preferred option for the faculty's future:

> "… we must *work as a faculty* and not as a set of loosely connected disciplinary areas or schools. We must strive to make the whole (the faculty) much greater than the sum of the parts (the disciplinary areas or schools)." (emphasis as in original) (Monash FIT Strategic Vision, 2004)

- Disciplinary integration: Closely associated with the need for structural integration was the need for closer integration of the faculty's academic programs. The Steering Committee suggested that rather than needing its existing set of 10 undergraduate programs based around disciplinary specialisations, the faculty should be able to get by with three degree programs catering for technical, organizational and applied orientations towards IT (Monash FIT Strategic Review, 2004a). These programs should share a common core of 8-10 units in fundamental IT concepts which were identified as essential knowledge for all FIT students. In indicating his support for this recommendation, Weber noted that the adoption of this approach would ensure that: "… Our students will be best able to solve problems that require broad, integrated knowledge about information technology rather than advanced knowledge in some specific disciplinary areas." (Monash FIT Strategic Vision, 2004)
- Central control of academic programs: All degrees and units offered by the faculty would be owned by it, with the teaching of each unit and degree being 'contracted' to the faculty organizational unit on each campus where it is offered. The faculty would seek advice from the key stakeholders within the faculty about all decisions about degree and unit offerings, but would retain the final say. The importance of this point was highlighted by Weber's suggestion that it may be best to avoid using the name 'School' in the title for the organizational units on each campus, in order to minimise the possibilities of them believing that they could still exercise control over degrees as they had done in the past (Monash FIT Strategic Vision, 2004).

The faculty implemented a range of measures to address these issues. Operational costs were reduced by a program of staff reduction; positions becoming vacant were not replaced, contracts for non-tenured staff were not renewed, and 24 staff (14 academic and 10 general staff) were given voluntary redundancy packages at the end of 2005 (McCarthy & Ketchen, 2009). The discipline-based schools at Caulfield and Clayton were amalgamated into a single multi-disciplinary school at each campus, operating under a new funding model which increased faculty control over expenditure.

All existing teaching programs at both undergraduate and postgraduate level were disestablished, and replaced with what it was hoped would be smaller, more closely-integrated sets of programs. At undergraduate level, this set comprised four degree programs – the Bachelor of Computer Science, Bachelor of Software Engineering, Bachelor of Business Information Systems (all based at the Clayton campus) and a Bachelor of Information Technology and Systems which was offered at the other campuses (Monash FIT Strategic Review, 2004b).

A key part of the strategy for the rationalisation and overall integration of the faculty's undergraduate degree programs was the introduction of a set of foundation units which were common to them all, and hence were called ‘the common core’. The units covered basic concepts in computer hardware, programming, database, networks and data communications, IT usage in organizations, systems analysis and design and project management. These topic areas were felt to be so fundamental to the role of the IT professional, that graduates of every faculty degree should be required to have at least a basic knowledge and understanding of them (Monash FIT Strategic Review, 2004b).

The new programs were developed throughout 2005, and offered for the first time in 2006. At the same time a major round of rationalisations of unit offerings, brought about a substantial reduction in the number of units which the faculty offered in each program.

2006 - The second round of re-structuring

The faculty review had anticipated that the cost savings generated by its recommended changes, together with an anticipated stabilisation in student enrolments would enable the faculty to return to profitability by 2006. But, contrary to the faculty’s original projections, student intakes continued to decline, causing further damage to its financial position. By late 2005 Weber reported that the faculty would suffer ‘significant losses’ in its operations in 2006 and 2007, and it was unclear whether it would be able to return to at least a break-even point in 2008 (Monash FIT FB 5/2005). By mid-2006 the budget deficit for the year was projected at well over $10 million (McCarthy & Ketchen, 2009).

As a consequence, in July 2006, the faculty decided to close down its operations at the Peninsula campus, and a new offer of redundancy packages was made to all staff. When this failed to prompt enough resignations from academic staff, a round of compulsory redundancies was introduced in September. In total, 38 professional staff and 50 academic staff were made redundant during 2006 (McCarthy & Ketchen, 2009).

The faculty also tried to address concerns that its rationalisation of its undergraduate programs had in fact exacerbated the decline in student enrolments, particularly in the generalist, vocationally-oriented Bachelor of Information Technology and Systems. This degree had been introduced as the sole FIT degree to be offered at all Victorian campuses except Clayton, as a replacement for the various specialised computing programs which had previously been offered at these campuses (network computing at Peninsula, multimedia at Berwick, computing at Gippsland, and computing and IS at Caulfield). At the Caulfield campus the degree was offered only with a major in systems development in 2006, and the number of applicants and enrolments dropped dramatically (this decline and its consequences are discussed in more detail in section 8.6.4 below).

In an attempt to restore the campus’s fortunes, new majors were developed in information systems, information management, internet systems and security, and two specialist streams which had been offered at the outer suburban campuses were re-located and offered as majors at Caulfield - the net-centric computing program which had been previously offered at the Peninsula campus, and a specialist stream in games development which had previously been offered at the Berwick campus. With these new specialist streams to attract students the Caulfield campus was able to regain some of the ground it had lost in 2006, though student demand remained far below the levels of earlier years.

2009: The second faculty review and more re-structuring

The round of staff reductions, together with the gradual flattening out in the decline in student numbers realised at least in part the goal of rescuing the faculty’s financial position. The huge operating deficits from which it had suffered from 2004 to 2006 were eliminated, and in the years from 2007 to 2009 its annual financial performance hovered around the break-even point.

But, although the situation had now stabilized somewhat, the faculty was still struggling to reach its enrolment targets, at a time when the university was increasing the pressure on all faculties to achieve specified minimum operating surpluses. With no clear signs of an imminent recovery in student numbers to boost income, the need for further rationalisation of academic programs to reduce operating costs became an important focus of the next faculty review, which took place in 2009.

The review left the BBIS largely untouched, but one of the main topics on which it focused was the number of majors in the BITS at Caulfield. It was widely felt that in its attempts to correct the disastrous collapse in BITS enrolments from the previous rationalisation of units in 2006, the faculty had gone too far in the other direction. The addition of new majors, together with the transfer of the majors which had previously been offered at the Peninsula and Berwick campuses, meant that there were now seven majors offered in the BITS at Caulfield. This was felt to be confusing to the student market, expensive in terms of the number of units which had to be offered, and difficult to maintain, because the staff reductions had reduced the levels of expertise available in some topic areas.

As a consequence, the BITS underwent another re-structuring in 2010. The curricula of all the majors were revised by the Caulfield School of IT, and several majors were eliminated or combined. Among the casualties of this rationalisation were the two majors in IS and IM. But rather than eliminating them both completely, the School decided to try to maintain some presence from the 'non-technical' end of the IT spectrum by combining them into a single new major, which was given the name 'Enterprise Information Management'. It aimed to provide a small set of generalist core units which integrated the key basic concepts in each discipline, and a set of specialist electives, which enabled students to study advanced topics from whichever one they preferred. The major was offered for the first time in 2011.

8.6.2 Overview of Impacts on IS at Monash

The discipline-based approach which was taken by the 2004 strategic review in its evaluation of the faculty's academic program offerings made it inevitable that only one of the BBusiness Systems and the BIS could survive the faculty re-structure. Although there were significant differences between the orientations and content of the two programs, they both occupied a similar part of the computing spectrum, and there was room for only one such program in the faculty's recommended set of undergraduate degrees.

Neither the BIS nor the BBusiness Systems was seen by the review Steering Committee as constituting an ideal base for the proposed applied organizational/ business-oriented degree program. The BIS was handicapped in this regard by its history (and the history of SIMS as its previous owner) of aspiring to represent a blend of both IM and IS, rather than being devoted solely to business-oriented IT. Despite the re-design and associated re-naming of the BIMS to BIS in 2002, the influence of arts-based studies in librarianship, archives and recordkeeping meant that SIMS and its academic programs were perceived to have a broader social science orientation than was desired in the new degree.

The School of Business Systems and the BBusiness Systems had clearly had the desired business focus throughout their history, but the Steering Committee was concerned that the degree was too vocational in its orientation, and lacked a strong underlying disciplinary foundation. Although the vocational focus of the program and the ongoing influence of the industry partners had been central to the popularity and financial success of the program, they were seen in less favourable light by the Steering Committee. Concerns were expressed that the degree and its content were too strongly influenced by the immediate needs of its industry sponsors, and lacked the underlying disciplinary focus expected of an academic program.

The Steering Committee made no specific recommendation on the name or content of the proposed new business-oriented program, or how it should relate to the two existing degrees. In his report to the faculty in response to the committee's proposals, Weber determined that the program should be specified as an information systems degree (subsequently given the name of Bachelor of Business Information Systems (BBIS)), which should be built around the Clayton program, and offered only at the Clayton campus (Monash FIT Strategic Review, 2004b). He did leave the door open for the possible future return of some form of IS program at Caulfield, by indicating that in time it may be possible for both the BBIS and the BITS to support additional specialist majors or unit sequences within the framework of the basic degree. However, he noted that the emphasis in the short term must be on reducing the number of units the faculty offered in order to cut the cost of its operations (Monash FIT Strategic Review, 2004b).

At an organizational level the move to multi-disciplinary schools at the Caulfield and Clayton campuses eliminated any specific recognition of IS within the faculty structure. Staff from the two IS-oriented schools merged with their colleagues from the School of Computer Science and Software Engineering who were located on each campus. At Clayton, this meant the staff from the School of Business Systems joined with those who had predominantly come from the original (pre-1998) School of Computer Science, while at Caulfield, staff from SIMS joined with staff who had predominantly come from the old (pre-1998) schools of Computer Technology and Software Development. In theory, the new structure made it possible for staff to move relatively easily between the two campuses, and operate as members of either school, but in practice only a few staff made use of this opportunity. Most preferred to stay where they had originally been based, working alongside the disciplinary colleagues with whom they had been previously most closely associated.

8.6.3 IS at Clayton - the Bachelor of Business Information Systems (BBIS)

The transformation of the BBusiness Systems to the BBIS was relatively straightforward. The documentation in the program proposal described the BBIS as a direct replacement for its predecessor, and it retained exactly the same course description in its handbook entry. As with the BBusiness Systems, the BBIS was offered as two alternative streams – one consisting entirely of coursework units, while the other replaced six units worth of elective units with scholarship-funded industry based learning placements.

Much of the core content of the BBIS units also remained the same. The main change was that some topics in DSS and Business Intelligence which had previously been taught predominantly as specialist areas in the Caulfield BIS, were elevated to the status of core units in the BBIS. However the diversity of content and the range of choice of units available to BBIS students were significantly reduced, as many of the electives offered in the old degree were disestablished. By 2006 the Clayton School offered only 18 units which were clearly associated with the BBIS, and this had fallen to 16 by the end of the period. Most of the seven faculty-wide common core units also contained content which had once been offered in the BBusiness Systems, but even with these taken into account, this represented a significant drop in the number and diversity of unit offerings from the peak of 32 Business Systems units which had been offered in 2003. The details of these changes in the curriculum are examined further in Section 8.7.

Table 8.9 shows how the downturn in demand affected the performance of the BBusiness Systems and the BBIS. The figures for enrolment numbers and Clearly-in ENTER were strongly influenced by the faculty's desire to maintain the status which the BBusiness Systems had enjoyed historically as a prestige degree. As discussed in earlier sections, the degree had developed and maintained a strong reputation for the quality of its graduates, and the faculty was anxious to ensure that this reputation was not lost in the interests of short-term expediency. Decision-making for admission was a delicate balancing act, as the faculty sought to keep enrolment numbers as high as possible, but without jeopardising the status of the degree by dropping entry standards too low. Aside from the issue of public perception of the quality of the degree, the faculty was also concerned about the need to satisfy the industry sponsors who funded the scholarships for the industry-based learning component of the program.

Year	Number of VTAC Preferences 1-4	VTAC Offers		VTAC Rd 1 Clearly-in ENTER	% of intake Below Clearly-in*
		Year 12 Students	Total		
2003	222	51	80	88.25	n/a
2004	196	50	82	82	n/a
2005	172	34	50	88.85	n/a
2006	193	32	57	87.35	40.6%
2007	125	37	51	86.15	37.8%
2008	138	40	52	87	40.0%
2009	149	43	64	78.35	2.3%
2010	162	37	46	79.6	10.8%
2011	157	55	62	85.8	47.1%

* This figure shows what percentage of the Year 12 students who were offered places had an ENTER less than the Clearly-in, but were admitted on the basis of additional criteria

Table 8.9: Measures of market demand for BBusiness Systems/ BBusiness Information Systems, 2003-2011

(Sources: VTAC admissions data and VTAC Guides, 2003-2012)

The table shows that the number of applicant preferences for the program dropped substantially, as did the number of student enrolments. The Clearly-in ENTER score looks to have been maintained at levels not far below what was achieved in the peak years, but the last column in the table shows that this is misleading. It shows that for four of the six years from 2006 to 2011 about 40% of the students who were made offers of places had ENTERs below the Clearly-in score. This is not an uncommon phenomenon in the VTAC admissions system, but to explain how it can occur would require much too lengthy an explanation of the way the system works. Suffice it to note that in the two years when the percentage of the intake below the Clearly-in was kept at reasonably low levels, in 2009 and 2010, the Clearly-in ENTER dropped substantially. The much lower figures for these two years are almost certainly a more realistic measure of the quality of the student intake throughout this period, in comparison to the intakes of the boom years.

As Chapter 7 showed, declines of this kind were experienced almost universally by all types of IT programs, so despite this the BBIS still remained one of the leading IT programs in Victoria in terms of both the level of its total student intake and their quality as measured by their Year 12 results.

8.6.4 IS at Caulfield – the IS major

For undergraduate IS teaching at the Caulfield campus, the effect of the decisions of the 2004 faculty review was to return it to a similar status to that which it had had at CIT and in the early 1990s at Monash - as the 'non-technical' component of a generalist technical computing degree. However, its presence in the BITS was significantly weaker than it had been in those earlier days. Then, there had been a clearly-designated compulsory stream of units built-in to the course structure, backed by a strong IS department; the new degree had no such in-built guarantees about the amount of IS content, and the IS staff were just one of a number of disciplinary groups within the new broadly-based Caulfield school, seeking to have their specialist areas included in the units of the degree. Their position was further weakened by the fact that the BBIS at Clayton had been designated as the faculty's IS program, which cast uncertainty on the disciplinary status of the Caulfield group.

The focus of the BITS at the Caulfield campus was designated as systems development (Monash FIT FEC, 2/2005). As with all faculty programs, it included the 'common core' units, two of which conformed closely with the themes previously covered by the Caulfield IS program - a unit on the use of IT in organizations, and another on systems analysis and design. In addition, the compulsory set of eight further IT units in the first offering of the degree in 2006, included two more which addressed these themes – a unit on organizational problem-solving, which took a broad view of the organizational environments in which information problems occurred and the kind of techniques helpful in analysing and understanding them; and a more traditional unit on advanced systems analysis and design techniques. Other than these four units, the only scope the BITS offered for studying IS unit was as third year electives. Several IS elective units were developed, based around the units previously offered in the BIMS/BIS, but the faculty's desire to cut operating costs by reducing unit numbers restricted them both in number and variety.

The initial market response to the new degree was a disaster for the Caulfield campus, where the number of local student applications and enrolments for the first semester BITS intake slumped to less than one-third of the combined total which the BComputing and BIS had attracted to the campus in 2005. This was a much worse result than at other campuses, where the rate of decline in the applications and enrolments in the faculty's other revised programs began at least to slow.

The Caulfield School held a series of emergency meetings to address this problem. The first of these resulted in a motion being submitted to the faculty's senior management team urging that the old BComputing and BIS be reinstated (Monash CaSIT, 1/2006)

Faculty management immediately made it clear that a return to the past was not possible, and in the debate which ensued over the following months, the School modified its position on the issue. It accepted the new BITS as an appropriate program for the School's technically-based content, provided it could incorporate more specialisations beyond systems development. However it continued to argue that the BITS was perceived to be technical computing degree, which was not attractive to students who were interested in the information and application-oriented aspects of IT. These were the type of students who had formerly been attracted to the old BIMS and BIS degrees, and the faculty needed to develop a new degree which could re-capture that market segment.

Although most of the school voted to support the idea of a second degree at the campus, significant disagreements emerged about its name and content. On the one hand, some staff advocated the re-establishment of the BIMS as a degree which combined IS and IM as a non-technically-oriented counterpart to the BITS. Against this, some staff, who felt that the BIMS's attempts to combine the two disciplines had not been successful, argued that IS should be kept separate from IM, and should seek to establish itself as a specialisation within the BITS. If a new degree were to be created, it should focus purely on information management.

From the faculty's point of view the over-riding concern was that any proposal must comply with the directions set by the strategic review, and must be demonstrated to be financially viable. A meeting of the faculty's Undergraduate Programs Sub-committee in March 2006 vigorously debated the issues, before narrowly passed a motion giving in-principle endorsement to the School's draft proposal for a BIMS degree combining IS and IM (Monash FIT UGPC, 2/2006). However, a few weeks later, when the full proposal was submitted to the meeting of the Faculty Education Committee as the next stage in the approval process, it had been revised to a proposal for a BInformation Management, with the IS content now being excluded. This name and content change were noted as having resulted from the discussions at the Undergraduate Programs Committee meeting and among academics at the Caulfield school (Monash FIT FEC, 1/2006). At the same meeting the School submitted a separate proposal for an IS major to be introduced into the BITS

This proposal for an IS major and a number of other specialist majors was approved by the committee (Monash FIT FEC 1/2006). The proposed BIM degree was rejected, largely on the basis of its inability to demonstrate its financial viability as an independent degree. The Committee suggested that the proposal could be re-submitted for consideration for offering in 2008 if a suitable business case was put forward to support it. A 'back-up' proposal for an IM major within the BITS was approved, to go with the other new specialist majors. All these new majors were offered from 2007 onwards under separate VTAC descriptions and admission codes, to highlight their varying emphases.

Table 8.10 shows the trends in the key measures of demand for IS at Caulfield in its various forms throughout the period. The figures highlight the severity and duration of the decline. As a consequence of this decline in demand, there was a significant reduction in both the size of the student intake into IS, and in the 'quality' of these students as measured by the published ENTER score. The Clearly-in ENTER as a measure of student quality bottomed-out at about 70 from 2004, because under Monash policy the lowest ENTER for which a place could be offered in a program was 70.

Year	Name under which IS program was offered	VTAC Applicant Preferences 1-4	VTAC Enrolments	VTAC Clearly-in ENTER
2002	Bachelor of Information Management & Systems	365	36	83.65
2003	Bachelor of Information Systems	279	40	75.35
2004	Bachelor of Information Systems	306	50	70.55
2005	Bachelor of Information Systems	230	21	71.45
2006				
2007	BITS with a major in Information Systems	84	5	71
2008	BITS with a major in Information Systems	81	15	71.65
2009	BITS with a major in Information Systems	49	9	70
2010	BITS with a major in Information Systems	45	3	70

Table 8.10: Measures of market demand for Information Systems at Caulfield Campus, 2002-2011
(Sources: VTAC admissions data and VTAC Guides, 2003-2011)

The IM major suffered similar declines over the period in which it was offered, from 2007-2010. Consequently, it was not surprising that these two majors were among those targeted for closure in the re-structure which followed the 2009 faculty review. The vulnerability of both majors was also increased by their lack of a clear and distinct identity: the IS major found it hard to establish a disciplinary focus to distinguish itself from the BBIS at Clayton, while the content of the IM major was largely duplicated in postgraduate programs at the Caulfield campus. The introduction in 2011 of the new EIM major, which again tried to integrate the content of the two majors, represented a last-ditch attempt to save these areas from complete elimination from the Caulfield campus's offerings at undergraduate level.

8.6.5 Summary of developments in IS in this period

The blend of disciplinary, structural and marketplace pressures which affected IS at Monash during this period was of similar complexity to that which prevailed in the previous one. But, as Table 8.11 shows, in this period most of their effects were felt in similar ways in the IS programs at both campuses. However the consequences for the IS program at Caulfield were clearly much more severe than for its counterpart at Clayton.

Once again it was market forces which were the clearly the dominant factor in driving developments. The effects of the downturn in student demands were some severe and so prolonged, that would be fair to say that there was not a single significant decision taken during the period for which market considerations were not a major factor. Although the faculty tried to maintain a long-term perspective and develop a strategic vision which was not geared solely to meeting immediate needs, the severity of the financial effects of the downturn, particularly at a time when the university was seeking to impose more stringent financial controls on faculties, made it difficult to pursue a long-term vision.

The disciplinary decisions taken as a consequence of the 2004 faculty review confirmed the place of the Clayton program as the university's main representative of the IS discipline. However it jeopardized the position of the Caulfield program, which was reduced to the status of a minor specialist component of a broadly-based generalist technical degree. Its problems in this regard continued to be compounded by confusion over the nature and extent of its disciplinary connections with IM. On both campuses the organizational decision to remove discipline-based schools, together with the loss of staff and reductions in unit numbers weakened the identity of the discipline at both campuses.

<table>
<tr><th></th><th>Clayton campus</th><th>Caulfield campus</th></tr>
<tr><td rowspan="2">Disciplinary forces</td><td colspan="2">• Desire to achieve closer integration between academic programs; influence on implementation of 'common core' units for all faculty programs</td></tr>
<tr><td>• Desire to enhance disciplinary integrity of BBIS as new Clayton IS program; impact on unit content</td><td>• Desire to integrate content of BIS into new generalist BITS program
• Ongoing uncertainty over disciplinary connection of IS with IM</td></tr>
<tr><td>Structural forces</td><td colspan="2">• Introduction of new faculty structure of geographically-based schools to improve organizational efficiency; consequent loss of explicit IS disciplinary presence in organizational structure
• Need for severe cut-backs in staffing levels to deal with financial problems; consequent reduction in size of departments and loss of expertise in some academic areas</td></tr>
<tr><td rowspan="2">Market forces</td><td colspan="2">• Impact of declining student market on faculty operations at both campuses:
o need to rationalise faculty undergraduate programs;
o need to rationalise faculty undergraduate unit offerings;
o need to reduce operating costs to meet university budgetary targets</td></tr>
<tr><td>• Importance of relative strength of demand for Clayton IS program in assisting its selection as the faculty's main IS program</td><td>• Impact of drastic decline of student demand for first implementation of new BITS program in 2006 in creating pressure for re-introduction of IS major
• Impact of long-term failure of IS major to attract strong student demand</td></tr>
<tr><td colspan="3">Table 8.11: Key influences on the evolution of IS: 2003-2011</td></tr>
</table>

8.7 IS curriculum

The evolution of the curricula of the undergraduate programs in IS which have been taught at Monash reflects the influence of the forces which have created and shaped the IS departments at the Caulfield and Clayton campuses, as described in the previous sections. This section examines how the effects of these forces can be seen in the two curricula, and highlights the differences in the models of the IS discipline which can be seen to be represented in each. The analysis aims to show the broad general characteristics of the curricula, rather than examining their content in detail. Therefore it does not attempt to track all the curriculum changes which occurred throughout the study period, but instead offers a series of snapshots of the curriculum at specific points in time. Section 8.7.1 tracks the history of the IS curriculum at the Clayton campus, and Section 8.7.2 follows its progress at the Caulfield campus.

8.7.1 IS curriculum at Monash Clayton

Table F8 in Appendix F shows the evolution of the curriculum of the IS program offered at the Clayton campus. For selected years it lists:

- the core IS units which were specified as essential to the completion of the highest available IS qualification – either a major or degree;
- any additional non-IS units which were also specified as a compulsory component of that qualification;
- other IS undergraduate units which were offered as electives in the IS program.

The table shows that after an initial period of volatility, the curriculum at Clayton stabilised and its core content remained largely unchanged from the time the degree moved to FCIT and took on the name 'Business Systems' in the early 1990s, until it was changed to the BBIS after the faculty re-structure in 2004. Since that re-structure it has again remained largely unchanged to the present day. The remainder of this section examines the curriculum content of the program in each of the time periods defined by these changes.

1987-90: The BIS curriculum in the Faculty of Economics and Politics

Under the circumstances associated with the establishment of the Clayton BIS – a new 'experimental' degree established from scratch in a new disciplinary area, run by a newly-formed academic department, subject to pressure from many stakeholders both within and outside the university, and developed in a relatively short period of time in a sometimes turbulent environment – it is not surprising that the curriculum was subject to a good deal of change in its early years.

Table F9 in Appendix F shows the curriculum in 1990 at a time when it had begun to stabilize. It shows that the core IS component of the program comprised units that covered the main themes which were typical of applied computing programs at this time, as outlined in Section 5.9. The table also illustrates the problem referred to in Section 8.3.1, regarding the extent to which the program content was oriented towards its business/economics disciplinary parent. As well as having to take seven core units in business and economics, the handbook indicated that students were also expected normally to take their electives from the Bachelor of Economics degree.

1991-2005: The BBusiness Systems curriculum

The re-location of the department to FCIT in 1990 enabled significant changes to the curriculum, under the program's new name of BBusiness Systems. Table F10 in Appendix F outlines the contents of the units as they stood in 1992, shortly after the re-location took place.

The table shows that the program dispensed with most of its business/economics content, leaving only one compulsory economics units from the Faculty of Business and Economics. Its core content, covering the basic themes in computers and computing, remained virtually the same as before, apart from changes in some unit names and their position in the unit sequence. More specialist units were added to take up the room made available by the elimination of the business core units. These units covered topics on various aspects of computer applications in business, with a general emphasis on mathematical modelling techniques which reflected the program's historical links with Operations Research. The choice of elective units was freed up, with the removal of the expectation that a student's electives would come from the Faculty of Business and Economics.

From that point on, until the faculty re-structure led to the replacement of the BBusiness Systems by the BBIS, the core of the program curriculum remained basically the same. Aside from minor changes in unit names and codes, the only significant changes in the content of the core were the addition of units in project management (BUS2176) and the development of the business case for system development (BUS3600), and additional units in programming (BUS2011) and business information systems (BUS2021).

But although the program core remained relatively stable, there was a substantial increase in the number and range of elective units which the department offered. Table F11 in Appendix F lists new additions to the department's suite of undergraduate units between 1992 and 2004. It shows that the rate of increase in these units was slow for most of the 1990s, but then increased rapidly during the dotcom boom, as the department grew larger and financially stronger. These new units covered a variety of topics relating to the business applications of computers, including e-commerce, multimedia, ERP systems and strategic planning.

The BBusiness Information Systems 2005-2011

The new BBIS, which was developed after the 2004 faculty review, was designed around the structure and content of the BBusiness Systems, but had a number of significant changes in its curriculum. Table F12 in Appendix F lists the units and their content as set out in the faculty handbook for 2006 (Monash FIT, 2006).

One of the first areas of concern for the revised curriculum was the need to adapt to the introduction of the 'common core' units which were discussed in Section 8.6.1. It was intended that the content of the common core units should be kept largely independent of the specific orientations of any one of the faculty's degree programs. This was the source of considerable angst within the faculty at the time. Many staff were fiercely opposed to the common core units, either because they believed their content was not required in the curriculum of their particular discipline, or because they believed that the way the content was presented did not address the specific needs of their discipline.

For example, the development of the new introductory programming unit, FIT1002, was a particular source of controversy. All faculty programs had previously included an introductory programming unit, but they had all offered their own, claiming it needed to be oriented specifically to the needs and capabilities of their students. The new unit, which was created by a committee comprising representatives from all programs, was attacked on all sides; it was claimed that rather than meeting the needs of all programs, it was in fact satisfactory to none. Critical responses of this kind were made to all the common core units, despite the best efforts of the faculty to ensure the widest possible level of staff involvement and input to their content.

Most of the themes covered by the common core units had been addressed in the previous core units of the BBusiness Systems, but the compromises involved in making the new units acceptable to all programs meant that the details of their content and the way in which they addressed it did not always accord with the requirements of the BBIS. Consequently, adjustments had to be made to the content of a number of other BBIS units to integrate them with the common core units and to ensure that all the issues relevant to the BBIS were covered.

Apart from this, the core content of the degree remained broadly the same, but with a notable strengthening of the coverage given to the areas of DSS and Business Intelligence. To supplement the unit in computer modelling, which had always been a part of the BBusiness Systems, additional units were included covering the fundamentals of DSS, Business Intelligence and Intelligent DSS. This came about as result of the desire to improve the disciplinary focus of the program. As will be seen in the next section, the curriculum of the IS program at Caulfield had always had a strong focus on MIS and DSS as an important aspect of the discipline. To reinforce the position of the BBIS as the faculty's main IS program, the content of the units which had been offered at Caulfield was transferred into these new units in the BBIS.

The reduction in the overall number of units which was required to meet the faculty's objectives for cost reduction was achieved by closing a large number of the elective units from the old BBusiness Systems. The small set of electives which remained is shown in Table F12 in Appendix F. It included more units on the topics covered in the specialist core units on DSS, e-commerce, enterprise systems, business communications and other applications of IT in business

8.7.2 IS curriculum at Chisholm/Monash Caulfield

Table F13 in Appendix F shows the evolution of the IS curriculum at the Caulfield campus of Monash. For each of the selected years the table lists:

- the core IS units which were specified as essential to the completion of the highest available IS qualification – either a major or degree;
- any additional non-IS units which were also specified as a compulsory component of that qualification;
- other IS undergraduate units which were offered as electives in the IS program.

The following discussion outlines the features of each of these versions of the curriculum, and how each version differed from its predecessor.

1972-1996: From the origins of the IS curriculum to the BIS

From the time of its first offering in 1972, the BApplied Science(EDP) at CaIT divided the computing content of its curriculum evenly between systems analysis, programming and computer operations. As outlined in Section 8.3.2, this division became the basis for the eventual formation of the specialist departments, which were created when the School of Computing and Information Systems was up-graded in status to become the Division of Information Technology in 1985. Under this separation, the newly-formed Department of Information Systems (DIS) was given responsibility for all aspects of the curriculum which were independent of the technical hardware and software aspects of the computer itself. This included topics dealing with organizational information needs, systems analysis, systems design, the management of the overall process of systems development, and the analysis of the organizational and social impacts of computer systems. It also dealt with the study of management information systems, decision support systems and expert systems as specialist issues in the organizational use of computers.

Until the time CIT merged with Monash, the IS undergraduate curriculum was restricted by the constraints of the undergraduate degree structure, which allowed room for only six specialist units from each of the three departments. The curriculum for the program as a whole was managed by a curriculum committee with representation from all departments, which restricted the ability of departments to make unilateral changes to the curricula of their units. In a discussion paper to the new FCIT Undergraduate Studies Committee, shortly after the merger, the Head of DIS noted that the general structure of the undergraduate IS units at Caulfield had remained essentially the same since 1983 (Monash FCIT USC, 2/1991). The units as they stood in 1991 are listed in Table 8.12

Unit Code	Unit Name	Unit Theme
SYS115	Information Systems 1	Introduction to Business Information Systems
SYS116	Information Systems 2	Introduction to Systems Development & Project Mgt
SYS215	Information Systems 3	Systems Analysis
SYS216	Information Systems 4	Systems Design and Implementation
SYS315	Information Systems 5	IS Management and CASE
SYS316	Information Systems 6	Decision Support and Knowledge-based Systems

Table 8.12: Core IS units at Caulfield Campus, 1991
(Source, Monash FCIT, 1991)

With the additional scope allowed to it by the course and disciplinary structures at Monash, the school was able to expand its unit offerings, and in 1991 it established the IS major based around the core systems development content of these units. In the following years, further units were added to the list of electives in the major, as shown by Table 8.13. Initially the major included only units offered by DIS, but the department sought and obtained approval for a number of units offered by the Department of Business Systems to be accepted as electives in the IS major, as shown in the table.

In keeping with its focus on the ‘non-technical’ side of computing, the IS major continued not to include units whose content related to the areas of computer hardware and software development, which were the preserve of the other Caulfield departments. However, the prerequisite study needed to enable a student to take SYS2161, which was a core unit in the major, meant that a student wishing to do the major needed also to take least one unit in database and one in programming.

Units about systems development	Units about organizational use of IS	Units about decision support	Business Systems units
SYS1252 Systems analysis* **SYS2161 Systems design and implementation*** SYS2170 Project management for IS	**SYS1001 Information systems*** SYS3074 Organizational issues in IS SYS3134 Geographical	SYS3054 Decision support systems SYS3064 Knowledge-based systems SYS3114 Neural networks	BUS1110 Computer models for business decisions BUS2112 Database systems and management

SYS2190 Systems prototyping SYS2204 Communication skills for IS SYS3044 CASE SYS3084 Cognitive aspects of interface design SYS3094 Object-oriented analysis SYS3104 Systems analysis methods SYS3144 Project leadership for information systems	information systems SYS3184 Information systems theory	SYS3124 Theoretical models of decision-making	BUS3020 Trading and financial systems BUS3030 Financial modelling BUS3150 Computer facilities management BUS3502 Decision support and expert systems BUS3530 Operations management systems
* denotes core unit in the major			

Table 8.13: Units in IS Major at Caulfield campus, 1991-1996
(Source: Monash FCIT, 1991-1996)

1996-98: The BIS

The first BIS degree maintained the IS major's focus on development process. The documentation associated with the degree cited a recently-published study by Hirschheim, Klein and Lyyttinen (1996) in support of its orientation:

> "Hirschheim et al (1996) in a major work on the intellectual foundations of information systems argue that the core of the discipline is the analysis design, construction and implementation of information systems – information systems development in the broadest sense. This orientation is the foundation of the new Monash undergraduate curriculum." (Monash DIS, 1997, p4)

Table F14 in Appendix F provides a list of the core IS units in the degree and a brief synopsis of their content.

With the increase in the core content of the degree, the number of IS units offered by DIS as electives in the degree was only about half that which had been offered towards the IS major. In addition, Business Systems units were no longer deemed suitable as IS electives in the degree. Table 8.14 shows that although the elective units were still spread across the same three broad categories which had applied for electives in the IS major, there were significant changes in the topics addressed by these units.

Units about systems development	Units about organizational use of IS	Units about decision support
SYS3230 Systems development methodologies SYS3470 Human-computer interaction	SYS3110 Information systems security SYS3134 Geographical information systems SYS3280 Electronic commerce systems SYS3290 Inter-organizational systems	SYS3160 Decision aids SYS3540 Intelligent decision aids

Table 8.14 Elective units in BIS, 1997
(Source: Monash FIT, 1997)

In order to placate the faculty concerns about the marketability of a degree which was weak in its coverage of the technical aspects of computing, the degree included a significantly stronger requirement than had the IS major for units in computer technology and programming. The curriculum specified a total of six units of co-requisite study in these areas, comprising three units in computer hardware, operating systems software and database offered by the Department of Computer Technology and three units on programming and software development offered by the Department of Software Development. In addition, the degree required students to take a unit on project management, which was offered by the Department of Business Systems.

1999-2002: The BIMS

The urgency associated with the initial development and implementation of the BIMS and the problems involved in trying to integrate the content of the BIS and the BIM which it replaced (described in Section 8.5.3), caused some problems with the first version of its curriculum. From the time of its conception in early 1998, the formulation and approval of the degree had to be completed within a period of a few months, to ensure that it met the university deadlines to enable it to be offered from the start of 1999. In the words of the then head of SIMS, this first version of the degree '… was developed in a time-critical environment', which meant that '… a number of subjects and issues were left for later consideration' (Monash FIT FEC 3/1999). Consequently SIMS undertook a major revision of the curriculum almost immediately, and a significantly modified version was put forward for approval early in 1999 (Monash FIT FEC 3/1999).

In the first proposal for the revised curriculum, the degree was described as supporting three specialist career outcomes:

- systems analyst/programmer;
- internet information manager;
- multimedia developer.

The last two of these reflected the school's involvement in the new BMultimedia and BElectronic Commerce at the Berwick campus, and its aim to incorporate content from these programs in its main program at Caulfield. The first two years of the degree curriculum were much the same for all students, but in the third year students were required to complete a specialist stream in at least one of these areas. SIMS claimed that "… the [degree] proposal and in particular, the specialisations, is a direct result of student demand" (Monash FIT FEC 3/1999).

These proposed specialisations were a major point of debate when the revised degree was submitted for approval by the faculty's education committee. Concerns were expressed that the specialisations clashed with the disciplinary territory of other faculty degrees (especially multimedia), that the names of the specialisations were inappropriate to their content, and that students should not be compelled to take a specialisation. As a consequence of these and other issues, the committee rejected the proposal, and suggested it be re-submitted with suitable modifications. A revised version without the specialisations was approved in mid-1999, and survived largely unchanged until the degree was changed to the BIS in 2003. It is this curriculum which is shown in Table F15 in Appendix F, as representing the content of the BIMS during this period.

Although the curriculum made some attempts to integrate the IS and IM content and teaching approaches - most notably in the project-based studio units - in most cases they remained separate, as can be seen in the unit synopses. The IS-related units in the degree retained the focus on systems development which had been central to the BIS, but the number of specialist units devoted to that theme was reduced to three – IMS1001, IMS1002 and IMS2001. In addition, the specialist third-year units in IT management and decision support systems which had been compulsory in the BIS lost that status and became electives. The studio units were year-long project units which aimed both the provide coverage of some specialist topics, and to integrate the content from the other units and show the interactions between them. The student projects were chosen to highlight specific themes.

The broadening of the scope of the school's undergraduate offerings and the declining emphasis on systems development was also reflected in the other units offered by SIMS, from which students of the BIMS chose their electives. Table 8.15 divides these units into three broad groups according to their disciplinary emphasis. The addition of specialist multimedia units flowed from the school's position as the joint managing department for the BMultimedia program, which was discussed in Section 8.5.3. Despite the school's aspirations for disciplinary convergence, the table shows only two units (FIT3012 Knowledge Management and FIT2401 Developing Multimedia Systems) as having content which reflected a strong cross-disciplinary influence.

A final significant change in the curriculum from the days of the IS major and the BIS was the decline in the level of externally-provided specialist content in the degree, and with it a reduction in its technical computing content. Where the BIS had had three technical computing units provided by each of the specialist computer hardware and software departments, this content was now absorbed into the department's own teaching, mainly through the studio teaching units which ran throughout each year of the course. This left the project management unit offered by the School of Business Systems as the only externally-owned core unit in the program.

Information Management related units	Information Systems related units	Multimedia-related units
IMS2103 Business Information Sources IMS3007 Managing Business Records IMS3010 Information Enterprise Management and Marketing	IMS3001 Management Support Systems IMS3002 IT Management IMS3110 IS Security IMS3230 IS Development Practices IMS3280 Electronic Commerce IMS3470 Human-Computer Interaction	IMS1402 Multimedia Tools 1 IMS2402 Multimedia Tools 2 IMS3402 Multimedia Tools 3
IMS3012 Knowledge Management	IMS2401 Developing Multimedia Systems	

Table 8.15 BIMS Elective units, 2003
(Source: Monash FIT, 2003)

Although the technical content was taught by staff with appropriate knowledge and skills in technical computing (some in fact joined the department from the specialist technical departments), the change in the manner of teaching of this content reflected a reduction in its emphasis in the curriculum. This reduction was largely in keeping with the preferences of the Information Management group within the school, who saw technical computing as outside the scope of their discipline.

2004-05: The BIS

The change from the BIMS back to the BIS at Caulfield described in the latter part of Section 8.5.3 brought a total revision of the curriculum. Table F16 in Appendix F lists the units in the degree after the implementation of the 2003 review, and provides a brief outline of their content.

The table shows that the curriculum substantially reduced its IM content, and returned to something broadly similar to the original 1996-97 BIS. Its main focus was on system development in an organizational context, and many of its units can be matched directly to those which were in the 1996-97 curriculum, covering topics in organizational use of information, business processes, systems analysis, design and implementation. The core technical computing content was strengthened, though still not to the level of coverage it was given in the original BIS. Programming and database were given specific units, rather than being just being covered in studio units, but the opposite happened to project management, with the specialist unit taught by the School of Business Systems being absorbed into a more broadly-based third year studio unit taught from within SIMS. The studio units were heavily focused around the systems development process, its phases and the role of the IS professional in development.

Specific coverage of topics in IM was limited to three units in the degree core – IMS1603, IMS2603 and IMS3603 - which gave general introductions to key concepts in information and its organizational management and use. Other specialist topics in IM were available only as level 3 elective units, as shown in Table 8.16, which also shows that the range of IS-focused electives was virtually unchanged. Knowledge Management remained as the only unit where the once hoped-for convergence of IM and IS was clearly evident. The table also shows further decline in the school's interests in multimedia, with the only units remaining being those with a focus on development process (IMS1401 and IMS2401)

Information Management related units	Information Systems related units
IMS3007 Managing business records IMS3010 Information enterprise management and marketing IMS3610 Evidence and metadata IMS3611 Recordkeeping, archiving and the internet IMS3615 Professional practice IMS3616 Information access IMS3617 Information organisation IMS3801 Information science	IMS1401 Web-based information systems IMS2001 Enterprise systems IMS2401 Developing multimedia systems IMS3001 Business intelligence systems IMS3002 Information systems strategy and management IMS3110 IS security IMS3230 IS development practices IMS3280 Electronic commerce IMS3470 Human-computer interaction
IMS3012 Knowledge Management	

Table 8.16 BIS Elective units, 2004
(Source: Monash FIT, 2004)

2006-2011: The IS Major and the Enterprise Information Management Major in the BITS

As outlined in Section 8.6.4, the sweeping changes to the faculty's organizational structure and academic programs after the 2004 strategic review, severely weakened the

IS component of its undergraduate offerings at Caulfield. The introduction in 2007 of the IS major in the BITS (separate once more from the IM major) enabled some of the core content of the original BIS to be maintained, but it remained a shell of its former self. The units and their outlines are included as Table F17 in Appendix F.

The major essentially retained similar themes to the BIS, with its main focus on systems development, supported by some specialist units in web-based systems, enterprise systems, IS management and e-commerce. However the restrictions on the number of available units meant that the coverage was relatively much more superficial than in the previous IS degrees. The major included no technical computing content, which was provided in the common core units. All IM content was completely removed and offered in a separate major.

When the IS and IM majors were closed down in the final stages of the period, the Enterprise Information Management major which replaced them condensed their content still further (Table F18 in Appendix F), and attempted once again to integrate the themes of the two disciplinary areas. The major comprised only four compulsory units, which sought to introduce the key fundamental concepts of IS and IM as fields of study, and to explain their significance for the application of computers to the management and use of information. These units aimed to use information and information usage as the common themes around which they could blend the content from each disciplinary area. The remaining elective units from which the students chose the other four units of the major comprised a mixture of specialist units from each disciplinary area; the IS units in the group included some units which were offered as part of the BBIS at the Clayton campus.

8.7.3 Summary of curriculum evolution

This comparative analysis of the two IS curricula offered at Monash demonstrates a number of important contrasts between them:

- The relative stability of the curricula: The difference in the stability of the programs is highlighted by the contrast in the length of the sections required to explain their histories. After its initial ‘teething’ period, the curriculum at Clayton stabilized quickly around a set of core themes and remained very stable until the faculty strategic review forced changes on it. The review caused some alterations to curriculum content, but the program still retained its same general focus. At Caulfield, on the other hand, the need to adapt the program to the changing circumstances of the program and the school, meant that from the mid-late 1990s until the end of the study period the IS curriculum was in an almost constant state of flux, undergoing substantial changes, both in its overall orientation and in the specifics of its content.
- The key themes of the curricula: The IS program at Clayton stayed, from the time of its origins, a business-based degree based around the use of IT to support the information and systems needs of large organizations. It retained its business focus and its core business, technology and information systems content, and all additions to the curriculum throughout the period were consistent with this theme. At Caulfield the original focus of the curriculum was information systems development and the tasks which need to be performed as part of the development process. This remained as a key theme for the curriculum throughout the period, but it was supplemented at various times by the department’s expansion of its interests, particularly into Information Management and multimedia.

- Fluctuations size, scope and status: Both programs experienced periods of growth and contraction as organizational circumstances changed, but the more volatile environment for the Caulfield program meant that it went through several such periods. During times of growth, both programs diversified the range of topics which they addressed, although as indicated above the Clayton program generally stayed closer to its original primary focus. The Clayton program, which initially relinquished the 'Information Systems' title as the more junior of the two programs was able to retain its degree status throughout the period. The Caulfield version of IS eventually lost its status in that regard.
- Technical computing content: From the beginning, the Clayton program incorporated coverage of the fundamental aspects of the technology of computer hardware and software, and units on those topics remained central to the degree. At Caulfield, the very definition of the department and its curriculum were initially based on the exclusion of this kind of content, and the department had to call on other departments to provide it when it was required. For a short period the department expanded its scope to include coverage of technical computing concepts, but after the 2004 faculty review caused the re-establishment of a closer organizational relationship with technically-based academic groups, IS returned to its original position at the 'non-technical' end of the computing spectrum.

8.8 Summary and conclusions

This detailed case study of the history of IS at Monash University has confirmed the general picture of the evolution of the IS discipline outlined in the earlier chapters. It has shown how disciplinary, structural and market influences led to the formation of the two separate and distinct implementations of IS at the university. The two departments and their academic programs shared a number of the general characteristics which were shown in earlier chapters to be common to most IS departments and programs:

- They were based around the application of computing to practical problems relating to the management and use of information;
- They were strongly vocational in their orientation, with curricula designed around the need to prepare graduates for specific types of career outcomes;
- They could each trace their evolutionary path back to their roots in the use of computing in other disciplines – in Operations Research for IS at Clayton, and in general business with an orientation toward accounting for IS at Caulfield;
- Although the curricula of the two programs covered a variety of common topics in the fundamentals of computer and their use, each had its own specific primary focus – at Caulfield on the process of systems development, and at Clayton on business applications of computing with a strong Operations Research flavour;
- Although initially geared towards meeting the needs of industry for skilled graduates, their fortunes (and survival) became heavily dependent on their ability to attract students.

But the chapter also highlighted the fact that, despite these broad areas of commonality, there were also many areas in which the form and content of the departments and their programs were shaped by circumstances which were unique to the institutions in which they evolved. These influences meant that these two implementations of the discipline remained distinctly different to one another and to the IS departments and programs at all other Victorian universities. Following are just some examples of key institution-specific events which uniquely shaped the two versions of the discipline at each Monash campus:

- At Clayton:
  - The IS degree owed its existence to the IBM initiative for a vocationally-based business-oriented computing degree, and the willingness of the Monash Vice-Chancellor to accept and act on the idea.
  - The initial orientation of the IS degree was set by the decisions of the Vice-Chancellor, first to involve both the faculties of Science and Economics & Politics in preparing the proposed new degree, and subsequently to grant full ownership of it to Economics & Politics when the two faculties were unable to reach agreement over its curriculum.
  - The disciplinary status of IS was secured by the decision of Economics & Politics to create a specialist department to oversee the new degree;
  - The long-term directions of the department and the degree were set by the department's decision when Monash merged with CIT to leave the Business faculty and re-locate in the new Faculty of Computing & Information Technology.
  - The sponsored industry-based learning component of the IS program helped to consolidate its place in the student market, and also helped to ensure that it retained its original practical and vocational orientation.

- At Caulfield:
  - The long-term future of IS as part of computing at Caulfield was secured by the institutional decision, when Caulfield Institute of Technology was formed, to establish computing as a major focus, with an independent Department of EDP with its own specialist degree.
  - The orientation of the department and its degree were significantly altered by the institutional decision to locate the Department of EDP in the Faculty of Applied Science, away from the business disciplines with which it had previously been most closely linked.
  - The orientation of IS at Caulfield was determined by the decision to sub-divide the Department of EDP into three separate departments, with IS being designated as comprising the 'non-technical' elements of the curriculum.
  - The orientation of IS was significantly altered by the decision to merge first the department and then its degree with IM.
  - The curriculum of the BIMS/BIS was also altered by the involvement of IS in the initial development and offering of the Bachelor of Multimedia (and to a lesser extent Electronic Commerce). These effects were then largely negated by the subsequent decision to remove the degrees from the department's influence.

Finally, it is important to note the arbitrary and at-times capricious nature of the decision-making which determined the way in which computing and IS evolved at each institution. It is easy to identify moments where key decisions might easily have set in train a set of events completely different to that which actually took place. The following are just a few examples of critical moments, where a very slight change in circumstances may have set the evolution of IS at Monash along a very different path:

- What if the Information Science department at Clayton had been located at the time of its formation in the Engineering faculty (which wanted it) rather than in the Science faculty (which was at best half-hearted, and at worst antagonistic towards it)? Perhaps a faculty like Engineering, with a stronger application-focus and vocational orientation, would have been more sympathetic to Bellamy's original vision of a broadly-based Information Science department encompassing all aspects of computing from data processing to CS, and encouraged the development of an IS program within the department.

- What if the Department of EDP at Caulfield had been placed in its preferred location in the business faculty? Its degree would certainly have taken on a much stronger business focus, the likelihood of the department being sub-divided would perhaps have been reduced and the IS curriculum may have changed accordingly.
- What if the IS Department at Clayton had stayed with the Faculty of Business & Commerce (which was its first preference), instead of re-locating to the new Faculty of Computing & Information Technology at the time of the merger between Monash and CIT? It would have had to retain a much stronger business orientation and its IT focus may have diminished.
- What if the two departments of IS had been amalgamated into a single IS school, either at the time of the CIT/Monash merger, or at the time of the faculty re-structure in 1997? A combined school would have had to decide whether to blend its separate versions of IS into a single integrated program, offer them both as separate degrees or separate majors in a combined degree, or eliminate one of them.
- What if the changeover of deans in 1997 (which occurred only because of the ill-health of incumbent) had happened a little later, when enrolments had begun to pick up in the dotcom boom? This would perhaps have given SIMS the financial strength needed to enable it to continue to keep the IS and IM programs as separate degrees as originally planned.

It is easy to dismiss questions like these as idle speculation, which is out of place in a historical study that aims to set out the facts of what did happen rather than what might have happened. But from the point of view of understanding IS, it is useful to list them here to highlight the sensitivity of the implementation of the discipline to the circumstances in which it formed and evolved. Unlike most other disciplines, for which the general form and content of an undergraduate program is largely independent of the circumstances of its creation, the fluidity of the nature of IS means that the form it took was heavily influenced by its surrounding environment.

This sensitivity to its circumstances also highlights the point that care must be taken in using Monash's experiences with IS as the basis for understanding what happened elsewhere. Monash presented a unique environment, which meant the details of the formation and growth of its programs could not replicated in any other university. Nevertheless, at a broader level, the case study highlights the way in which disciplinary, structural and market forces influenced the evolution of the discipline.

Chapter 9: Summary and conclusions

9.1 Introduction

The overall purpose of this study, as set out in Chapter 1, was to provide a historical analysis of the implementation of the IS discipline in practice in a sample group of universities. In doing so the study aimed to offer a perspective of the discipline in practice, to contrast with the largely theoretical pictures provided by the IS literature. Within this broad overall purpose, the detailed objectives of the study outlined in Chapter 1 were:

- At a descriptive level to identify the key features of the way in which the IS discipline formed and evolved in each of a sample group of universities, and to compare the form of the IS undergraduate curriculum which resulted in each case;
- At an analytical level, to explain how the course of events at each institution shaped the discipline and its curriculum, and to identify the key factors which determined the areas of similarity and difference between the different institutional implementations of the discipline; and
- At a prescriptive or predictive level, to use the history of these implementations of the discipline as a basis for reflecting on the disciplinary issues with which IS has grappled throughout its history, and for assessing its future prospects.

This chapter briefly summarises and reviews the key findings of the study in light of these objectives.

As discussed in Chapter 4, the suitability of historical research for these three different kinds of purpose has long been a matter of controversy among historians. In deference to the different schools of thought on this matter, the study findings and conclusions have been divided into two groups, which are discussed in separate sections as follows:

- Section 9.2 summarises the key study findings. It outlines the basic facts about the historical evolution of IS, and uses the theoretical model outlined in Chapter 4 as the basis for explaining the way in which the discipline has evolved, and the reasons for the variations in the nature of the IS departments and programs which have become established in each of the universities;
- Section 9.3 offers a brief analysis of the implications of the study findings for the discipline and its future.

The chapter concludes with a brief review of the value of the study and suggests some suitable directions for further research.

9.2 "Showing what actually happened" and understanding why

As noted in Chapter 4, the study adopted a blend of the traditionalist Rankean approach to historical research, together with some aspects of the modernist approach epitomised by the work of EH Carr (Carr, 1961). In keeping with the Rankean approach, the study relied as much as possible on the official documentary record to establish a base of factual information about the way in which the IS discipline became established in Victorian universities, through the formation of IS departments and academic programs. As noted in the earlier chapters of the study, much of the theorising about the discipline has taken place at an abstract or conceptual level, and has not considered the organizational realities of how the discipline has been formed in practice. The establishment of this base of factual information about the discipline in the sample set of universities is believed to be an important contribution to the development of a better understanding of the nature of the evolution of IS in Australia.

Although it conformed to the traditional Rankean historical model in its reliance on the official documentary record as its primary source of factual information, the study adopted Carr's (1961) view that it should (and in fact must) follow some form of theoretical model as a basis for the process of collection of facts. The theoretical model which was adopted for this purpose was that outlined in Section 4.3.4, which depicts the implementation of an academic discipline and its curriculum in a university as being subject to three interacting sets of influences: disciplinary forces, structural forces and marketplace forces. The study demonstrated that this model provides a useful explanatory device for understanding the way in which the IS discipline evolved in each university, and the differences in the form it took in each one. It shows that the model works equally well at the macroscopic level in explaining broad areas of similarity and differences in the patterns of events across institutions, and at the microscopic level, in examining the details of events within a specific institution.

The study's findings in regard to the development of IS across the institutions as a group have been summarised in the conclusions to Chapters 5-7, and the conclusions to Chapter 8 outlined the key features of the case study of development of IS at Monash University. As noted in those chapters the variability in the evolutionary process for the discipline at each university makes it difficult to make generalisations which hold true for them all. In almost all stages of the evolutionary process and in all aspects of the discipline there were examples of cases where departments or programs at some institutions went against the trend which was followed by the majority. In fact on some issues the level of difference between programs was such that it was difficult to determine if there was such a thing as a majority trend. The following points, which reiterate and summarise the key features of the evolution of the discipline that were outlined in those chapters should be seen in that light as indicators of the broad patterns of its development, which are not necessarily applicable to every university:

- Disciplinary presence of IS in Victorian universities: Despite the length of the history of discussions of the concept of IS or MIS as a discipline in the academic literature, it is only since the early 1990s that it has gained widespread recognition in the form of academic departments and dedicated degree programs in Victorian universities. The formation of academic departments and degree programs which went by the name 'Information Systems' became widespread only when the Dawkins reforms unified the higher education system and ended the division between the vocationally-oriented Colleges of Advanced Education (CAEs) and the academically-oriented universities.

  Until that time, IS had been confined mainly to the CAEs, and had been generally excluded from the major Melbourne metropolitan universities. Even within the CAEs, only a small minority of computing-related departments and academic programs identified themselves by the name 'Information Systems' (or some variant of it), and the use of the name was generally confined to individual units or streams of units within generalist computing majors or degree programs. The content of the units which used the name was variable, but most commonly focussed on topics related to the process of system development.

- Disciplinary roots: The roots of the Information Systems discipline which emerged during the 1990s were most commonly found in applied computing programs. These were programs that typically evolved from small groups of computing units which were originally developed to support the application of computers and computing within a specific academic discipline, and which then grew in size and complexity to the point where they broke away from their parent discipline to become independent programs of study. Applied computing programs formed in association with both science-based and business-based academic disciplines, and it was commonplace for separate programs to be offered independently in association with business-based and science-based disciplines within the same tertiary institution. A variety of disciplines played the part of disciplinary 'parent', with accounting, business administration, operations research and computer science being the most prominent.

  The nature of the evolutionary process by which applied computing programs formed meant that most of them had no direct organizational or disciplinary connection with other IT disciplines such as Computer Science and Computer Engineering. In particular, programs which were established in association with business disciplines generally evolved from disciplinary traditions very different to the mathematical and technical foundations on which other computer-based disciplines were typically based.

  As indicated earlier, a small minority of applied computing programs were known by the name of 'Information Systems' from the time they were established, but they were more commonly known by other names such as 'business computing', 'data processing' or 'computing'. The primary stated objective of the programs was to prepare graduates for professional careers, working on the development of information systems in business, industry and government.

- Curriculum content of applied computing programs: In the early years of their development, applied computing programs were usually offered only as majors comprising about 6-8 units of study. The curriculum content of the units in each program normally covered a similar range of themes dealing with fundamental concepts in computers and the development process for building computing applications. These themes were similar to those included in the early version of the ACM model curriculum for IS. For as long as the programs were offered only in this form, the effects of the differences in their disciplinary origins were observable only at the broad level of differences between business-based and science-based programs. There is insufficient detail in the available outlines of program curricula to tell whether the apparent similarity in the content of the programs within each of these broad categories was real, or whether it was a superficial resemblance that concealed fundamental differences in the way the themes were covered.

- Impact of the Dawkins reforms: The organizational mergers and structural changes which followed the Dawkins reforms brought about the re-organization and integration of computing-related programs for most universities, and had significant impacts on most applied computing programs. In several universities, the formation of IS departments and programs was directly associated with these changes. The differences in the circumstances of each institutional merger/re-structure and in the way that each university chose to approach its particular situation meant that the disciplinary orientations of the IS departments and programs which emerged from them were unique to each university.

- Curricula of specialist IS programs: The IS programs which had become established in almost all universities by the time the institutional changes caused by the Dawkins reforms had been implemented continued to include core sets of units on fundamental computing themes of the same kind which their applied computing predecessors had offered. This maintained an appearance of similarity between them. But the content of the additional units which were available in their expanded curricula as full degree programs reflected the fundamental differences in their disciplinary orientations.

- Impact of the changing student market in the dotcom boom: The increased general interest in IT and the increases in overall student demand for IT-related programs enabled IS departments and programs to expand the scope of their disciplinary interests during the period of the dotcom boom. Most IS departments increased the number of units they offered and the range of specialist themes which they addressed; in addition, several programs established double degrees, usually with non-IT-related disciplines. The new units which were introduced provided coverage of additional specialist topics associated with the department's disciplinary orientation, but also introduced new topics relating to applications of emerging technologies, in areas such as e-commerce, multimedia and the web. The differences in the way in which IS departments responded to the opportunities presented by the boom helped further magnify the differences between their curricula.

- Impact of the changing student market after the dotcom crash: IS departments and programs were as hard-hit as all other IT-related disciplines by the long period of declining student demand which followed the end of the dotcom boom. Closures, re-locations and mergers during the slump left only one independent specialist IS academic department in existence in Victorian universities by the end of the study period. Although only two IS programs were closed down entirely, all IS departments were forced to cut back their academic programs and unit offerings, and in some cases significantly re-structure them. As was the case in the boom, the differences in the way in which IS departments responded to the situation helped further magnify the differences between their curricula.

- Disciplinary affiliations of IS with other IT disciplines: IS departments were also affected by the trend towards consolidation of IT-related academic units and programs which had begun during the Dawkins mergers/re-structures, and which continued both during the dotcom boom and after the crash. At half the universities, IS ended the study period as part of a broadly-based IT faculty or school.

This outline of the key features of the formation and evolution of IS shows the value of the study's theoretical model as a basis for explaining the nature of the IS departments and programs at each university and the differences between them. The following discussion of each of the key components of the model briefly outlines the impacts which they had on the way in which the discipline evolved, and how they contributed to the differences in the outcomes across the universities:

- Disciplinary forces: The nature of the evolutionary development process for IS programs meant that disciplinary forces have generally been the most significant factor in influencing their orientation and causing the differences which eventually emerged between them. The 'parent' discipline with which each applied computing program was initially associated determined the orientation of the units from which they grew, which meant that each IS program inherited, at least in part, some of that discipline's key characteristics.

  The effects of these inherited characteristics can be seen at two levels. Firstly, at a broad level they defined whether the program's overall orientation was business-based or science-based; this determined its immediate disciplinary neighbours and the general characteristics of the environment in which it was taught. Secondly, they linked the program with the cognitive content and disciplinary culture associated with a particular business or science discipline. Signs of the impact of each department/program's disciplinary heritage can be seen throughout their history, in the subsequent disciplinary associations which they formed, and in the overall orientation of their undergraduate curricula.

  It is not easy to define precisely the specific characteristics associated with the disciplinary origins of a department and the effects they have on its programs. Studies of academic disciplines, such as those by Biglan (1973a and 1973b) and Becher & Trowler (2001) have noted the problems involved in finding tangible or quantitative measures of the differences in the nature of the cognitive content and the disciplinary culture associated with different disciplines. As indicated in the summary points above, the impacts of disciplinary origins were not always immediately apparent and directly observable in program curricula. But over time the effects became increasingly obvious in the divergence in the content of different programs as their curricula grew in size and scope.

  One of the areas where differences became apparent was in the approaches which departments took to new aspects of IT and its applications. For example, when developing units in a newly-emerging area such as the web, programs with roots in business tended to focus on aspects related to its business application, while programs which originated in the sciences were more likely to develop units which examined its technical components. Of course these tendencies and the differences which resulted from them were not absolute; in elective units in particular, there are often signs of units that do not conform to the typical pattern of a department's offerings. These may well be the result of the individual interests and backgrounds of the members of a department not conforming to those of the department as a whole. But in the core curricula of each program, the overall pattern in the orientation of each department's units was usually consistent.

A final point to note about the influence of the differences in disciplinary origins is its effects on institutional attempts to create mergers between their applied computing/IS departments and programs and those from other disciplines. The Monash case study highlights the difficulties which disciplinary differences could cause in this regard. This is an issue of particular significance given the growing tendency for IS departments and programs to be linked with other IT-based disciplines, regardless of whether they share a common or (compatible) disciplinary heritage. This point will be addressed further in the next section

- Structural influences affecting IS were felt through organizational decision-making over where the academic groups which taught IS programs or their applied computing precursors should be located. These structural decisions took three main forms – firstly, there were those concerning the separation of an applied computing or IS program from its disciplinary parent and its creation as an independent academic unit; secondly, there were those which involved the re-location of an applied computing or IS department to a faculty different to the one in which it had originally been established; and thirdly there were those which involved the integration of a department or academic group with a group which taught another discipline. Each of these types of structural change created a different set of opportunities or pressures for the applied computing or IS department, with corresponding differences in the consequences for its academic programs.

  Structural decisions of the first type usually flowed naturally as part of the normal processes of disciplinary evolution. That is, as an applied computing or IS program reached a certain size, specialisation of content, and level of independence from the discipline of its parent department, the academic group which was responsible for it was granted the status of an independent department. This form of structural change usually had minimal effect on the overall orientation of the program, but often removed constraints under which it had previously been required to operate as a part of its parent department, and gave it greater freedom to expand and extend the scope of its curriculum.

  Structural changes which involved the re-location of a department or academic group were carried out for a variety of reasons: sometimes they were based on academic grounds, such as seeking to achieve greater unity between previously separate disciplines; sometimes they were based on administrative grounds, such as improving organizational efficiency, and sometimes they involved some mixture of the two. In some cases the department retained its independent departmental status within its new school/faculty, and in others it was absorbed into the larger academic administrative unit. Changes of this kind often introduced discontinuities into the normal process of disciplinary evolution, in that they ran counter to what could be expected to have occurred in the normal disciplinary development process. A notable common example of changes of this type were those which involved the re-location of IS departments and their programs to specialist IT schools/faculties.

The third type of change, which involved a merger with another discipline, can be seen as less drastic than re-location in its impact, because the merger was invariably with a neighbouring department which was likely to be similar in both its disciplinary culture and cognitive content. On the other hand, it involved the department losing its disciplinary independence, which was not always the case with re-locations.

The most obvious examples of the occurrence of structural changes of all three types were those which occurred during the organizational mergers and re-structures associated with the Dawkins reforms, As noted in the previous point, it is impossible to tell from the published documentary record what mix of disciplinary and structural factors were involved in the decision making in each of these changes. However, it is clear that the need for structural changes were the catalyst, and that the decisions about organizational structures played an important part in determining the characteristics of the IS departments and programs which emerged from them. It is also clear that the decisions on the positioning of IS in the organizational structure within each university had an important bearing on the options which where available for its future development and growth.

- Market forces: Two types of market forces were seen to have influenced the evolution of IS at different times during the study period. In the early years, the dominant market influence was that of the work force demand, as applied computing programs were created to meet the need for skilled computing professionals. Evidence of the impact of these workforce pressures can be seen in a number of applied computing programs which were created in direct response to requests from industry (eg the programs at CIT and Bendigo CAE, which were formed at least in part as a response to the federal government’s request for academic institutions to take over the running of the PIT scheme, and the Monash BIS and Swinburne BIT which were created as a direct result of the IBM-sponsored initiative for new programs which better-targeted industry needs).

  Beyond these specific examples, the public record contains little information about the way in which these workforce demand pressures influenced other applied computing programs. However it seems clear, given the vocational orientation of the CAEs, that perceived industry needs would have played an important role in encouraging the transformation by which applied computing evolved from the role of support to another discipline to the status of an independent discipline in its own right. A final point worth noting in this regard is the indications of industry preference for graduates from vocationally-oriented courses over those from the more academically-focussed programs such as Computer Science.

After the Dawkins reforms, the impact of student demand for IT-related programs was seen to take over as the dominant aspect of market forces. This transition was strongly influenced by two broad trends in the higher education system: firstly the increasing tendency for universities to be seen as mass education providers; and secondly the increasing financial pressure on universities to end their reliance on government funding, and develop the capabilities to fund their own activities. As a consequence, all universities increasingly based their evaluations of the merits of their academic programs on the basis of their economic viability, which was determined largely by the income which the programs generated from student fees. The impacts of the rising influence of market demand was evident during the rise in interest in IT associated with the dotcom boom, and the dramatic and prolonged decline in demand which followed the dotcom crash. The expansion or contraction of IS programs came as a direct response to these market pressures.

Although market forces played a significant role in influencing the formation of applied computing and IS programs and their content, their effects were generally broader and less targeted than those of the disciplinary and structural influences outlined above. They created pressure for action to be taken by universities, but did not dictate precisely what that action should be. Therefore their impacts were often mediated through the disciplinary or structural decisions which were made as a consequence of them.

The study showed that it was the unique combination of these influences in each university which shaped the IS discipline and its curriculum. At different times, the relative level of impact of each set of factors has varied, and at times they have differed in the directions in which they have pushed the evolution of the discipline. Thus, as indicated above, disciplinary factors tended to predominate in the early years; the impacts of structural change were most obvious during the period immediately after the Dawkins reforms; and the effects of the labour market component of market forces were felt most strongly in the dotcom boom and its aftermath. However, the detailed study of events in the Monash case study demonstrated that within these general patterns there was a much more complex web of interactions between these forces as they operated in combination to shape the discipline.

9.3 Implications of the study

Before considering the possible broader implications of the findings of the study, it is important to sound a cautionary note about how much can be extrapolated from them. The study has provided a demonstrably accurate set of factual information about aspects of the processes of formation and evolution of IS programs in Victorian universities, and a theoretical model which has been shown to provide a plausible framework for interpreting them. However, is not intended that they should be regarded as constituting a complete and definitive account of the discipline in these universities, let alone elsewhere. Both the catalogue of facts which the study presents and its theoretical model are subject to interpretation, and omit other aspects of the discipline's history which could also be deemed to be relevant to the evolution of the discipline. Therefore, as postmodernists would argue, this history must be treated as simply one account of the development of IS in these universities, based on a particular perspective of events. Its relevance to the way in which the discipline has evolved elsewhere is a matter for further research.

These cautionary words are intended to set the context for the following comments about the broader implications of the study. They mean that these comments are offered in this light, as contributions to the debate, rather than definitive conclusions. Although there is significant overlap between them, for the sake of simplicity they are divided into topic areas in line with the key areas of disciplinary conflict which were highlighted in Chapter 3:

- Disciplinary diversity: The disciplinary diversity about which some IS scholars have expressed concern is strikingly evident in the IS departments and programs examined in the study. In fact the analysis showed that the extent of these differences is such as to reverse the normal pattern found in most disciplines, where differences can be found at a superficial level in the details of departments and their academic programs at different universities, but at their core the departments/programs can be seen to be essentially much the same. For IS the areas of similarity between departments and programs are largely superficial. At their core there are fundamental differences in the characteristics of each university's implementation of IS, which have been driven by the differences in their historical roots.

  The explanation for this diversity can be found in the differences in the combination of forces acting on them as shown by the model which was discussed in the previous section. In most cases, the most fundamental factor was the differences in the disciplinary forces which drove the early stages of the formation and evolution of the units of each program, in their initial role in support of the application of computers in some disciplinary area. The study showed that from the time of their origins, the programs which came to be known as IS in Victorian universities have varied significantly in both the nature of the applications with which they have been associated, and in the aspects of applications on which they have focused. As a consequence, the programs are linked superficially by their shared focus on the application of computers, but fragmented at a more fundamental level by the differences in the aspects of those applications with which they are interested.

  The study also showed that the decision as to which direction the discipline takes in dealing with different application domains does not always lie in its own hands. Disciplinary and structural decisions taken by other parts of the university may affect the range of content which an IS department is able to include in its programs, and some application areas may elect not to identify themselves with the discipline. The study's focus on academic programs which explicitly identified their objectives as being to educate computing professionals meant that it did not consider some programs which included substantial coverage of computing and IS concepts but chose to keep their affiliation with some other discipline. For example the study of Land Information Systems and geographical information systems in general was noticeable by its absence from the IS programs in the study, because these subject areas have generally retained their position as part of the disciplines in which they originated. As computer applications become more diversified and ubiquitous, and the technology itself becomes more commodified and accessible, there is an increasing tendency for other disciplines to develop their own specialised units of study on the applications of IT. This has shown signs of leading to a repetition of the pattern of disciplinary growth which led to the first generation of applied computing programs in the 1960s and 1970s, but without its emphasis on technical computing content. The issue as to which of these areas of computer applications should, in theory, belong as part of the IS disciplinary domain cannot be determined solely on the merits of academic arguments. In a higher education environment increasingly characterised by competition within and between universities, battles for disciplinary control over knowledge territories may be driven as much by the internal power structures of the university as by rational analysis.

The implication of these study findings is that, regardless of the relative merits in theory of the arguments which have been presented in debates about IS disciplinary diversity, the discipline's association with applications of computing means that diversity in practice is an unavoidable characteristic. The diversity of computer applications means that unlike other computing disciplines, IS has no obvious natural 'home' academic territory to use as a base for deriving its disciplinary traditions and affiliations. Instead, the ever-increasing number and diversity of the applications for which computers are used has left it with a large and constantly evolving array of disciplinary territories from which its fundamental concepts and disciplinary characteristics can potentially be drawn.

- Disciplinary identity: The identity problems which are a consequence of the diversity of IS are epitomised by the confusion over the simplest and most fundamental aspect of the discipline – its name. The study showed that it is difficult to track the evolution of IS, or address questions of its identity, simply because of the variability in the way in which the name has been used as a label for academic departments and programs. The historian wishing to examine the evolution of IS in practice is left with a dilemma as to whether they should base their judgement of what constitutes IS on the designation which an academic department has given to itself or its program, or on their own assessment of its orientation and content. The study generally adopted the former approach, on the basis that the name which is given represents the public face of the discipline, but at times this had to be varied to accommodate the peculiarities of specific situations.

  Examples of the confusion over names abound throughout the study. It is most vividly illustrated by the fact that at various times during the study period four of the eight universities simultaneously offered two programs by the name of IS from different faculties (interestingly, these were the four original Victorian universities, which in the pre-Dawkins era had been so reluctant to accept IS as a discipline).

  Problems equally arise from the failure of some departments and programs to use IS as their name. The study showed that until as late as the start of the

1990s, Information Systems' (or some recognisable variant of it) was being used for only a minority of the departments/programs which later went on to call themselves IS. This raises the obvious question as to whether their subsequent adoption of that name was based on some change in their disciplinary orientation, or whether they decided that they had in fact been teaching IS all along – somewhat in the manner of the character in the play by Moliere, who discovered at the age of forty that he had been speaking prose all his life.

These situations occurred because most of the applied computing programs which came to be known by the name of 'Information Systems' were originally established before the name became widely-recognised, and were known under some other name, such as 'data processing', 'business computing', 'computing', or 'information technology'. That is, the name 'Information Systems' was adopted as a new name to an existing academic program or group of units, rather than the program being developed around some pre-existing concept of IS as a formal academic discipline. The program at the University of Melbourne stands as the only clear-cut example of an IS program being developed in the latter way.

The reasons for the widespread adoption of the term 'Information Systems' by a large number of number of academic programs and departments in the early-mid 1990s are not clear, but it seems likely that it was linked to the impact of the Dawkins reforms. For applied computing programs in their original incarnation as vocationally-oriented programs in vocationally-oriented educational institutions, the choice of name as an indicator of the academic disciplinary affiliation (and their departments) was perhaps not a major consideration. But the Dawkins reforms created pressure for departments and programs to identify themselves with recognised academic disciplines, in keeping with their institutions' new-found status as universities. The increased profile of the IS discipline, both internationally through the work on the IS97 model curriculum, and locally through the development of broadly-based disciplinary support structures (such as the Australasian Conference on IS, the Australian Journal of IS and the like), made it an obvious suitable candidate.

It is difficult to see that there will be any change in the near future which will make universities more discriminating in their use of the term 'Information Systems' as a label, either by itself or with some application-specific adjective. The combination of the diversity of program types and promiscuous use of the name is likely to see the discipline's identity programs continue for the foreseeable future.

- Foundations/core concepts: The concerns over disciplinary diversity and identity have stimulated the quest to identify the core central concepts which define the foundations of IS, while at same time rendering it highly unlikely that they can be found. The study showed that the main area of commonality which is shared by programs which are designated as Information Systems - their common focus on computer-based applications - is too broad to act as a meaningful disciplinary foundation. But the nature of the applications themselves and the aspects of their development and use which provide the focus for the programs are so diverse as to provide no obvious unifying theme. The main areas of commonality between programs is their coverage of topics relating to the computer itself, but, as will be made apparent in the discussion of core curricula in the next point, the fact that these topics are essential does not imply that they necessarily constitute the discipline's foundations.

The most obvious sign of the deep-seated differences in the disciplinary foundations for IS departments and programs is the division according to whether they originated in association with business-based or science-based disciplines. This division alone is enough to make it highly improbable that a foundation of shared concepts could ever be achieved. The extent of the differences in the cognitive styles and cultures of disciplines in these areas has been well-established. The difficulties involved in transcending them have been regularly demonstrated in the failure of periodic attempts to establish multi-disciplinary, cross-disciplinary or trans-disciplinary fields of study. As far back as the first ACM model curriculum, IS was idealistically described as being a cross-disciplinary or multi-disciplinary field, but no matter how attractive that notion may be in theory, it has little chance of success in practice.

A significant issue in this regard is the tendency shown by the study for IS to be organizationally linked with other computer-based disciplines such as computer Science. The association of IS with computers means that it has historically been seen to have a disciplinary connection with the other computer-based disciplines. In the US, its strongest and most enduring disciplinary relationship has been with the ACM, and the connection between IS and the other computer-based disciplines has been emphasised in the ACM's IT curriculum development framework.

However this study showed that in practice there has not been a close historical link between IS and other computing disciplines, except in cases where it has developed in association with science-based disciplines. In those cases it has tended to be treated as an offshoot of CS, with little to distinguish its units from those of a CS program. For business-based programs, being integrated with technically-oriented IT disciplines will create significant conflicts, because the disciplinary divide between them is so substantial.

- Core curriculum: The development of an agreed core curriculum for IS has long been identified as an important step towards overcoming the issues associated with differing perceptions of the nature of the discipline. The establishment of the ACM core curriculum model, and its eventual unification with its DPMA-sponsored rival appeared to offer the prospects of a common foundation for studies in IS which would enhance the sense of a shared disciplinary identity. In practice most of the IS programs which were included in the study covered much the same themes as the ACM model. But the evidence of this study suggests that any appearance of unity which this similarity conveys is largely illusory.

The explanation for this lies in the dichotomy between the vocational elements of program curricula, which focus on the fundamental knowledge and skills in computing required by computer professionals in the work force, and the other elements of their curricula, which are oriented towards the disciplinary foundations on which the programs are based. The vocational computing elements have always covered much the same topic areas for virtually all types of applied computing/IS programs, and have therefore given them a surface appearance of similarity. This was particularly the case in the early years of their development, when their curricula were limited in size, and their vocational orientation meant that they were restricted largely to the coverage of these essential computing concepts. As the study showed, the mix of units varied a little, but essentially they addressed the same set of themes covering computer hardware, programming, database, systems development and the like. But once the programs were able to extend their coverage beyond these essential computing fundamentals, the balance in their mixture of content began to shift towards the units which reflected their true disciplinary orientation. Therefore the differences in their historical roots began to reveal themselves as differences in their curricula.

Even within the vocationally-based ‘standard’ computing themes the study showed that some differences could be observed in the way they were handled, according to whether the program had originated in association with a business-based or science-based discipline. It may well be that if more data were available on the details of unit content and assessment, further differences reflecting more specifically the differences in disciplinary orientation would have emerged.

As the vocational focus on meeting industry needs for specific narrowly-defined types of computing specialists has declined, so too has the level of shared content on ‘standard’ computing themes. Likewise the ongoing diversification of computing applications and the commodification of technologies have helped to reduce the number of essential ‘universal’ computing concepts, and increased the scope for specialised study in the technologies specific to particular applications. Therefore the level of similarity between the curriculum content of IS programs has steadily declined. It is worth noting that the effects of these phenomena are also observable in IS2010, as shown by its removal of programming as a core element of an IS major, its reduction in the number of compulsory unit, and its specification of range of electives across a variety of areas.

- Legitimacy of IS as a discipline: In the academic literature, issues about the disciplinary legitimacy of IS have generally been addressed in abstract terms, usually by comparing the perceived characteristics of the discipline with the criteria for disciplinary legitimacy identified in some theoretical model of the division of knowledge. As discussed in Chapter 2, various models have been proposed as the basis for earning the status of a discipline, which complicates the problem of defining what constitutes legitimacy for IS. Within the practical orientation of this study, the key measure of disciplinary legitimacy is a very simple, pragmatic one - namely the extent to which the discipline is given recognition by universities in their disciplinary structures and academic

> programs. That is, regardless of the ability or otherwise of a body of knowledge to meet the theoretical requirements for disciplinary recognition, its fate as a discipline is determined by the willingness of universities to treat it as such.
>
> The study showed that by this measure IS in Victorian universities has encountered two major impediments to its recognition as an academic discipline. The first of these was founded in the attitudes held by universities towards the acceptability of applied and vocationally-oriented education programs. The study showed that until the Dawkins reforms unified the Australian higher education system, IS was generally deemed to lack disciplinary legitimacy in universities on the basis of its applied and vocational orientation, and was confined largely to the second tier of institutions of advanced education. The unification of the higher education system broke down this barrier and brought almost universal recognition and acceptance of its disciplinary status, through the formation of specialist IS departments and degree programs.
>
> The second threat to IS came as a consequence of the decline in student demand after the dotcom crash. Although most programs survived (though with significantly reduced size and scope in most cases), the level of closures or mergers of IS departments has significantly reduced the overall profile of the discipline within university academic structures. In combination with the trend towards closer integration with other IT-related disciplines, the loss of departmental status brings the possibility of significant change to the essential characteristics of the discipline as it has evolved to date.
>
> The IS community has remained generally confident that the decline in student demand will right itself in time. If so, perhaps IS departments will again begin to re-appear and the discipline will regain its previous status.

The obvious question emerging from these comments is what their implications are for the future of the discipline. As noted in Chapter 4, using the events of the past as the basis for predicting the future is arguably the most contentious of all the uses for historical research. Therefore the following comments are offered less as conclusions than as tentative speculations about the lessons the study might offer in regard to the future of the discipline.

The evidence of the history of IS described in the study suggests that there will always be a need for academic programs addressing the issues associated with the application of computers, and that the variety of content and level of specialist expertise required means that such programs will grow to warrant the need for specialist programs of study. The study findings also seem to indicate that the name ‘Information Systems’, or some variant of it, will continue to be used as a convenient label for such programs. From this perspective, the future of IS in some form(s) seems relatively secure. However the evidence suggests that the cognitive content and orientation of these implementations of IS will continue to vary according to the applications which motivate their formation, and the disciplinary associations of the academic groups which are involved in teaching them.

The diversity of the discipline in practice in universities means that attempts to define IS as a knowledge construct independent of its implementation in practice are unlikely to change this picture. Whatever the merits theoretical studies or model curricula may have in theory, the reality is that in practice departments which call themselves IS will continue to define the discipline in accordance with their needs. Prescriptions of what IS should be are always unlikely to be very successful, because the audience which claims to be IS scholars is viewing the discipline from such varied perspectives. The diverse nature of the discipline as it exists at present makes it unlikely that a sufficiently strong majority trend supporting a particular view of IS could ever emerge to suppress alternative formulations.

The question as to whether this constitutes a satisfactory basis for an academic discipline in the pure terms of academic discourse is a matter for educational theorists. The evidence of the past suggests that this issue will also continue to provide a long-running source of dispute between those who would like to see a narrower more precisely-defined idea of the discipline, and those who are comfortable with its diverse and ever-changing nature.

9.4 Value of the study and directions for future research

The results of the study have validated the merits of the key features of its approach to the analysis of the characteristics of IS as an academic discipline. The analysis of the academic departments and their undergraduate programs in the sample group of universities has highlighted the range of key factors which have influenced the shape of the discipline as it has been implemented in practice. It has demonstrated the importance of the impact of the pragmatic realities of the operation of higher education system on the processes of formation and evolution of IS as an academic discipline in each university. The study's focus on the details of the implementation of the discipline in practice provides an important complement to the theoretical studies which have dominated the IS academic literature. It provides useful insights into the extent to which the theoretical formulations of the discipline in the academic literature are reflected in the fundamental characteristics of the IS discipline as expressed through academic departments and their undergraduate programs in practice. Although such an approach to understanding IS may not be in keeping with the traditional academic ideal of a discipline as an intellectual construct, it reflects the reality that the nature of the discipline in practice has been shaped by the educational environment in which it has evolved.

The study's use of the historical research approach has demonstrated its usefulness as a method of inquiry. It has shown that a knowledge of historical factors is essential in order to understand the range of forces which have shaped the discipline's formation and evolution in each university. The study complements Gable et al's (2008) broader study of the characteristics of IS departments and programs across the Asia Pacific region, by adding the historical perspective and the analysis of curricula which that study initially aimed to include, but was unable to implement.

There are a number of areas addressed by this study which stand out as candidates for further research. The first and most obvious is the need to extend the investigation of the IS departments and programs which were the subject of this study to include other characteristics and aspects of their development which it did not address. There are two main areas in which this could be done. Firstly, the limitations of the scope of the study meant that it was able to focus only on the undergraduate programs and curricula offered by each department, and was unable to include other important aspects of their work. For example studies of the nature of their postgraduate teaching programs, the focus of their research work and the characteristics of the academics who work in them would all provide additional insights into the nature of each department and their orientation towards IS. The study has also highlighted the fact that further study of undergraduate curricula is needed to enable more detailed analysis of the way in which differences in disciplinary orientation were reflected in the way in which individual units were taught.

Secondly, although the study's reliance on the documented historical record helped to ensure the reliability of its reconstruction of the past, it also showed the limitations imposed by these documents as a data source. The study suffered at times from its reliance on these official published records, because of their lack of detail about the internal decision-making involved in events at each university. Further work is required which makes use of the recollections of the individuals who were in positions of managerial responsibility at the time or were otherwise involved in the key events. The problems and deficiencies of histories that rely solely on the memories of individuals has been well-established, but their use to complement the documentary record established in this study would be valuable in furthering our understanding of events.

Another important area for further work is the development of more detailed individual case studies of the development of the discipline in each university. The Monash case study demonstrated the value of conducting such in-depth analyses of the implementation of IS within specific institutions. Both the Monash case study and Dreyfus's (2004) brief account of the events leading to the formation of the IS program at the University of Melbourne highlighted the benefits which could be achieved from a more detailed study using inputs from a wider range of sources. In-depth studies of this kind give greater insights into the full range of factors involved in the evolution of the discipline in each institution.

Finally, additional studies are needed to replicate this one, by conducting similar analyses of the discipline in other institutions in other educational settings. Further studies of this kind would help to determine if the features of the discipline and its patterns of development can be seen in other universities, or whether they are specific to the implementations of IS at the universities in this study.

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