DEVELOPING RESILIENCE AND MANAGING CHANGE

IN TECHNOLOGY-ENHANCED

LEARNING ENVIRONMENTS

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ABSTRACT

In the competitive higher education environment there is pressure for organisational change at all levels, from major organisational structural change to introducing new curricula or new and innovative educational technology. However, current educational and organisational management strategies in higher education do not adequately address an emerging issue, that of managing for change and uncertainty. The aim of this research was to fill this gap, focusing educational management back on the domain of teaching and learning through a focus on the learning environment.

This thesis explored new heuristics for understanding and managing changing technology-enhanced learning environments. The source of inspiration was concepts and theoretical frameworks from the field of environmental management, including Resilience Thinking and the social-ecological systems approach which grounded the research.

The research took the form of a single case study situated in a regional, mixed mode university in NSW. The time frame corresponded to a period of five years of rapid organisational change which included the institution-wide introduction of a new learning management system (LMS) and other educational technology. The unit of analysis was the technology-enhanced learning environment. The research methods used were primarily qualitative and included the use of ethnography and autoethnography. Data collection included interviews, document analysis, reflective journal and observation and meeting notes.

The work complements and builds on existing frameworks and theories of management. A key finding was that the technology-enhanced learning environment is a complex system that can be represented by five Dimensions. This system was analysed through the application of the five heuristics of the social-ecological systems approach: panarchy, adaptive cycles, adaptability, transformability and resilience. Institutional system variables were identified that can be used to ground institutional planning and management. Panarchy contributed to the understanding of the institutional impact of the implementation of educational technology and
institutional initiatives. The Adaptive Cycle Framework was developed for understanding change and transformation in the technology-enhanced learning environment in the case. Investigation of individual adaptability to change provided new insights into institutional change management approaches. The heuristic of transformability contributed towards understanding the adaptability of the organisation and its capacity to predict, plan for and support ongoing changes in educational technology. Finally, features of a resilient institutional system were identified.

The findings can be applied to wide-ranging issues in the higher education environment. The value in the research lies in its interdisciplinary nature and at a number of levels: systemic, generic and operational. The outcomes of the research offer those in higher education: leaders, managers, academics and professional staff an alternative paradigm from which to prepare for a future of uncertainty and change. Resilience, at the individual and at the institutional level, will be an essential attribute in resolving the wicked problems in higher education.
STATEMENT OF ORIGINAL AUTHORSHIP

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

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ACKNOWLEDGEMENTS

Throughout the course of this research there were many people who contributed to its final outcomes.

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For my understanding and patient children Elizabeth, Ann, Sarah and Matthew – the accomplished young people you have become are a daily inspiration.

Finally, to my ever-understanding and supportive husband, Alastair. Your determination to make the world a better place has been a driving force and motivation for completing this work.

Dedicated to my mother Bessie Stephenson, the quiet academic achiever.
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<td>Are we there yet? Adapting to a changing world</td>
<td>Faculty of Education EDM team, annual team Indaba (Forum)</td>
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| 2010       | Riding the waves of technological change                                              | USQ LTSU/ADFI visiting scholar.  
| 2010       | Developing strategies to introduce and manage technological change and innovation in higher education towards learning and teaching transformation | Ascilite Workshop  
5 December                                                     | Adaptive cycle & para-analysis, social-ecological systems etc.       |
| 2010       | Learning and Teaching Services Leadership Committee                                   | Presentation                                                   | Adaptive cycle, social-ecological systems                              |
| 2011       | Exploring the transformational potential of Sakai (CLE) as an educational technology | AuSakai Conference.  
Canberra                                                        | Transformation                                                   |
<p>| 2011       | Developing resilience and managing change in technology-enhanced learning environments | CSU Faculty of Education. Technology in Teaching Research Group | Overview of Ph.D. study                                               |
| 2011       | The transformation we have to have: preparing students for a sustainable future     | CSU ED 2011 Conference. Internal. A thinkpiece                 | Managing change, adaptability                                         |
| 2012       | Coming face-to-face with                                                              | CSU Division of Learning                                       | Change                                                              |</p>
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GLOSSARY

This glossary contains terminology and abbreviations relevant to the case study. Some generic terminology is drawn from the literature while other terms are context-specific and reflect modified or new terminology. The origin of those terms is described in the Findings in the case. Bringing all key terms up front provides an easy reference point for the reader.

Unless otherwise indicated, all terms relate to the context of the case study institution, Charles Sturt University.

*Adaptability* - The capacity of the social components in a system to experience change, including technological change

*Adaptive cycle* - A key dynamic of the social-ecological systems approach describing the dynamics of an ecosystem and how the system might respond to changes in the environment

*Adaptive management* – A management approach which uses management as a tool not only to change the system, but as a tool to learn about the system through a structured, iterative process of robust decision making, identifying uncertainties, and then establishing methodologies to test hypotheses concerning those uncertainties

*AUQA* – Australian Universities Quality Agency

*Boundaries* - The boundary of a system is determined by the purpose of the system

*CELT* – Centre for Enhancing Learning and Teaching

*CLE* – Collaborative Learning Environment, Sakai community source software

*Course* – A course is the equivalent of a program of study. A course is made up of a number of subjects or units

*CSU Interact (or Interact)* – The University’s name for its instance of the community source Sakai Collaborative Learning Environment (CLE), a learning management system equivalent, which was the platform for the online learning environment
DE – Distance education

Disturbance – See shock/disturbance

DIT – Division of Information Technology

DLTS – Division of Learning and Teaching Services

DLS – Division of Library Services

DIMS – Digital Object Management System

Ecological system (ecosystem) - A place that consists of living and non-living (physical) components

ED – Educational Designer

EDM – Educational Design and Media section in the Division of Learning and Teaching Services

EMS – Educational Management Studies field

Feedbacks - A cause and effect relationship in the system whereby a change in one component or variable can be shown to have an effect on other parts of the system

Function - The activity or output of a system. “Function” is generally used for a non-human system, the word “purpose” for a human one but the distinction is not absolute, since many systems have both human and nonhuman elements

HOS – Head of School

ICT - Information Communication Technology

Identity (of system) - The purpose of the system where the purpose grounds the function and output of the system

Institution – The term applied to the specific educational context of the case university, reflecting the origins of educational institutions as enduring social structures
Interact – See CSU Interact.

Interview participant IP – Participants who were interviewed as part of the data collection process

IVT - Interactive Video Teaching

LMC – Learning Materials Centre

LML – Learning Media Laboratory (within Centre for Enhancing Learning and Teaching)

LMLC - Learning Media Laboratory Coordinator

LMS - Learning Management System

MDC – Media Development Coordinator

Metaphor – A framework used to help interpret events and to create a world view

MOOC – Massive Open Online Course

MSI – Mandatory Subject Information Policy

OLE - Online learning environment in the case study university, consisting of Interact and other learning technologies

Organisation – The term applied to the generic context of the case and used to distinguish the business origins and focus of the university

Panarchy – One of two dynamics of the five heuristics of the social-ecological systems approach

Participant - An individual or group who was part of the engagement in the study. Active participants were actively engaged in parts of the research process (members of professional groups, interview participants). Passive participants were part of the engagement and observation in the study
Resilience - Resilience is the capacity of a system to undergo some change without crossing a threshold, to absorb disturbance and to retain essentially the same structure, function and feedbacks. Resilience (capital R) is used for the overarching concept and resilience (small r) refers to the heuristic. The more general application of resilience outside of the environmental management field (in this study) is denoted by resilience (small r)

Sakai – An international community which develops community (open) source software and systems

Shock/disturbance - A shock is an external impact to the system which impacts the system. A disturbance is an impact which comes from within the system. Within the case study context the terms are used whereby shock refers to a larger impact and disturbance a lesser impact

SLTI - Strategic Learning, Teaching and Innovation section in Division of Learning and Teaching Services

Social-ecological system - The interaction between two systems namely, social systems and ecological systems

Social-ecological system heuristics - The dynamics of a social-ecological system can be described and understood by two heuristics: the adaptive cycle and panarchy. The properties which determine the dynamics of the social-ecological system are resilience, adaptability and transformability

Stability landscape - The extent of the different possible states of system space, defined by a set of control variables in which stability domains are embedded

Structure of system – The components, people and physical resources, which make up the system

Subject – A subject is a structured unit or module of work which forms part of a broader course or program
System - For consistency within the context of Resilience the term system is analogous with the stability landscape as applied to the property of transformability

TAFE – Tertiary and Further Education Institution

Technology-enhanced learning environment - The environment in which learning that is supported and facilitated by technology takes place

Thresholds - Levels in controlling variables where feedbacks to the rest of the social-ecological system change

Transformability - The capacity to create a fundamentally new system when the existing system is untenable

VLE – Virtual learning environment. The VLE was an in-house developed system made up of a number of tools and did not have Web 2.0 capabilities

Wicked Problem - A problem that is difficult or impossible to solve because of incomplete, contradictory and changing requirements that are often difficult to recognise
CHAPTER 1: INTRODUCTION

1.1. The Research Problem

In the competitive higher education environment there is pressure for organisational change at all levels, from major organisational structural change to introducing new curriculum or new and innovative educational technology (Bacsich & Pepler, 2009; Conole, 2013; Reushle, McDonald, & Postle, 2009). In the twenty years since the development of the World Wide Web there has been significant investment in educational technology by higher education institutions (Bates & Sangra, 2011). Funding for information technology remains a top institutional issue (Allison, De Blois, & 2008 EDUCAUSE Current Issues Committee, 2008) and there is pressure on institutional management to factor in the perspective of the campus community members and to be able demonstrate the value of existing services and investments, as well as the true cost of future decisions (Ingerman, Yang, & Committee., 2010).

The academic process involves the creation and sharing of knowledge. Ideas are challenged and rigorous research required so that claims and decisions are challenged before they are accepted within the discipline area. In the university institution, the very nature of the academic process can create a tension between university management making decisions about institutional change and outcomes and acceptance of these decisions by the academic community - without the debate (Keller, 1983). There is a tendency towards the disarticulation of studies of management from other education processes taking place in institutions. The aim of this research is to fill this gap and to focus educational management back on the domain of teaching and learning through the focus on the learning environment.

The theme of a 2003 Open and Distance Learning Association (ODLAA) conference “Sustaining quality learning environments” was the impetus for original reflection where similarities between the challenges and management issues for the university environment and those in the natural environment were highlighted.
Environmental managers have developed a range of techniques and tools towards developing sustainability and to manage the impact of ecological disasters and constant environmental changes. Of interest to the field of higher education management, and in particular for those involved in managing the rapidly changing educational technology environment (Johnson, Levine, Smith, Smythe, & Stone, 2009; New Media Consortium, 2012), are two things. Firstly, that there is intrinsic value in the learning environment; secondly, the solutions coming out of the environmental field for understanding the nexus between the people (social) and environmental (ecological) elements in order to manage that environment wisely for the benefit of future generations.

Insight into the essence of the problems facing environmental management in a changing world, and the role of Resilience Thinking in building “capacity to work with change, as opposed to being a victim of it”, is provided by Walker et al.

Current approaches to sustainable NRM [natural resource management] are modelled on average conditions, ignore major disturbances, and seek to optimise some components of a system in isolation of others. This approach fails to acknowledge how the world actually works; increasing efficiency and optimising performance is good for economic purpose but fails to acknowledge secondary effects and feedback that can cause changes that affect the bigger system and can affect sustainability; resilience thinking (emphasis added) is about understanding and engaging with a changing world. By understanding how and why the system as a whole is changing, we are better placed to build a capacity to work with change, as opposed to being a victim of it (Walker, Anderies, Kinzig, & Ryan, 2006, p. 6).

The concept of Resilience was introduced into environmental management as a way of thinking that would contribute to an understanding of constantly changing systems.

A management approach based on resilience…would emphasize the need to keep options open, the need to view events in a regional rather than a local context, and the need to emphasize heterogeneity. Flowing from this would be
not the presumption of sufficient knowledge, but the recognition of our ignorance; not the assumption that future events are expected, but that they will be unexpected…The resilience framework can accommodate this shift of perspective, for it does not require a precise capacity to predict the future, but only a qualitative capacity to devise systems that can absorb and accommodate future events in whatever unexpected form they may take (Holling, 1973, p. 21).

Potential was seen for the application of Resilience within the field of educational management, Resilience thus formed a major part of the theoretical foundations to this research. This is represented in the Overarching Conceptual Framework (see Methodology, Figure 3.2) where the connection is made between Resilience at the individual level and Resilience at the institutional level.

The primary focus of this Ph.D. study became the rigorous examination of new heuristics for understanding and managing changing technology-enhanced learning environments. The source of inspiration for those new heuristics was the field of environmental management.

*The research problem*

Current educational and organisational management processes/strategies in higher education do not adequately address the urgent issues; of how to understand and manage the learning environment in the face of constant change in the broader educational environment.

As the speed of change in educational technology continues to increase, there is a lack of suitable strategies that educators and managers can use to understand and manage rapidly changing technology-enhanced learning environments.
1.2. **Background to the Case Study**

The research took the form of a single case study, situated in Charles Sturt University. Charles Sturt University (CSU) is a regional, multi-campus university based in NSW with campuses in Bathurst, Wagga Wagga, Albury-Wodonga, Dubbo, Orange, Canberra, Port Macquarie, Parramatta, Manly, and Ontario Canada. It also has study centres in cities such as Melbourne and Sydney as well as links with international partner institutions. The multi-campus nature of CSU creates particular challenges for the logistics of administration, teaching and the support of learning and teaching. Faculties, divisions and institutes must necessarily work across the campuses and all four faculties have at least one fully cross-campus school. CSU is a dual-mode university offering courses (programs) in on-campus and distance education (DE) modes. The official enrolment mode choices students have for their subjects is either internal (on-campus) or distance education (DE). At the time of this research the University had approximately 38,000 students of whom approximately two-thirds were enrolled as distance education (DE) students. In order to address the changing needs of student enrolments, the diversity of study programs and the logistics of cross-campus courses and schools, the use of *technology* in its broadest sense, and teaching with ICT’s (information communication technology) was becoming increasingly important.

The University’s Mission was outlined in the new University Strategy 2007-2011 (Charles Sturt University, 2006).

As a national university Charles Sturt University’s mission [was]:

- To provide distinctive educational programs for the professions that prepare students for work and citizenship
- To conduct strategic and applied research which is nationally and internationally recognised
- To lead in the quality provision of flexible learning and teaching, and
- To enhance its communities, which include:
  - rural and regional Australia
  - Indigenous Australians
– the professions, industries and students for whom we provide research and education, and
– national and international institutions, scholars and researchers with whom our staff and students are linked (Charles Sturt University, 2006).

Of importance to this research was the new Mission’s focus on increasing its national and international presence and on becoming a leader in “the quality provision of flexible learning and teaching” with the attendant dependence on technology that this would require. At that time the notion of blended learning was contested in policy but relevant in practice in the institution (Buchan, Rafferty, & Munday, 2009; Tulloch, Uys, Arthur, & Buckland, 2005).

In late 2006 the following key drivers for the development and timing of this study were identified in my working environment at CSU (Buchan 2007, original Ph.D. proposal).

- The restructuring of the faculties from five to four faculties and the associated widespread use of cross-campus schools.
- The implementation of a new University Learning and Teaching Plan.
- The implementation of a new Course Plan.
- The introduction of two institutes; The Flexible Learning Institute and the Educating for Practice Institute.
- The development on the main campuses of new Learning Commons, including a new Learning Commons and the Teaching and Learning Hub at Albury in a campus expansion.
- The choice by the University to adopt a community source Learning Management System, Sakai, from 2007 onwards to enhance CSU’s online learning environment (OLE).

A major driver for the choice of topic and timing of this Ph.D. study was the decision made in 2006 to adopt a new open source learning management system (LMS), Sakai. This was a major technological change which would effectively move
the university from an integrated, in-house developed virtual learning environment, known locally as the VLE (Virtual Learning Environment), to an online learning environment (OLE) encompassing Web 2.0 tools. The new OLE was named CSU Interact. This heralded a major paradigm shift in the way learning and teaching occurred at the university. A major institutional project, the OLE Program, was established to oversee the multiple projects and coordinate the implementation of Interact. This would be one of the largest multi-stakeholder educational technology projects the university had seen. In the words of our (then) Manager for Educational Design and Educational Technology at the February 2007 launch of the Centre for Enhancing Learning and Teaching (CELT) implementation of CSU Interact; “If at the end of the introduction of Interact we have not seen a significant transformation in learning and teaching at this university – we will have failed”.

During the years of this study CSU was undergoing significant and transformative change in response to the new CSU Strategy 2007-2011 and to changes in the broader higher education environment (Bradley, Noonan, Nugent, & Scales, 2008; Charles Sturt University, 2006). Change and the challenges and issues change raises were noted in many forums and contexts throughout the study.

In 2008 one of CSU’s commitments to its students was; “The world is changing. Get ready. Preparing leaders for a changing world”. In his presentation for the position of Dean, Faculty of Science CSU the candidate noted the need to align his vision and the university’s moves and many changes; “we are at a stage where we are still vulnerable if we stand still” (Candidate for Dean, Faculty of Science, December 2007, pers.comm).

In the transition from the Centre for Enhancing Learning and Teaching to Learning and Teaching Services it was noted that; “The ED role is changing and they will need a new identity. To become more change agents than helpers” (Executive Director of Learning and Teaching Services, CSU, February 2008, pers. Comm.).

“The university is just trying to do too much at the moment…heads of school are working 15-16 hours a day.. Many staff are saying they are totally overwhelmed” (Manager Educational Design and Media, 1 June 2010). “…We are being asked to do
the impossible in a short space of time without the resources” (Faculty Forum participant, February 2010, pers.comm.). The rhetoric of “waves” and even a “tsunami of change issues” became common, and there was a perceived tension between organisational management approaches and strategies suitable for the academic learning environment.

1.3. Professional Context

My position in the study was as a researcher-practitioner. Over the time period of the research I was designated to play a key part in the implementation of CSU Interact (hereafter referred to as Interact) and the implementation, management and dissemination of other educational technology. This was done from within multiple, changing professional roles including educational designer, educational technologist and team manager. The details and significance of these changing roles is explicated in the Methodology (see Chapter 3) and in Study 2, the autoethnographic report of the case study (see Chapter 6).

1.4. How the Study was Conducted

The research used a case study approach with Charles Sturt University as the single case study and the broad unit of analysis. The narrow unit of analysis and key focus was confined to the technology-enhanced learning environment. The narrow unit of study is described in the Methodology, see Figure 3.4. The major focus of the research was the exploration of the application of the five heuristics of a social-ecological systems approach to the case in two separate studies.

The time period covered was from 2007 to 2011 which corresponded to the implementation of the University’s new Strategy. A variety of data collection methods were used to address the many faceted research study and these are described in detail in the Methodology and Research Design (see Chapter 3).

The literature which grounds the exploration of the research problem is described in Chapter 2. The literature draws from a number of disciplines towards a
single focal point, which is the learning environment and change. This is illustrated in a single conceptual map, *Figure 2.1*.

The research question posed was:

*How can the technology-enhanced learning environment be understood and managed in the face of constant change in the broader educational environment?*

with the research sub-question:

*How can the contemporary technology-enhanced learning environment be described?*

The Methodology and Research Design, along with the ethical considerations which underpin the study, are described in Chapter 3. Study 1 is an ethnographic case study of Charles Sturt University’s technology-enhanced learning environment. The first part of Study 1, reported in Chapter 4, describes the investigation into the research sub-question. The second part of Study 1, reported in Chapter 5, describes the investigation into fulfilling the primary research question.

Selected aspects of the findings are explored in Study 2, an autoethnography of the case study which is described in Chapter 6.

Finally, the Conclusion and Future Directions (see Chapter 7) bring together an expansive piece of research and set the scene for ensuring that there is ongoing impact of this important, original work.

### 1.5. The Potential Value of the Research

At the start of the study in 2007 Charles Sturt University was just beginning to enter the world of learning management systems and Web 2.0 technology and was at the cusp of major, disruptive technological change in line with world-wide developments. By the end of the period of research, comment on, and reference to, change and uncertainty was ubiquitous. At the local scale the study should prove timely for the case study institution, Charles Sturt University, by providing new
theoretical insights and practical approaches to managing the changing technology-enhanced learning environment.

The challenges for universities are demanding. Over the course of this research the Bradley Review (2008) stimulated major changes in the Australian higher education environment. On a global scale, during the course of the study Australia weathered the Global Financial Crisis; there were changes in governments and world leaders in Australia (2007, 2010), the UK (2010) and the USA (2008) among others. There were major advances in technology over the time period including a rise in mobile learning, the introduction of tablet computing and social-networking (New Media Consortium, 2012). Throughout the world higher education institutions continue to grapple with the provision of educational technology in a changing institutional environment (Oblinger, 2012).

The main focus of the research addresses an emerging issue, that of managing change and uncertainty. The application of a social-ecological systems approach to the management of the learning environment on this scale is unique. The outcomes from this unique research have significant potential for application beyond the case study institution. The research has applied a systems approach and identified and developed concepts, theories, frameworks and systems all of which have potential for application beyond the specific case within which they were investigated.
CHAPTER 2: REVIEW OF THE LITERATURE

2.1. Introduction: The Global Context

“The purpose of theories … is not to explain what is; it is to give a sense of what might be. We cannot predict the specific of future possibilities, but we might be able to define the consequences that limit or expand those future possibilities. As a consequence, the properties we need to choose are not those chosen to describe the existing state of a system and its behaviors, but rather ones chosen to identify the properties and processes that shape the future” (Holling & Gunderson, 2002, p. 32).

The literature which grounds this research is wide-ranging and draws from a number of disciplines. A conceptual map of the literature which informed the research is illustrated in Figure 2.1. The central kernel of the literature map shows the intersection of the literature and depicts what became the final focus of the study: the focus on the learning environment and that of understanding and managing change in the face of uncertainty. The many areas of literature which informed the study are depicted as shards of knowledge. The representation is generalised and there is no quantitative distinction in the size of the shards. However, the convergence of the shards towards a central focal point is significant because it demonstrates the common elements and contribution made to the study from a variety of fields of knowledge.

The following introduction to the context of higher education positions the case study institution globally and sets the scene for the focus of the research on the contemporary technology-enhanced learning environment. An understanding of the current and historical context of higher education in Australia is important to this study because it identifies issues and events that are impacting, and have impacted, on individuals and their learning environment. In addition, the case study will demonstrate the temporal aspects of the learning environment which are an integral part of the social-ecological systems approach to managing the learning environment.
The decade of the 1990's saw the massification and diversification of Higher Education and a consistent worldwide reform agenda for the finance and management of universities (Johnstone, 1998). This included countries disparate in wealth and political-economic systems. Five themes were noted in Johnstone’s 1990's reform agenda:

1. expansion and diversification;
2. fiscal pressure - measure in low and declining per-student expenditures, overcrowding, low-paid faculty, lack of academic equipment;
3. the ascendance of market orientations and solutions;
4. the demand of greater accountability - on the part of institutions, faculty, on behalf of students, employers;
5. the demand for greater quality and efficiency, more rigor, more relevance and more learning.

These are all aspects that still resonate today (Bradley et al., 2008).

Private sectors continued to grow in some countries with market-responsive learning taking place. Entrepreneurship on the part of institutions, the faculty and departments was growing. It was noted that the quest for productivity and efficiency was dominated by cost considerations rather than by outputs or learning.

An early warning on the use of technology in higher education was given by Johnstone in his worldwide review. He noted that there is a risk that “technology continues to be incorporated by individual faculty, mainly as ‘add-ons’ to conventional teaching and curricula, without the accompanying changes in the instructional production function that are required to realize useful productivity gains” (Johnstone, 1998, p. 28). There was widespread recognition that the learning (or pedagogy) should drive the implementation of technology, not technology drive the learning.

The Bradley Review of Higher Education in 2008 (Bradley et al., 2008) underpinned the direction of Australian Higher Education for the duration of this research.

The review was established to address the question of whether this critical sector of education is structured, organised and financed to position Australia to compete effectively in the new globalised economy. The panel has concluded that, while the system has great strengths, it faces significant, emerging threats which require decisive action. To address these, major reforms are recommended to the financing and regulatory frameworks for higher education (Bradley et al., 2008, p. xvii).

The Review laid the foundations for long term reform in Australia and the development of strategies and initiatives (Holden, 2008). Initiatives such as lifting
the cap on university fees and removing the cap on enrolments and funding on the basis of student demand finally became a reality in 2012.

The Bradley Review had a mixed reception. Across the higher education sector there were early concerns about funding for the different initiatives. The (then) Deputy Prime Minister and Minister for Education, Julia Gillard, noted that “Budgetary constraints will affect the immediacy of our response. We can’t implement it all today or tomorrow.’ (Holden, 2008).

Diana Oblinger, President and CEO of EDUCAUSE put forward some “Questions for the future” in an article that was the result of global collaboration on the future of higher education (CAUDIT, JISC, SURF, and EDUCAUSE 2010). The following extract sets the global context for this study.

[T]he Council of Australian University Directors of Information Technology (CAUDIT, http://www.caudit.edu.au/), the U.S.-based EDUCAUSE (http://www.educause.edu/), the United Kingdom's Joint Information Systems Committee (JISC, http://www.jisc.ac.uk/), and the Netherlands' SURF foundation (http://www.surffoundation.nl/en/) undertook a collaborative visioning of the future of higher education. Although information technology is the focus of all four of these associations, the resulting white paper (from which this article is drawn) explores higher education overall, not just information technology. The value of information technology lies in the activities it supports, which span virtually every college and university system for managing finances, learning, research, security, sustainability, and more. IT professionals thus need to understand the larger issues faced by their institutions: the drivers of change and the enablers, themes, and questions for the future (Oblinger, 2010, p. 44).

Oblinger (p. 44) also notes that higher education is;

A complex and adaptive system [and] … is influenced by trends in the larger society. Although Australia, the United States, the United Kingdom, and
the Netherlands differ in many ways, similar forces are driving change in higher education in all four countries.

To enable higher education institutions to respond to a rapidly changing landscape, over the years there has been a call for moves into a variety of areas. There have been moves into flexible learning (Scott, 2003), blended learning, e-learning (online learning), more recently the focus has shifted to mobile learning (m-learning) and mass education in the form of Massive Open Online Courses (MOOCs).

In the late 2000’s there was an increasing focus on innovation as a distinguishing factor in the competitive higher education environment. The types of innovation being courted were widespread and included: innovation in teaching approaches (Childs, Brown, Keppell, Hard, & Hunter, 2011; Hannan, 2005); learning and teaching spaces (Keppell, Souter, & Riddle, 2012) and leadership and management approaches (Bates & Sangra, 2011; Philip Uys & Tulloch, 2007).

There is increasing, repetitive recognition that the sustainability of innovation and constant change at a variety of levels in the higher education sector needs to be addressed. The term sustainability in its broadest sense seems to reoccur whenever there is widespread interest in a new model or mode of learning and teaching, or a new wave of technology. This is often highlighted in the themes of special editions of professional journals or conferences for professional organisations.

The themes of professional conferences in the area of higher education management and educational technology from 2010 to 2012 give an indication of some of the pressing issues facing the higher education sector. Current research contributing to solutions to some of those issues and where the priority areas for research and action could lie in the years ahead in this field are documented in the conference proceedings.


The Ascilite 2012 conference presentations reflected on “Future challenges, sustainable futures” with this background to the conference theme:

Waves of global uncertainty coupled with local crisis and government reforms are reshaping the tertiary education landscape. In the backdrop of these challenges new digital technology is enabling new models of teaching and learning. Yet, serious questions remain over the sustainability of these new models and the claims about the potential of new technology, especially in the face of deeper challenges (http://www.ascilite.org.au/index.php?p=conference).

These national and global challenges for higher education sector impacted on Charles Sturt University which, as a regional university, was responding to the external changes during the implementation of a new University Strategy.

### 2.2. The Learning Environment

The emerging picture of the contemporary higher education environment provides the backdrop to the primary focus of this study – the learning environment. This research is premised on the understanding that there is intrinsic value in the learning environment. It is also driven by the awareness that, in the face of the impact of constant change in technology and in the broader learning environment,
current management approaches do not adequately address the needs of the learning environment, in particular the technology-enhanced learning environment.

The term *learning environment* is liberally used throughout the educational literature from school (K-12) to higher education levels (Brown & Adler, 2008; Hall, Ramsay, & Raven, 2002; Henning & Van der Westhuizen, 2004; Victoria, 2006) and within organisational policy (Charles Sturt University, 2006; Hannan, 2005). Perhaps the only commonality in its definition being that everyone has their own understanding and perception of the learning environment - within their own context. At its simplest, the learning environment has been described as the “place” within which learning takes place (Confessore & Kops, 1998; Gourley, 2007).

Early attempts to visualise the institutional learning environment were made during exploratory research into the application of *adaptive management* (Buchan, 2004; Buchan & Buchan, 2003). That early research into adaptive management matured to underpin this research. The model of the learning environment, developed in an exploratory study, depicts the relationship between the learning environment and the different impact levels within the organisation and the external environment (see Figure 2.2). The model provides a way for managers to understand their sphere of influence, with attendant limitations, in the institution. The sphere of influence for the Vice-Chancellor is the whole organisation - the University. For a Dean it is the Faculty, for a Head of School it is the school, while for the lecturer it might be the (virtual) class or subject/course.

For lecturers, those elements of the learning experience under their control can positively influence the way students approach their study and the consequent learning outcomes (Lizzio, Wilson, & Simons, 2002). One cannot necessarily control things outside of one’s sphere of influence and can only manage for the impact or effect on the learning environment itself (Buchan, 2008b). The concepts raised in this model underpin the selection of the unit of study (see Figure 3.4) and scope of the research which is described in Chapter 3.
These early representations of the interactions in the learning environment are consistent with more recent research into learning environments where the focus is on more than the physical or virtual space but has a focus on tools and infrastructure. Cheers, Eng and Postle (2012) put forward an *experiential space* as a learning environment where there is a call for an emphasis on interactions. Jones (2012, p. 104) describes networked learning environments as; “the totality of surrounding conditions, mediated by digital networks, within which education or learning can take place”.

At the start of this research in 2007 the implications of the application and use of educational technology in envisioning alternative *learning spaces*, not just different approaches to learning, were only just beginning to be understood. To some extent practitioners were only just coming to grips with applying educational technology within existing models of teaching and learning (Conole & Oliver, 2007; Holley & Dobson, 2008; Milne, 2007; Seely, 2008). By 2012 it was being noted that “Higher education is facing a renaissance in terms of its approaches to teaching and learning and the use of physical and virtual spaces” (Keppell et al., 2012, p. xvi).
Although the term “environment” is used in connection with “learning”, in the literature, there does not appear to be much deliberate combining of the terms into the term learning environment. References to the learning environment are numerous, loose and inconsistent in recent publications on learning spaces (C. Jones, 2012). The term learning environment is often separated from the learning space (Rafferty, 2012). While this is not necessarily a problem, it is important to this research to understand and validate the position of the learning environment within the context of the research.

Barron’s learning ecology framework draws on ecological perspectives as well as constructs developed from socio-cultural and activity theory, where learning ecology is defined as the set of contexts found in physical or virtual spaces that provide opportunities for learning (Barron, 2006). Each context is comprised of a unique configuration of activities, material resources, relationships, and the interactions which emerge from them. “An ecology is basically an open, complex, adaptive system comprising elements that are dynamic and interdependent. One of the things that makes an ecology so powerful and adaptive to new environments is its diversity” (Brown, 2002).

Brown’s work focuses on the World Wide Web as a transformative learning technology. Written in the relatively early stages of the widespread use of the internet as a learning medium, Brown’s work was visionary and theoretical. Other key aspects include the potential role of how knowledge is created (tacit and explicit) and the notion of distributed intelligence. This leads into the description of the technology-enhanced learning environment in the case.

2.2.1. The Technology-Enhanced Learning Environment

There are different interpretations of the technology-enhanced learning environment. Firstly, there is the systems view whereby the technology is the focus. Technology-enhanced learning environments are thus seen as technology-based learning and instructional systems through which students acquire skills or knowledge, usually with the help of teachers or facilitators, learning support tools and technological resources (Balacheff, Ludvigsen, Jong, Lazonder, & Barnes,
The term managed learning environment has been used to describe the institution-wide IT systems which support learning and teaching (Conole, White, & Oliver, 2007).

Secondly, there is the broader, learning space and interaction view where technology-enhanced learning refers to the support of any learning activity through technology (Browne et al., 2010). The technology-enhanced learning environment can refer to any setting where technology is integrated into learning and instruction and is used to enhance the learning experience of a user (Mckenzie, 1998; Spector & Davidsen, 2000). The preferencing of terms such as e-learning and online learning has been purposefully avoided in this study because those terms focus more specifically on the pedagogical aspects of the approach to designing the learning experience (Richardson, 2002). Given the rapidly changing technology in education, debate over the semantics of such terminology is also best avoided. This research has a somewhat more fundamental and practical focus, that of the management of the technology-enhanced learning environment and the support of learning activity through technology. The learning experience and particular pedagogical approaches are just one part of understanding the whole learning environment (Centre for the Advancement of Teaching and Learning, 2007).

Although widely used the term technology-enhanced learning environment or TELE, is a manufactured term and like many of the terms associated with educational technology; e-learning, online learning, computer-based training (CBT), computer assisted assessment (CAA), it is likely to date. It does, however, reflect most closely the role of educational technology in the case. A definition for technology-enhanced learning (TEL) which has been widely used in longitudinal surveys is: any online facility or system that directly supports learning and teaching (Browne et al., 2010). This facility may include a formal virtual learning environment (VLE), an institutional intranet that has a learning and teaching component, a system that has been developed in-house or a particular suite of individual tools.
“Learning technology is the broad range of communication, information and related technologies that can be used to support learning, teaching, and assessment” (Association for Learning Technology, 2013). The distinction is made here between educational technology, also referred to as learning technology and information technology (IT) systems and software.

While students and staff may not make a distinction between a software application or system used for course administration or one specifically for teaching or designing and creating learning experiences, this distinction is emerging as an important practical consideration in the broader scheme of institutional support and management of technology-enhanced learning environments (Conole, White, et al., 2007; Goldstein, 2004; Jackson, 2007; Padron, 2008; Philip Uys & Tulloch, 2007). The increased dependence of users of educational technology on core IT systems and hardware and wireless connections is not to be underestimated. For example, Koester (2011) reports a nearly 95 percent increase in the number of unique wireless users on their California campus compared with a year earlier.

Charles Sturt University has a high portion of distance education (DE) enrolments making up approximately two thirds of its students. Historically, delivery of its DE courses was through print resources with increasing online support of subjects from the late 1990’s onwards. In order to take into account the variety and changing modes of delivery and presentation of digital media at the university over the time period of the study, the definition of the technology-enhanced learning environment applied in this research was necessarily broader than “online”. The definition to be used is:

Technology-enhanced learning environment - The environment in which learning that is supported and facilitated by technology takes place.

At the start of this research in 2007 the concept of personal learning environments (PLE’s) was just moving on to the horizon with a personal learning environment being understood at that time as comprised of all the different tools we use in our everyday life for learning (Attwell, 2007). The debate of the personal learning environment versus the learning management system (LMS) was beginning
and continues today (Mott, 2010; Sclater, 2008). The evolution in thinking in the personal learning environments has continued apace, consistent with the rapid growth in technology supporting social-networking. It has moved away from the tools to settle on what happens in the environment, that is, the interactions and the learning. Of interest in this research, with its focus on the nexus of organisational management and the learning environment, is the early promise of personal learning environments for knowledge development and sharing in the domain of organisational learning. Personal learning environment applications were perceived to have the potential to develop organisational learning within the enterprise (Attwell, 2007).

Looi (2000) uses the metaphor of a learning ecology to examine the phenomenon of learning on the internet. Looi notes that learning is a process “in which learners construct knowledge and negotiate meanings together” and draws attention to the community focus by using the ecological term population. “Ecological theory focuses on populations, not individuals, and on the dynamics of the relationship between populations and environment” (Looi, 2000, p. 57). The Web is seen as an information space in the pre-Web 2.0 era in which the article was written.

Finally, George Siemens’ theories and work on connectivism gives some grounding for understanding the processes of learning and draws a link between complex systems, complexity and the learning environment. Connectivism is the integration of principles explored by chaos, network and complexity and self-organization theories. Siemens contests that learning is a process that occurs within environments of shifting core elements, not entirely under the control of the individual and that the connections that enable us to learn more are more important than our current state of knowing (Siemens, 2005).

2.3. Management

The primary focus of this study is management of the learning environment. The body of knowledge and practice around management relevant to this study will now be examined. The shards of knowledge draw on literature from several areas of
Managers are not confronted with problems that are independent of each other, but with dynamic situations that consist of complex systems of changing problems that interact with each other. I call such situations messes…Managers do not solve problems, they manage messes (Russell Ackoff, quoted in Meadows, 2009, p. 1).

On the surface this appears as a flippant observation, but is very relevant to this work where the connections between management, changing or dynamic institutional situations and complex systems will become apparent.

2.3.1. **Educational Management**

Educational management studies (EMS) is a field of study and practice concerned with the operation and management of educational organisations. It provides a source of research relevant to university management challenges posed in this study. The literature is broad-scoping and includes educational management, administration and leadership. A key reference in this field includes the *Journal of Educational Management and Leadership* (formerly *Educational Management Administration & Leadership*).

An understanding of the terminology used in educational management is important for analysing the discourse in the data and for understanding the nexus between organisational, environmental and educational management in this study. There is a clear distinction between management and leadership. Management is defined as the “routine maintenance of present operations” (Bush, 2006, p. 2). Leadership, on the other hand, involves influencing others’ actions in achieving desirable ends. Administration refers to lower order duties in some contexts. *Management* is the term commonly used in the UK, Europe and Africa while *administration* tends to be substituted for management in the US and Canada. Administration is an overarching term that incorporates both management and
leadership and Australians tend to use these terms loosely and interchangeably (Bush, 2006).

In the early days at least, the EMS field functioned primarily as a recontextualising field whereby texts and discourses from other fields; most notably business management studies, industrial psychology and the political-administrative fields, were interpreted, reordered and recreated as texts and practices for, and in, educational institutions. Some of the problems noted were that the types of models finding their way into educational management; for example total quality management, reengineering and leadership, and terms such as Human Resource Management and competitive edge, have their origins in the field of production. By appropriating the discourse from the fields of production and from the political-administrative field the values of those fields was absorbed “and from which it is difficult to engage” (Fitz, 1999, p. 315). While the studies of management models may bring about the promise of improvement and may offer processes to make an organisation run more efficiently, the discourse of values has important implications for this research.

The decision to explore environmental management strategies in this study was premised on the assumption that there is intrinsic value in the learning environment, thereby promoting a focus on the learning environment. This is explored in Study 1, Part 1 (see Chapter 4: Study 1, Part 1 - Describing the Contemporary Technology-Enhanced Learning Environment).

The research also challenges institutional managers to consider different approaches to management - approaches which have their origins in a different field with different discourse and values.

Management approaches in higher education help to fulfil the promise and rhetoric of technology-enhanced learning have been challenged by educators. “Are the assumptions about learning in the post-industrial era out of sync with the administrative and managerial models still applied vigorously in most higher education teaching and learning contexts?” (Reushle et al., 2009)
2.3.2. **Organisational Management**

Higher education institutions support an organisational environment so an understanding of the structure, processes and peoples’ thinking in that environment is useful in order to respect existing good practice and to look for ways to improve the management of the technology-enhanced learning environment. The literature around organisational management relevant to this research includes organisational learning, continuous improvement processes, evidence-informed management and change management.

There is little consistency in the use of the terms *organisation* and *institution* in the literature around university management (Bacsich & Pepler, 2008; Benson & Palaskas, 2006; Bush, 2006). The distinction in how the terms are used in this dissertation is made on the semantics of the context. *Organisation* will be used mainly in the more generic context and to distinguish the business origins/focus of the university. *Institution* will be used in a more specific context and to draw the focus back to the educational context of the university, reflecting the origins of educational institutions as enduring social structures.

Historically, management and organisational studies arose out of a need to provide greater efficiency for the manufacturing and mining sector. Chester Barnard was the father of organisational theory (circa 1938) and sired the birth of organisational science through scholars like James March, Richard Cyert and psychologist Herbert Simon. Contributors to the human relations school of organisational analysis included Chris Argyris, Douglas McGregor, Keith Davis, William Whyte, Azalesnik and F Herzberg (Keller, 1983).

Management is “the study – and actual direction – of organizations other than the comprehensively political, i.e. organizations outside those with the monopoly use of coercive power” (Keller, 1983, p. 40). Management was originally associated with business and commerce but in the 1970’s and 1980’s there was a move away from the industrial origins of management and servicing companies, to servicing government agencies, higher education institutions and non-profit organisations in their production of services. From the 1980’s onwards management became a core
concern for all universities and colleges. In dealing with the emerging needs of management in organisations whose core business is the provision of educational services, Keller (1983, p. 44) notes that the existing management practices were not only inadequate, but provided significant challenges.

The authority needed is not the old kind of giving orders but one that decides on long-term realistic objectives, devises shrewd strategies, and defines long-term goals towards which members ... can work... Management has not yet considered in any depth what is involved in managing an organisation heavily populated with people whose prime contribution consists of intellectual effort.

The challenges remain today, although there have been a number of attempts to introduce a variety of management practices into higher education management (Centre for Organization Leadership & Management Research, 2006; Prichard, 2000; Scott, Coates, & Anderson, 2008; Stacey, Griffin, & Shaw, 2000; Wallace, 2003).

The literature around organisational management relevant to this research includes organisational learning, continuous improvement processes and change management.

2.3.2.1. **The learning organisation.**

**Learning organisation** is a term which has generally been reserved for business companies with relatively few references linking higher education institutions with the learning organisation. A learning organisation exhibits five main characteristics: systems thinking, personal mastery, mental models, a shared vision and team learning (Senge, 1990). A broad-scoping view of the learning organisation that has been informed by knowledge from a variety of fields will be presented.

Conceptions of organisational learning grew out a critique of bureaucratic organisations as closed systems, designed for production and not for learning. It is suggested that bureaucratic learning systems are flawed in three ways: choices about the values and purposes of those activities are separated from the performance of those activities; the learning of organisational members is focused on narrow, specific tasks with routine procedures and finally; feedback about results is so
fragmented that individuals do not really learn how their performance affects the overall task (Watkins & Marsicr, 1993).

Single loop learning within prescribed processes makes existing processes more efficient. Double loop learning means knowledge generated from single loop learning is internalised in the organisation (Argyris & Schon, 1978). Single and double loop learning are principles of organisational learning and are pre-cursors to complex systems thinking. This has significance for this case study which examines systems approaches in the case study institution. Double loop learning also supports the concept of the learning feedback loops in the Adaptive Management Framework (Buchan, 2004, 2012c) where, at all stages of the adaptive management process, there is the opportunity for learning within the organisation.

2.3.2.2. Continuous improvement.

The role of the manager in the learning organisation becomes that of a leader with multiple roles and multiple viewpoints or lenses. Through the lens of a teacher or steward the organisation focuses on continuous improvement. This necessitates having benchmarking systems for determining where the organisation is now, strategies for how it can get to where it wants to be and finally, being able to change itself to get to where it needs to be.

Part of the role of professionals in the higher education management field is to identify and solve problems, look for changes in the environment, formulate strategies and to make informed choices (Oblinger, 2011). A major challenge is to help others see the need for change and to support their role in making it happen. Oblinger is not alone in calling for a broad view for the future (Australia21, 2010; Brown & Adler, 2008; Jasman & McIlveen, 2011).

There is a variety of continuous improvement processes and practices which have their origins in organisational management and which are being applied in the university context (Bromage, 2006; Charles Sturt University, 2008). Some, such as PDCA (plan, do, check, act), have their origins in project management. Others such as DMAIC (define, measure, analyse, improve, control) and the PIRI cycle (plan,
implement, review, improve) have their origins in strategic management. PIRI underpins risk management strategies in business organisations and has increasingly been incorporated into higher education institutional workforce planning documentation and change and renewal frameworks (Bromage, 2006; Charles Sturt University, 2008). DMAIC has been applied at the University of Notre Dame (University of Notre Dame, 2012).

Benchmarking activities support continuous improvement processes. Benchmarking outputs are a measure of achieving one’s own institutional goals and outputs through key performance indicators (KPI’s) or a measure of staff workplace satisfaction through climate surveys. In a standards-based higher education environment benchmarking can be a measure of the institution’s position in relation to other institutions (Australian Government. Tertiary Education Quality Standards Agency, 2013). Benchmarks can also be used to drive the introduction of good practice and to set common standards, as seen in the ACODE Benchmarking Project’s “ACODE benchmarks for e-learning in universities” (Australasian Council on Open Distance and e-Learning, 2007). Benchmarking can be both a planning tool and a review tool and ideally it guides the planning and review process.

Watkins & Marsicr (1993, p. 21) suggest that; “Change is a cyclical process of creating knowledge (the change or innovation), disseminating it, implementing the change, and then institutionalizing what is learned by making it part of the organization’s routines through, for example, operating procedures or policies.” This change cycle complements the social-ecological system adaptive cycle (Walker & Salt, 2006) which is part of the social-ecological systems approach underpinning this research (see Section 2.6.1 and Chapter 5). A model of continuous learning by individuals is advocated and “The promise of continuous learning is innovation” (Watkins & Marsicer, 1993, p. 25). The fundamentals of the learning organisation and specific strategies provide insights into how to develop characteristics that can enable individuals and systems to adapt to change.
2.3.3. **Change Management**

2.3.3.1. **Background to change management.**

Traditional notions of change and management are generally brought together in the field of *change management*. “Change management is the application of a structured process and tools to enable individuals or groups to transition from a current state to a future state, such that a desired outcome is achieved” (Prosci, 2013).

Some key approaches and models associated with change management in business organisations include: Kotter and Cohen’s (2002) “Eight guiding principles for change management” and the Prosci ADKAR model - which is a tool to assist managers to identify why changes are not working and help them take the necessary steps to make the change successful (Warrilow, 2011). Bridges (2004) distinguishes *change* from *transition* whereby change is situational – an event focus - whilst transition is psychological.

Kurt Lewin had a background as a psychologist and his pioneering work in change management helped to establish the need for change management programs to focus on people. Lewin’s (1936) Change Management Model recognised the three *freeze states* of: freeze, unfreeze and refreeze. Lewin also introduced “force-field analysis” as a tool for assessing the case for change.

Although there is a broad convergence between generic literature on change management and that in the higher education sector, there are some limitations in the generic models of change management when applied to higher education (Bromage, 2006; Hunt, Bromage, & Tomkinson, 2006). There is varied evidence to illustrate the extent to which higher education organisations are actually adopting and/or developing new models of change management more suited to the sector (Atlay, 2006; Benson & Palaskas, 2006; Bryde & Leighton, 2009; Gijselaers & Harendza, 2006; McInnis, 2006; Parker, 2006).
Over the period of time covered in this study, 1998 to 2011, in the higher education sector there was increased rhetoric surrounding change and an increased awareness of an uncertain future in higher education. This impacted on universities where funded initiatives at a variety of levels in higher education were susceptible to the vagaries of change within the higher education sector and beyond (Parker, 2006). This is particularly relevant to technology-led change management (Vibert & Place, 2006).

There is an abundance of advice and evidence-based practice in change management for business organisations and, to a lesser extent, for the higher education sector (McInnis, 2006; Scott, 2003). The focus of this research has grown out of a perceived need to understand how individuals and higher education institutions respond to and manage change. The 2006 CSU Climate Survey (Internal document) identified some concerns around communication and change management in the university. This resulted in the establishment of an administrative unit focused on organisational development and change. The university also adopted a formal change management process, *The Eight Dimensions for Effective Organisational Change and Renewal*, during the implementation and ongoing development of the new online learning environment (Charles Sturt University, 2008). This process also underpinned the Work Process Improvement strategies (Bryant, 2008).

2.3.3.2. *Change and the technology-enhanced learning environment.*

From the early days of the availability of the internet and the subsequent growth of educational technology, there have been high expectations of educational technology as a means to change and transform higher education, either on its own or as a part of broader government agendas (Bates, 2000; Browne & Jenkins, 2008; Conole, Smith, & White, 2007; H. Jones, 2008; O'Donoghue, 2006; Oliver, 2005).

Part of the role of professionals in the field is to identify and solve problems, look for changes in the environment, formulate strategies and to make informed choices (Oblinger, 2011). A major challenge is to help others see the need for change and to support their role in making it happen (Bates & Sangra, 2011).
2.3.3.3. **The gap in management practice.**

The propensity to talk about management as practices and relationships that detach these from the broader environmental context remains. There is a tendency towards the disarticulation of studies of management from other education processes taking place in institutions. The aim of this research is to fill this gap and to focus educational management back on the domain of teaching and learning through the focus on the learning environment.

There is an established field of literature around change management and leading change (Kotter & Cohen, 2002; Synnot & Fitzgerald, 2007). There is also a body of literature around the implementation of major educational technology initiatives (Benson & Palaskas, 2006; Buchan & Swann, 2007; Timmis, 2003; Philip Uys, 2007; Philip Uys, 2009). Significant work has been done around the relationships between educational technologies and organisational change (Conole, White, et al., 2007; Hannan, 2005; Hunt et al., 2006; Vibert & Place, 2006). There are valuable insights into the transformational impact of technology-enhanced learning (Mayes, Morrison, Mellar, Bullen, & Oliver, 2009) including perceived barriers to that effectiveness (Reushle et al., 2009). However, there appears to be a gap in the literature and practice around educational management:

This gap is the lack of suitable strategies that educators and managers can use to understand and manage technology-enhanced learning environments in the face of constant change in the broader educational environment.

The primary focus of this Ph.D. study became the rigorous examination of new heuristics for understanding and managing changing technology-enhanced learning environments. The source of inspiration for those new heuristics was the field of environmental management.

2.3.4. **Environmental Management**

A number of concepts and theoretical frameworks from the environmental management field were explored for their potential contribution to the management of the learning environment. These included wicked problems and adaptive
management. Resilience Thinking and social-ecological systems formed the over-arching conceptual framework.

2.3.4.1. *Wicked problems.*

[The following section draws on material published in the paper, “Sustaining new approaches to learning and teaching with technology – more than just a Wicked Problem” (Buchan, 2012c).]

An exploration into environmental management introduces the concept of the *wicked problem*. The perspective afforded by a study of the wicked problem contributes to an understanding of the variety of challenges in the changing higher education environment where; “some problems are so complex that you have to be highly intelligent and well informed just to be undecided about them (Laurence J. Peter quoted in Conklin, 2006, p. 1)”.

“Wicked problem” describes a problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognise. Moreover, because of complex interdependencies, the effort to solve one aspect of a wicked problem may reveal or create other problems (Conklin, 2006). At its simplest, a wicked problem can be described as having the following defining characteristics:

- one may not understand the problem until a solution is developed;
- stakeholders have radically different world views and different frames for understanding the problem;
- constraints and resources for solving the problem change over time;
- wicked problems have no stopping rule (the problem is never solved completely);
- every wicked problem is essentially unique and novel;
- solutions to wicked problems are not right or wrong; and
- every solution to a wicked problem is a *one-shot* operation (Conklin, 2006; Rittel & Webber, 1973).
References to wicked problems in the literature range from personal blog references, daily news items and company reports to scientific and academic research. The concept of the wicked problem has been applied to juvenile justice (Murphy, 2010), healthcare systems (Periyakoil, 2007), public service policy, software solutions (DeGrace & Leslie Hulet, 1990) and business strategy (Camillus, 2008). The use of the wicked problem is widespread in environmental management (Allan & Stankey, 2009b). In that field it is more than simply a convenient term, but is supported by research into management solutions. There are, however, relatively few substantial references to wicked problems in the field of education and this is a new and growing area of research (Bore & Wright, 2009; Krause, 2010; Trowler, 2010).

The term wicked problem was first introduced into the literature in 1973 in Rittel and Webber’s definitive article, “Dilemmas in a general theory of planning”, published in the journal Policy Sciences. This is significant since policy and planning are fundamental to all organisational, educational and environmental fields of practice. From the industrial age onwards the idea of efficiency has pervaded planning, whereby problems could be easily defined and efficient solutions found. The change in the 20th century has been that, “We have come to think about the planning task in very different ways in recent years. We have been learning to ask whether what we are doing is the right thing to do” (Rittel & Webber, 1973, p. 159) and to ask questions about the outputs of actions and to pose problems in valuative frameworks. This focus has synergies with the autoethnographic focus in this research.

The desirability of what was then seen as a typical planning process, and whether the ideal planning system was in fact attainable was questioned.

Quite simply, the types of problems that planners deal with – societal problems – are inherently different from those the scientists or engineers deal with. Planning problems are inherently wicked [emphasis added]…The problems of governmental planning – and especially those of social or policy planning - are ill-defined; and they rely upon elusive political judgement for resolution (not
‘solution.’ Social problems are never solved. At best they are only re-solved – over and over again) (Rittel & Webber, 1973, p. 160).

The image drawn of an idealised system almost four decades ago is not out of place in today’s management practices. That system comprised more than just isolated components but included the processes and interactions, it was dynamic and changing. At the time it was a relatively new concept and still has relevance today. A systems focus is fundamental to this research.

The wicked problem aptly identifies many of the managerial situations found in higher education. At a national level these could be the new national curriculum for schools, funding for higher education or the Federal Government’s laptop programme for schools (Wyld, 2009). At a local level this could be the provision of IT services across a university, determining university priority initiatives, how to respond to government agendas within existing budgets or what to do about dwindling enrolment numbers in some courses (Ingerman et al., 2010; Jackson, 2007; Padron, 2008).

2.3.4.2. Adaptive management.

[The following section on adaptive management draws extensively on text from the publication, “Sustaining new approaches to learning and teaching with technology – more than just a Wicked Problem” (Buchan, 2012c).]

Foundational research which informed this study explored the potential in environmental theory and management strategies. The first application of environmental management strategies into organisational management was research into the use of adaptive management. Adaptive management techniques are used extensively in natural resource management in an attempt to manage the uncertainty and complexity associated with natural resource management (Allan, 2004; Allan & Curtis, 2003; Lee, 1999). The promise of adaptive management is that it has the potential to use the management process as a way of understanding complex processes (Allan & Stankey, 2009a).
Adaptive management is an approach which uses management as a tool to change the system. It is also a tool to learn about the system through a structured, iterative process of robust decision making, identifying uncertainties, and then establishing methodologies to test hypotheses concerning those uncertainties (Resilience Alliance, 2002). Briefly, the adaptive management cycle begins with using indicators to benchmark and determine the current state of the environment. Planning is then done, the plans are implemented and the effects of the changes/new systems are monitored and reviewed. At each stage in the adaptive management cycle there is active reviewing of the current situation and learning from action that informs ongoing changes and improvements towards desired outcomes (see Figure 2.3).

![Figure 2.3. An Adaptive Management Framework.](Buchan et al., 2009).

The essence of adaptive management is that it contributes to improved policy and organisational processes. Adaptive management has promise in the educational management field because it ensures a focus on the shared values of the learning environment. It could potentially provide a way of developing dynamic policy and management decisions that can last beyond the lifecycle of a research or institutional
project and could contribute to the ongoing management of the learning environment (Buchan et al., 2009).

The promise of adaptive management also provides a way in which the evidence from academic research can inform management decisions to help a university truly become a learning organisation (Dealtry, 2009; Somekh & Thaler, 1997; Watkins & Marsicr, 1993) thus making the most of its core business – learning.

The initial research proposal for this Ph.D. included as one of its research questions, the investigation of the application of adaptive management as a management strategy for the technology-enhanced learning environment. The exploratory stages of the research looked at adaptive management within a formal project management context at CSU. The findings from that investigation which informed the direction of the research are reported in Appendix 8.

Within the environmental management field Resilience Thinking is an important component of the complex systems theory relevant to this work.

2.4. Resilience Thinking: Theoretical Background

Two central themes which underpin Resilience Thinking are: thresholds and system dynamics.

System dynamics describes how a system changes over time. Social-ecological systems are complex adaptive systems. As such they can be unpredictable and do not change in a linear, incremental fashion. These systems have the potential to exist in more than one state or regime where their structure, function and feedbacks are different. Disturbances and shocks to the systems can drive the system across a threshold into a different regime. One way to think about how a system changes is to try to understand the phases the system moves through during a period of change. The adaptive cycle is put forward as a way of understanding the four phases through which a system moves (Gunderson & Holling, 2002) and this is investigated in depth as part of the social-ecological systems approach (see Chapter 5, Section 5.4).
Thresholds are levels in controlling variables where feedbacks to the rest of the social-ecological system change. Thresholds are crossing points that have the potential to alter the particular system (Walker & Salt, 2006, p. 53). A key tenet of Resilience Thinking is that systems have multiple stable states, or regimes, which are separated by thresholds. Resilience is the capacity of a system to undergo some change without crossing a threshold, to absorb disturbance and to retain essentially the same structure, function and feedbacks.

A resilient social-ecological system in a desirable state, such as a productive agricultural region or industrial region, has a greater capacity to continue providing us with the goods and services that support our quality of life while being subjected to a variety of shocks (Walker & Salt, 2006, p. 32).

A system has a stability landscape which is defined as; “The extent of the possible states of system space, defined by the set of control variables in which stability domains are embedded” (Folke et al., 2010 online). More simply, the stability landscape is the extent of the different possible states of the system. It is variously represented in the literature. The representation used here is that of a ball-in-the-basin (see Figure 2.4).

A ball in a basin metaphor (also referred to as a model by the authors) is used to illustrate the concept of multiple stable states and systems crossing thresholds during periods of transformation. The system is depicted as consisting of a number of basins in two, four- or more dimensional space (see Figure 2.4). The variables used to describe the system are the system’s state variables. A two-dimensional system would consider just two variables; for example numbers of livestock and the number of pastoralists. A four-dimensional system would consider four variables; for example grass, trees, livestock and pastoralists. In Walker and Salt’s metaphor, the ball represents the combination of variables under scrutiny. The position of the ball represents the current state of the system.
Each system can be envisaged as having a number of basins in two-, four- or \( n \)-dimensional spaces. The shape of the basin is continually changing in response to changing external conditions so the system is effectively tracking a moving target and being pushed off course as it does so. “From a resilience perspective the question is how much change can occur in the basin and in the system’s trajectory without the system leaving the basin” (Walker & Salt, 2006, p. 54). The system can be said to have crossed the threshold into a new regime, or basin of attraction, when it has developed a different structure and function. This moves the system beyond the edge, or limit, of the basin. This limit is defined as that point where there is a change in the feedbacks that drive the system’s dynamics and the system tends towards a new equilibrium. The new equilibrium is the new stability landscape.

Crossing a threshold into a new basin of attraction has important consequences for society and the environment since some states are more desirable than others. Along with the change in state of the system is the change in the system itself. For example, external conditions may cause the basin to become smaller or shallower thereby decreasing the Resilience, or the ability to absorb changes, and increasing the ease with which the system crosses into a different basin. Resilience is a measure of how much disturbance and change a system is able to take before it loses the ability
to stay in the same basin. “It’s about what happens near the edge of the basin, not what happens near the equilibrium point at the bottom” (Walker & Salt, 2006, p. 63). Resilience of the system is not to be confused with the more common use of resilience in education and medical fields where resilience is used to describe individual attributes or capacity.

In a social-ecological systems approach resilience at an individual level is described better by the term adaptability (see adaptability heuristic Section 2.6.1). This work will adhere closely to the origins of the terminology in environmental management, with factors contributing to resilience at an individual level being discussed primarily under adaptability, and factors contributing to Resilience of the system as a whole being discussed under Resilience.

The measurability of variables in the science discipline helped convert the ball-in-the-basin metaphor into a useful analytical model. One of the challenges in this research will be the application of the ball-in-basin metaphor to the management of the technology-enhanced learning environment in a university environment where measurability is more qualitative and less clear-cut.

While there are some limitations in the analogy of linked systems in nature and linked organisational systems, the challenges are common. “A fundamental challenge is to change perceptions and mind-sets, among actors and across all sectors of society, from the over-riding goal of increasing productive capacity to one of increasing adaptive capacity” (Folke, Colding, & Berkes, 2002, p. 12). This requires a change in expectations and making prudent decisions about organisational and personal values and priorities.

Resilience Thinking is systems thinking. An awareness of how Resilience Thinking has been applied to environmental management and in other spheres gives a vision for its possible application in educational management.
2.5. Systems Thinking

Resilience Thinking is an important component of complex systems theory. Complex systems theory is a way to understand the relationships between the social and the physical aspects of the environment and provides a way to begin to understand and contribute to the resolution of wicked problems. Systems thinking is a way to think and plan over longer time frames and to move away from the human tendency towards short-term action and optimisation (Walker & Salt, 2006).

A system is a set of elements or parts that is coherently organised and interconnected in a pattern or structure that produces a characteristic set of behaviours, often classified as its “function” or ”purpose”. Some of the key principles of systems are:

- a system is more than the sum of its parts;
- many of the interconnections in systems operate through the flow of information;
- the least obvious part of the system, its function of purpose, is often the most crucial determinant of the system’s behaviour; and
- system structure is the source of system behaviour (Meadows, 2009, p. 188).

It would be an oversight not to flag the role of complexity theory in the foundations of this research. Complexity theory seeks to understand how order and stability arise from the interactions of many components according to a few simple rules. “It concerns itself with environments, organisations, or systems that are complex in the sense that very large numbers of constituent elements or agents are connected to and interacting with each other in many different ways” (Mason, 2008, p. 33). Key constructs of the theory are the notions of emergence and self-organisation.

For the purposes of this work, complexity theory provides an over-arching world view. Social-ecological systems theory forms a sub-set of complexity theory and can be seen as a practical blueprint or “game plan” that can contribute to the
understanding of order and stability. In this case study social-ecological systems theory will be examined for its potential contribution to educational management and managing change in the complex and changing environment of a university.

2.6. Social-Ecological Systems Foundations

The literature reviewed within this chapter relating to educational management, organisational management, environmental management, and Resilience Thinking builds the foundation for this study; the major focus of which is the examination and application of the five heuristics of the social-ecological system to the technology-enhanced learning environment. The following insight into the theory and application of social-ecological systems is the start of envisioning the potential, and possible limitations, of the application of this approach to the management of the learning and broader educational environments.

An ecological system, or ecosystem, is defined as a space that consists of living and non-living (physical) components. A complex and diverse set of structures is formed from the processes that result from the interaction of the components. The interaction is self-organising and structure and processes mutually reinforce each other (Westley, Carpenter, Brock, Holling, & Gunderson, 2002). Ecosystems exist over a wide range of scales and timeframes.

A social-ecological system (see Figure 2.5) can be described as the interaction between two systems namely, social systems and ecological systems (Cumming, Cumming, Cumming, & Redman, 2006). “A social system is defined as any group of people who interact long enough to create a shared set of understandings, norms, or routines to integrate actions, and established patterns of dominance and resource allocation” (Westley et al., 2002, p. 107). Social systems are dynamic and a change in one part will affect other parts.
There are five heuristics of the social-ecological system which can be used to explain patterns of change in complex social-ecological systems (see Figure 2.6). The *dynamics* of a social-ecological system can be described and understood by two heuristics: the *adaptive cycle* and *panarchy*. The *properties* which determine the dynamics of the social-ecological system are *resilience*, *adaptability* and *transformability* (Walker, Gunderson, *et al.*, 2006). The aim of this research is to demonstrate the application of these five heuristics to the technology-enhanced learning environment in an in-depth case study. The detailed background to each heuristic is embedded in the relevant section of Chapter 5 where the research findings are reported.
A key understanding is that social systems are structured by the human ability to construct and manipulate symbols, that is, words. The building blocks of social systems are structures of signification (symbols, words), structures of domination (the flow and power and resources and patterns of authority in a particular system) and structures of legitimation (norms, rules, routines and procedures). The structures of signification play an important role in distinguishing social systems from ecological systems and also in understanding how social systems work (Westley et al., 2002).

Humans are sense-making animals and through the use of language and symbols (communication) they collectively invent and reinvent a meaningful order, acting in accordance with that order as if it were real. Structures of signification have the potential to create a hierarchy of abstraction. What this means for Resilience in social systems is that people are in effect able to create a virtual reality and while resources and routines may lose Resilience, the system will not necessarily transform radically but will return to a previous equilibrium – so long as the structures of signification stay in place. The opposite is also true. Where there are communities in crisis and there is a loss of meaning, human systems seem unable to recover.
This ability to construct meaning through symbolic interaction permits a higher level of organisation than that found in ecosystems. Human systems are able to flip from one kind of organisation to another in a relatively short time frame. This ability for social systems to shape and then be shaped by structures of signification essentially allows those systems to, to some degree, divorce themselves from space and time - which are the critical organising dimensions of ecosystems. Social systems can thus be more resilient to environmental disturbances at the local level.

Structures of signification have an inherent capacity for \textit{reflexivity}. Two definitions or applications of reflexivity pertain here. Firstly, where reflexivity refers to cause and effect relationships a reflexive relationship is bidirectional, with the cause and the effect impacting one another in a situation that renders both functions causes and effects (G. M. Russell & Kelly, 2002).

The second definition applicable to this research is used in sociology, where reflexivity is usually taken to refer to the capacity of an individual agent to recognise the forces of socialisation and to alter his/her place in the social structure (Pearce, 2005). In ethnographic research reflexivity refers to the belief that a person's thoughts and ideas tend to be inherently biased and these values and thoughts will be represented in their work (Wall, 2006). Reflexivity is particularly significant to this work in which the key methodologies are ethnography (applied in Study 1) and autoethnography (applied in Study 2). Reflexivity is examined in more detail in the Methodology (see Chapter 3, Section 3.3.3).

Social systems are dynamic and continually maintained and reproduced by society. Social laws are able to be constructed and changed, unlike laws such as gravity, evolution and thermodynamics which govern the natural environment. The human ability for self-organisation allows people to transcend the boundaries of the system that they have created. People play roles in a wide variety of systems and it is the human ability to move between these systems that gives each individual system the variety of possibilities for combinations and recombinations to deal with crises.

In sum, the human capacity for representation, for communication, and for making meaning seems to drive the processes of both maintaining system
integrity and dealing with change. Yet that abstraction and reflexivity have limits when applied to complex problems of the environment (Westley et al., 2002, p. 113).

Time scales of problem-solving are different in human systems and ecological systems. One sees in the self-organising features of ecosystems an array of time scales and potential mechanisms of response to a given situation. In contrast, humans tend to solve problems one time scale at a time with the result that human systems may be successful in one domain but this tends towards a rigidity that limits their resilience. Human solutions tend to create spin-off problems which engage people in a recursive loop of endless problem solving, which is the essence of reflexivity. An example of this from the environmental context, which reveals a wicked problem is the introduction of nitrogen fertilizer to agriculture.

The availability of industrial nitrogen solved the problem of nitrogen fixation on the soil and promoted agricultural production. Unexpected side effects included toxic levels of nitrate in ground water, widespread acidification of ecosystems, increased greenhouse gas release, toxic algal blooms in waterways, amongst others. On another scale, human population growth supported by increased food production has created a dependency on industrially produced fertilizers. In an attempt to minimise the impact of nitrogen fertilizers on the environment the world now faces a critical shortage of phosphorus-based products with the consequence that the price of these has tripled in recent years, taking fertilizer out of reach of many of those in developing countries living on subsistence agriculture (Westley et al., 2002).

2.6.3. Propositions for Understanding Resilience in Social-Ecological Systems

A perspective on the state of the understanding of change and social-ecological systems is summarised in Walker, Gunderson et al.’s (2006) 14 Propositions (pp. 9-17). The authors note that these propositions are tentative and ask researchers to challenge the propositions. Personal contact with Brian Walker indicated that, as at 2011, there had been no further work done specifically on these propositions. However, there is a rapidly growing body of research in the area of Resilience and since 2006 there have been numerous individual publications and case studies that
apply and embed the propositions at the practical level. Of particular note is work linked to the Resilience Alliance (available from http://www.resalliance.org/) and work published in the journal of that Alliance; Ecology and Society. These propositions were a valuable starting point for this study since they identify key concepts and factors which need to be considered when applying the social-ecological system approach to a new discipline area.

2.6.4. The Social-Ecological System in Context - Asking the Right Questions

The social-ecological system in its refined use of the term was introduced into environmental management literature in 2002 (Holling, Gunderson, & Ludwig, 2002). When applied to the learning environment, social-ecological systems analysis potentially provides a way of identifying the possible causes and effects of changes in the environment at a variety of levels and importantly, introduces a temporal and physical dimension that requires one to take a holistic view of the learning environment. This approach informs the basic premise in this research that one must focus at two levels, individual and institutional, when investigating aspects of educational technology (see Original Conceptual Framework Figure 3.2).

A few examples of how social-ecological systems have been applied in the environmental management field are now presented. While the outcomes of the scientific and social research might be of interest to scientists, they may appear less relevant to those who are immersed in the intricacies of higher education technology-enhanced learning environments. However, what is important to this study are the types of research questions that were asked in the scientific studies and those questions which can potentially be asked, and answered, by applying a social-ecological system approach to our considerations of the management of the technology-enhanced learning environment. It is not intended that this research will follow up on all these questions, although that is a wealth of opportunity for future research. The questions also foreground the questioning approach taken in Study 2, the autoethnography (see Chapter 6). Example 1- Cultural resilience and cultural transformation.
The social-ecological system lens was used to analyse the situation in Mali where many years of drought and political unrest had affected the way in which local people lived (Crane, 2010). Crane focuses specifically on exploring changes in cultural resilience and cultural transformation between two agro-pastoralist groups, the Marka and the Fulani. The Marka typically rely more on subsistence crops and having few livestock while the Fulani are primarily herders with minimal subsistence cropping. The questions asked are: “What is the place of culture in a social–ecological system? How can normative, culturally bound positions be constructively articulated with empirical analyses of social–ecological resilience? Is it possible for the ecological and material components of a system to be resilient, while at the same time a cultural group within it is pushed over a threshold to a new state in which the most valued practices and beliefs become untenable, irrevocably transforming the culture itself? Do such transformations even matter?” (Crane, 2010 Online).

Although beyond the scope of this review to relate the findings, the findings make interesting reading and are a good example of the wicked problems faced in environmental management.

The importance of understanding the significance of cultural transformation is highlighted in work being done in climate change adaptation research. Crane further notes that;

The increasing threat of violent competition over diminishing natural resources has been cited as a potential outcome of climate-change pressures. Again from humanistic terms, this is clearly worth avoiding. In this sense, issues around the processes of cultural resilience and cultural transformation are especially relevant to concerns about social–ecological resilience and merit closer consideration in climate-change adaptation research” (Crane, 2010 Online).

Application to the technology-enhanced learning environment – How can this scenario contribute to our understanding of how the practice and culture of real-time, real people, on-campus classes may be valued differently by traditional academic staff, new generation staff, new generation students and administration; practice and culture that may be affected by the changes
brought about by use of technology in the rapidly evolving technology-enhanced learning environment?

2.6.4.2. **Example 2 - How people in social-ecological systems prepare for and navigate periods of transformation.**

Gunderson et al. (2006) seek an understanding of how people in social-ecological systems prepare for and navigate periods of transformation. By comparing a number of case studies from *The Resilience Alliance* the authors explore how the emergence of adaptive governance regimes relates to the concept of transformability. These case studies range from the Florida Everglades in the United States to the Mae Nam Ping Basin in Thailand to Kristianstads Vattenrike in Sweden. Three phases of transformation in systems are identified: preparing for change, transition to a new social context for ecosystem management and finally, building the Resilience of the new direction.

*Application to the technology-enhanced learning environment - Can similar phases of transformation be identified in the case in order to understand how people in the case study institution can prepare for and navigate periods of transformation in the technology-enhanced learning environment?*

2.6.4.3. **Example 3 - Regime shifts and cascading effects.**

One of the most important agricultural areas of Australia is the Goulburn-Broken Catchment. As a result of land clearing over a hundred years ago and replacing native vegetation with constant cropping there have been significant rises in water tables with a consequent increase in waterlogging and salinity levels. This has affected the productivity of the area and provides significant challenges for the agricultural industry and the environment.

Kinzig et al. (2006) examined the Goulburn-Broken Catchment in terms of system dynamics, thresholds and drivers. They explored *regime shifts* and looked at the emerging evidence for supporting the theory that, while crossing into a new regime may lead to initial loss of resilience, crossing a threshold can also lead to a
**cascading effect** in which multiple thresholds across scales of space, time and social organisation as well as ecological, social and economic domains, may be breached. They found that the new regime this cascading effect produces has a tendency to be highly resilient and resistant.

*Application to the technology-enhanced learning environment* - Can one or more regime shifts be identified in the case, can cascading effects be identified in the case and if a new regime is identified, is it highly resilient and resistant?

2.6.4.4. **Example 4 - Why systems of people and nature are not just social and ecological systems.**

Westley et al. explore this notion from two disciplinary perspectives - system ecologists and social scientists - by asking two questions: firstly; “Why are systems of people and nature not just ecosystems?” and secondly; “why are systems of people and nature not just a type of social system?” (Westley et al., 2002, p. 104).

In their conclusion they suggest that the key to understanding the differences in sustainability and the sustainable use of resources lies in understanding the dimensions around which the patterns and structures are identified and studied. For ecosystems (ecological systems) the dimensions are identified as space and time. The authors add a third dimension for social systems, that of “symbolic construction of meaning”. They suggest that there are four elements of the third dimension which are helpful in understanding the differences. These four elements are significant to this study.

The first element is the creation of a hierarchy of abstraction, which loosens the power of time and space to explain social systems. The second is the inherent capacity of such meaning-making structures for reflexivity. The third is the ability to generate expectations and look forward, rather than to react and look backwards in time. The final element is the ability of humans to externalize these symbolic constructions in technology (Westley et al., 2002, p. 118).
Application to the technology-enhanced learning environment – Can similar patterns and structures and dimensions be identified in the technology-enhanced learning environment in the case study?
CHAPTER 3: METHODOLOGY AND RESEARCH DESIGN

“Data are nothing more than ordinary bits and pieces of information found in the environment” (Merriam, 2009, p.85).

3.1. The Research Questions

Research Question

How can the technology-enhanced learning environment be understood and managed in the face of constant change in the broader educational environment?

Research sub-question

How can the contemporary technology-enhanced learning environment be described?

Objective

To apply the five heuristics of a social-ecological systems approach to understanding and managing change in Charles Sturt University’s technology-enhanced learning environment.

3.2. Research Design

The research design looks at the overall strategy used to integrate the different components of the study in a coherent and logical way in order to effectively address the research question. The research design constitutes the blueprint for the collection, measurement and analysis of data in this study.

The framework represented in Figure 3.1 (informed by Latham, 2005) summarises the research design and methodology used in the study. The first step in the research was to identify the research problem (see Chapter 1). The Review of the Literature (see Chapter 2) underpins the development of the research questions and
the evolution of the main argument in the thesis. This chapter deals primarily with Step 4: the choice of approach and methodology.

**Figure 3.1.** Methodology and research design.

3.2.1. **Design Considerations and Decisions**

The timeline of research activity and data collection is summarised in Table A 3.1 (Appendix 3).
The preliminary research conducted in 2007-2008 was primarily inductive. The early data collection informed future directions of the study. For example, trends observed and the participatory action research exploration into adaptive management led to the decision not to pursue adaptive management in more depth. Instead the focus became the exploration the concepts of resilience and the social-ecological systems approach. To explore the propositions that came out of that initial study a deductive approach was then employed. The focus on the social-ecological system with its five heuristics meant that there were clear analytic categories for which data would be collected. These five heuristics guided the description and analysis of the patterns and relationships that were observed throughout the study. This helped scope the research and to set the boundaries towards a clearly defined and manageable research study.

The study design informed the data collection, reduction and display. Design decisions to focus the data collection were made through what Miles and Huberman (1994) call an anticipatory data reduction, constraining late analysis by limiting certain variables and relationships and focusing on others. Examples of these included: the targeted sampling of interviewees (see Table 3.3), confining the study to a single case, the choice of instrumentation or the tools used to collect the data, and the type of data that was to be collected (see Appendix 5 and Appendix 8). Closely informed by these choices were the operational issues around the storage, processing and managing of data; and the choice of software to support the data collection and analysis and the role of participants in the study.

Conceptual frameworks were used to organise variables and their relationships. Examples of these include the original overarching conceptual framework for the study (see Figure 3.2.) which was drawn up for the initial proposal for acceptance into the Ph.D. degree. The variables were organised into bins to help clarify important aspects and to begin to draw relationships between the different components. These bins included both concepts and process. This original conceptual framework was an exploratory framework which, in addition to the basic concepts and ideas, also described the processes of possible methodology and rationale for the choice of different factors in the study. The initial research proposal
focused on Resilience Thinking and Adaptive Management and through the course of the study the proposal was modified to focus on the social-ecological systems approach, with resilience as just one aspect of the five heuristics of the social-ecological system.

The conceptual and process components of the original framework were separated when decisions about approach and methodology were made. Preliminary findings revealed a variety of patterns and relationships and confirmatory frameworks were developed for different aspects of the study. Some of the conceptual frameworks and visual display of the findings were shared in early publications and presentations (see Appendix 1, Annotated list of Publications Arising from the Research.) and as a result of peer review and feedback, were modified to inform the research. **Blueprint for the Study**

The original conceptual framework (see Figure 3.2) was a visual framework which brought together a number of concepts and processes and helped to establish possible linkages. Towards the end of the research the original framework was revisited and a new framework developed which represents what actually took place during the study. This has been called this the **Blueprint for the study** and the term “blueprint” reflects the intention of the framework. The final **Blueprint for the study** is illustrated in Figure 3.3. The purpose of a conventional blueprint is to provide an annotated, visual set of instructions for a specific project. Another professional should be able to pick up the blueprint and interpret the symbols and language to be able to understand how the project was, or should be carried out, and to begin to visualise the end result. Unlike the concrete world of architecture where a blueprint can be drawn up in advance of a project and the instructions followed to create a particular structure, qualitative research is not quite so clear cut.
Why Adaptive Management?

The concept of adaptive management has been embraced by natural resource managers worldwide. Adaptive management is learning from doing; learning comes through the implementation of policies and strategies, so adaptive management complements research-based learning. Active adaptive management involves a range of practices designed to achieve strategic goals (treatments) to test the hypothesis that ‘best’ practice is just that. ...For adaptive management to achieve its promise it must be recognised as a radical departure from established ways of managing. ...[educational] resources [i.e. learning environment]; it promises it must be recognised as a radical departure from established ways of managing. ...In order to build resilience into our learning environment, I posit that we need to build resilience through two main areas:

1. Institutional governance developed ‘from the ground up’ using through Adaptive Management
2. Building resilience into the individual components of the system i.e. the people. And/or understanding what factors make the individuals resilient

Understanding the learning environment

Application of the fundamentals of social-ecological systems (systems analysts) will help us understand the learning environment & the relationships within it which is an important starting point for understanding & developing resilience within the system.

In order to build resilience into our learning environment, I posit that we need to build resilience through two main areas:

1. Institutional governance developed ‘from the ground up’ using through Adaptive Management
2. Building resilience into the individual components of the system i.e. the people. And/or understanding what factors make the individuals resilient

What is Resilience?

Resilience is the capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks & therefore identity. Resilience is also the amount of disturbance a system can absorb without shifting into an alternate regime. Social-ecological systems exhibit thresholds that, when exceeded, result in changed system feedbacks that lead to changes in function & structure. Resilience thinking principles also allows one to affect transformational changes when one actually wants to create a shift to a new regime – in the natural environment this may be a change in land use from monoculture to natural habitat. In the learning environment it equates to what is happening at CSU at present.

**Key Points on Resilience Thinking** (as applied to natural resource management NRM, with the significant parallels in educational environments to be explored in this thesis)

1. current approaches to sustainable NRM modelled on average conditions, ignore major disturbances, & seek to optimise some components of a system in isolation of others. This approach falls to acknowledge how the world actually works.
2. increasing efficiency & optimising performance is good for economic purpose but fails to acknowledge secondary effects & feedback that can cause changes that affect the bigger system & can affect sustainability
3. resilience thinking is about understanding and engaging with a changing world. By understanding how & why the system as a whole is changing, we are better placed to build a capacity to work with change, as opposed to being a victim of it.

**Figure 3.2.** Original Conceptual Framework 2007.
Developing a blueprint for a research study in retrospect is important to the research process. Case studies are by definition unique and individual. Builders will use the blueprint developed by an architect to build a concrete structure and will be able to visualise the end result from the start because the architect has usually supplied an inspiring graphic of the structure in situ. Unlike the builders’ world, in qualitative research the end result is not known – although like the architect, the researcher does have a defined problem and vision for the end outcome. Within the context of this qualitative research, the blueprint for the research essentially establishes the research question which is the main focus of the research, and describes how this was investigated. Although every case study is unique, I have confidently used the term blueprint because the value of this type of academic research is that it is reproducible and generalisable to other cases. The Blueprint for the study (see Figure 3.3), together with the methodology and research design (see Figure 3.1), provide the mechanisms by which the study could be reused and applied to other unique case studies.
Figure 3.3. Blueprint for the study.
3.3. Choice of Approach and Methodology

This research explored theory and practice drawn from different disciplines and fields and included exposure to a variety of research approaches and methods. The research paradigm within which the study was conducted is presented as background to the choice of approach and methodology.

An interpretivist/constructivist research paradigm underpinned the research. The research methods used were primarily qualitative. Qualitative research is characterised by inductive inquiry, understanding social phenomena and by grounded theory (Birks & Mills, 2011). These fundamentals of qualitative research supported the interdisciplinary nature of the research.

The early stages of the study were exploratory and deductive. Consequently, the process of scoping the focus of the study meant that the research design and choice of approach and research methodologies was adaptive (or evolutionary) whereby the methodology, data collection and analysis techniques were modified and improved during the research process according to current findings and identified needs (Buchan et al., 2009). Progress against the research questions was determined by publication and presentation of the preliminary findings through conference papers, journal articles and presentations within a variety of forums. This is presented in the annotated version of the list of publications in Appendix 1.

3.3.1. Case Study

A case study approach was chosen early in the research, with Charles Sturt University as the single case study and the broad unit of analysis in this study. The range of teaching and delivery modes, enrolment options, the diversity of study programs, the regional and multiple campus structure, the diversity of student demographics and the increasing use of technology made CSU a particularly rich environment for a case study that should have relevance to a variety of higher education contexts. At the time this research began in 2007 CSU was just moving to its first learning management system and embarking on the implementation of other educational technology.
The scope of the proposed case study fitted well within the following technical definition: “A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (Yin, 2003, p. 13). The case study provided the means to conduct an in-depth study of the research problem. The case study was used to develop an understanding of the complex issues associated with the research problem. This was done by narrowing down the broad field of research into a few defined examples.

Yin suggests that “case studies, like experiments, are generalisable to theoretical propositions and not to populations or universes” (Yin, 2003, p.10). The aim of the research was to expand and generalise the theoretical propositions as indicated by the objectives of the study, providing analytical generalisation as opposed to the statistical generalisation provided by an experimental approach. It is acknowledged that a case study approach may have some limitations in its generalisability. This was particularly true in this research since it was the first time that some of the key concepts, such as Resilience Thinking and social-ecological systems, were being introduced to educational management and within the context of the university learning environment.

The case study approach allowed the many research variables relating to change in the chosen study environment to be managed. It required multiple sources of evidence which suited the broad interdisciplinary background to the study. In particular the case study “benefits from the prior development of theoretical propositions to guide data collection and analysis” (Yin, 2003, p. 14). This is particularly relevant to the main objective of the study which was to apply the five heuristics of a social-ecological systems approach to understanding and managing change in Charles Sturt University’s technology-enhanced learning environment.

Many of the research methods and features of the study used resonated with grounded theory approaches. There were a number of common data analysis techniques and methodology such as the use of memos and interviews (Cresswell, 2013). Some of the common features included a focus on a process or action that has
distinct steps or phases that occur over time – as seen in institutional change management processes. The significant difference between this case study and a grounded theory study is that the final product of a grounded theory study is an integrated and comprehensive grounded theory that explains a process or scheme associated with a phenomenon (Birks & Mills, 2011). However, in this study an existing theory, that of the social-ecological system approach, was systematically pulled apart and applied to a new discipline. This was done through a single, in-depth case study – that of the technology-enhanced learning environment at Charles Sturt University. The existing theory was taken from the environmental management field and the findings led to modifying and extending the theory for application to the higher education environment.

3.3.2. **Use of Ethnography**

The complexity of the research problem meant that there was a need for a flexible and adaptable approach to the research that could be responsive to changes in the environment being studied. The ethnographic approach was chosen to serve this function. *Ethnography* has become one of the major methods of researching educational settings and can be described as the “process of providing holistic and scientific descriptions of educational systems, processes, and phenomena within their specific contexts…Ethnographic research is an inquiry process guided by experience in the research setting” (Wiersma, 2000, p. 237). Perhaps the most important reason for including ethnography in the approach is the view that there may be problems in education that “can best be attacked, and possibly only attacked, through an ethnographic research approach” (Wiersma, 2000, p. 237).

In ethnographic research hypotheses are more likely to emerge from the data than to be formulated prior to the research. It was only after some time of studying and assimilating information during the research process that the research questions and objectives of the study were able to be refined and finalised.
3.3.3. **Use of Autoethnography**

Autoethnography has been used to position the researcher in the study and to guide the data collection. An autoethnography treats research as a political, socially-just and socially-conscious act (Denzin & Lincoln, 2007), which was consistent with my researcher-practitioner role and ongoing mission to improve the management of our learning environment. Autoethnography is both process and product (Ellis, Adams, & Bochner, 2010).

My position in the research was consistent with the subgenre of ethnography known as analytic autoethnography. Within this paradigm the researcher is (1) a full member in the research group or setting, (2) visible as such a member in the researcher’s published texts, and (3) committed to an analytic research agenda focused on improving theoretical understandings (Anderson, 2006). The researcher position was also consistent with Anderson’s five key features of analytic autoethnography: (1) complete member researcher (CMR) status; (2) analytic reflexivity; (3) narrative visibility of the researcher’s self; (4) dialogue with informants beyond the self, and (5) commitment to theoretical analysis.

**Objectivity, subjectivity and reflexivity.** As a researcher-practitioner I put on a researcher’s objective hat in order to apply the five heuristics of the social-ecological systems approach to the case. This is the outcome of Study 1 – the Ethnographic case study of the technology-enhanced learning environment at CSU (see Chapters 4 and 5).

However, it is difficult to remain objective about social-ecological systems because they are unavoidably social – people are involved. It is also difficult to remain objective about ethnographic research. There is inherent subjectivity found in research information; subjectivity which originates with both researcher and participants, each of whom brings individual experiences and pre-existing perspectives into the research event (G. M. Russell & Kelly, 2002). Consistent with Russell and Kelly’s observation, in this study both researcher and participants brought their own lenses of subjectivity to inform and mediate each element of the research project. This influenced not only the process and intended goals but also the
interaction and attributions found within the event itself. It will become clear as the findings of this research are revealed, that the application of the metaphor of lenses of subjectivity is particularly appropriate to, and supportive of, the social-ecological systems approach and the outcomes of this research.

Research strategists have shown a growing interest in the complex nature of data and have moved toward a model that employs a critical reflection and examination from multiple positions. This is seen in the use of \textit{reflexivity} in a team approach to research (G. M. Russell & Kelly, 2002). The processes of \textit{team research} also illuminate the multiple levels of reflexivity that are available for implementation within the research process.

As a \textit{sole researcher} my changing roles throughout the study provided me with multiple positions, or lenses, for critical reflection and this richness of perspectives was an important part of the data collection and analysis. As a sole researcher there was subjectivity in my personal perspective and objectivity in my approach to conducting the study. As a practitioner experiencing changing professional roles for the duration of the study there was a need for professional objectivity. Those changing roles added to the richness of the data collection, the complexity of interactions and the implications of personal subjectivity associated with each of those roles.

Reflexivity became fundamental to the outcomes of the study and underpinned the use of auto/ethnography approaches. Reflexivity is the process of self-examination that is informed primarily by the thoughts and actions of the researcher. “Strategies for its implementation often include the completion of self-reflective records and diaries, the examination of personal assumptions and goals, and the clarification of individual belief systems and subjectivities” (G. M. Russell & Kelly, 2002 online). The authors further counsel that “a commitment to reflexivity suggests that we continue to look at the impact of our research at all points during the research process—including its impact on us”.

The mission of this research was grounded in certain values which included those values underpinning a vision for the higher education environment, in
particular the technology-enhanced learning environment (see Chapter 2). Rather than attempting to control the researcher’s values through method or by bracketing assumptions, use of a reflexive approach enabled the researcher to consciously acknowledge those values (Ortlipp, 2008).

It is accepted that research is no longer simply objective, where the researcher is necessarily a passive observer, but that the researcher can be a subject in the research (Mruck & Breuer, 2003). A criticism of researchers, however, is that they have not yet determined how to operationalise the subjective nature of research in a way that provides for expanded understanding and insight arising from the data. It is suggested that; “As researchers, we take seriously the obligation and we enjoy the privilege of inquiring as to the broader political assumptions underlying our work and the wider political ramifications of our findings” (G. M. Russell & Kelly, 2002 available from http://www.qualitative-research.net/index.php/fqs/article/view/831/1807).

My position in the study as a reflexive researcher-practitioner privileged me with access to wide-ranging opportunities and discourse and full use was made of the opportunity for personal reflection. However, the role also demanded careful consideration of the ethical concerns concerning any potential conflict between my professional position and that as researcher. Those ethical considerations are described in Section 3.7.

3.4. The Thesis as Linked Studies

Ethnography and autoethnography underpin the two studies in the thesis. The thesis reports on two linked studies which emerged from the case study. Study 1 is an ethnographic case study of Charles Sturt University’s technology-enhanced learning environment and will demonstrate the contribution the research makes to theory and to literature, together with significant implications for practice. The first part of Study 1 (see Chapter 4) reports on the investigation into the research sub-question:

How can the contemporary technology-enhanced learning environment be described?
The second part of Study 1 (see Chapter 5) reports on the investigation into fulfilling the primary research question:

How can the technology-enhanced learning environment be understood and managed in the face of constant change in the broader educational environment?

This was achieved through fulfilling the main objective of the research which was:

**Objective** - To apply the five heuristics of a social-ecological systems approach to understanding and managing change in Charles Sturt University’s technology-enhanced learning environment.

**Study 2** (see Chapter 6) is an autoethnography of the case study and explores selected aspects of the findings from the position of researcher-practitioner. Study 2 makes explicit the contribution of this research to management practices in the case study institution.

### 3.5. Defining the Unit of Study

The aim of this research was to fill a gap in our knowledge on management of technology-enhanced learning environments and to focus educational management back on the domain of teaching and learning through the focus on the learning environment. Charles Sturt University was the case study and the broad unit of analysis in this study. The relationship between the learning environment, the organisation and the external environment is represented in *Figure 2.2* (see Section 2.2). The background research which has informed this representation of the relationship between the learning environment, the organisation and the external environment draws on previously published work (Buchan, 2004, 2008a; Buchan & Buchan, 2003) and has been described in the review of the literature in Chapter 2 (Section 2.2).

The social-ecological system approach has been used to define the boundaries of the study. The ecological system, or ecosystem, referred to in this study is the organisation that supports the learning environment. The focus of the study was the
technology-enhanced learning environment in which academics teach and students learn. This is represented as the central kernel. The research involved identifying the following: firstly, the issues and problems people faced with respect to change and secondly, those influences which impact on the technology-enhanced learning environment from inside and outside the learning environment. This was done by examining the components of the system which included the people, other aspects of the system, and the interactions between the components.

The basic unit of study was that part of the social-ecological system which forms the CSU technology-enhanced learning environment. The unit of analysis was a particular cross-section of the university associated with managing change in the technology-enhanced learning environment, as represented in Figure 3.4. The study recorded and analysed data in the cross-section which grounded the collection of data from a variety of levels and over a period of time in the ecological system. In scope were the different levels in the ecosystem; the organisation, faculty and the technology-enhanced learning environment itself. The locus of the research was confined to those interactions, players and components directly related to managing the changing technology-enhanced learning environment. A detailed study of the learning and teaching processes within the technology-enhanced learning environment itself was considered out of scope.
Figure 3.4. Representation of the unit of study as a cross-section.

3.6. Data Collection and Analysis

Data collection and analysis were considered together because in this research the data collection and analysis was necessarily an iterative process. Ongoing data collection was dependent on preliminary data collection and analysis and as the focus of the study became clearer additional data collection was required. Research

Timeline

The social-ecological systems approach requires that one look beyond a snapshot in time of the current environment in order to build up an understanding of factors and events that may have long-term effects (Gunderson & Holling, 2002). A temporal focus was thus an important facet of the data collection process. Formal data collection took place from the beginning of 2007 to the end of 2011 during a period of major technological and organisational change at the university. Historical records of organisational and technological change were accessed from as far back as 1998, which was the date when CSU first offered all distance education subjects as online supported subjects.
The sequence of research activities during the study are illustrated in the timeline of the study in Table A 3.1. The activities included data collection and ethics approval processes.

During an exploratory phase which took place from February 2007 until late 2008, the original research questions put forward in the proposal for admission to the Ph.D. program were investigated and the focus and scope of the research was refined.

Ethics approval was obtained in early 2007 so that the collection of data through participant observation could begin. In order to accommodate minor changes in focus in the data collection and to enable the use of institutional data, ethics requirements were updated in early 2009 and again in 2011 through the respective CSU and USQ Ethics Committees.

The exploration of adaptive management as a way of managing the technology-enhanced learning environment was put forward in the initial research proposal (2007). It was trialled in a participatory action research study in one of the CSU OLE Program project teams of which I was the Project Lead. The methodology and findings from this investigation were reported in a publication (Buchan, 2012c). Key findings and concepts from adaptive management which have informed the main focus of this research are reported in Appendix 2. It soon became clear that adaptive management in its purest sense was not compatible with traditional organisational educational technology project management techniques. Adaptive management did, however, reveal a number of general principles which have informed this study. Building on prior research, the final conclusions of the research into adaptive management have been summarised in the publication, “Sustaining new approaches to learning and teaching: more than just a Wicked Problem” (Buchan, 2012c). It was the “discovery” in early 2007 of the concept of Resilience Thinking which helped to focus the rest of the study.
3.6.2. **Focusing and Bounding the Collection of Data**

During the exploratory stages the data collection was broad. Preliminary findings helped provide clarity for the development of the conceptual frameworks which in turn informed and focused the data collection and analysis (Buchan, 2008b, 2010b). Boundaries were set on the data collection in order to keep the study manageable and to continue to focus on the research questions and propositions. Although consisting of only a single case study, the research study had multiple subsets. These included the different organisational divisions, faculties and centres/units as well as hierarchies of structure and individuals within these. These subsets provided distinct units within which data could be collected.

3.6.3. **Sampling**

*Ensuring high quality accessible data.*

Qualitative data collected in this study concentrated primarily on data in the form of words and graphical representations. Data collection activities were carried out within my professional working environment over the duration of the research study. The principle behind obtaining good quality data was to ensure that the source of the data had integrity and was reliable. This principle informed the choice of sources of documents as well as the selection of participants for the interviews.

*Sampling parameters.*

The principle used for determining the sampling parameters was that the data needed to address the research questions and to achieve the stated objectives. Sampling was *purposive*. The sampling parameters of the study were initially set through the choice of CSU as a single case study and through the choice of data collection methods. During the fieldwork stage, in response to the initial findings and further reading, there was a redefining of the sampling parameters.

*Classes of data.*

The collation of data into a collection matrix was the start of data coding and helped to identify gaps in the data. The following criteria guided the data collection to produce data that would:
(a) identify new leads of importance - as seen through choice of interviewees;
(b) extend the area of information - as seen through the use of follow-up interviews, collection of more documents;
(c) relate or bridge existing elements - as seen in the links between interviews and document data and journal entries;
(d) reinforce main trends - as seen through the collection of documentary evidence and choice of interviewees;
(e) account for information already in hand – for example university documents;
(f) exemplify or provide more evidence for an important theme - as seen in recent documents confirming the importance and existence of constant change; and
(g) quantify or refute existing information – such as the results from the adaptive management exploration during the study or references in the literature (Miles & Huberman, 1994).

3.6.4. **Data Collection Methods**

The following four data collection methods were used in the study:

- observation and meeting notes
- reflective journal
- interviews, and
- documents.

Tables A5.1 to A5.8 (see Appendix 5) illustrate how the data collection instruments were set up to align with the research questions and list the details for the retention of data. The data collection methods, instruments and purpose are summarised in Table 3.1.

The term *instrumentation*, as used in this study, refers to the specific methods used for collecting data. The instrumentation used in the field consisted of making notes and memos in a hard copy notebook during a variety of professional encounters. These included meetings, professional development sessions, conferences and seminars and after informal interactions with people. A reflective
journal was kept in hard copy. A variety of software was used to support the research including NVivo 8™ and the standard Office Microsoft™ suite programs.
Table 3.1. *Summary of Data Collection Methods, Instruments and Purpose.*

<table>
<thead>
<tr>
<th>Data collection method</th>
<th>Instrument</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation and meeting notes with</td>
<td>Paper notebook with memos</td>
<td>Documenting: events, change in the organisation, discussions, the roles of</td>
</tr>
<tr>
<td>Participant as observer</td>
<td>Observation and meeting notes</td>
<td>people, other people’s point of view, management solutions, issues at a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>range of levels</td>
</tr>
<tr>
<td>Reflective journal</td>
<td>Paper notebook with memos</td>
<td>Observation, documenting the researcher’s lived experience, growth in understanding, personal learning journey and perceived change in the organisation</td>
</tr>
<tr>
<td>Interviews</td>
<td>Sets of questions</td>
<td>Understanding the world view and experience of other people, understanding the experience of other people, documenting the experience and views of other people, understanding what the learning environment means to others, recording the issues and impacts that face other people</td>
</tr>
<tr>
<td>Documents</td>
<td>Electronic and hard copies</td>
<td>Documenting the history, changes in the organisation/technology/roles, gathering the discourse, documenting the issues, describing the current and changing organisational environment</td>
</tr>
</tbody>
</table>
Observation and meeting notes.

Observing and learning from the environment including the people, the events and the experience, is a fundamental aspect of ethnographic research. In order to gather reliable sources of primary data it was necessary to make first hand observations in the field. The field ranged from Charles Sturt University - with a specific focus on educational technology and those areas of the university developing, supporting and using the technology - to parts of the higher education sector which formed the broader educational environment. A primary method for information gathering involved observing within my various professional roles in the organisation. My stance in *observation* can best be described as *participant as observer* where the researcher’s observer activities which are known to the group, are subordinate to the researcher’s role as participant (Merriam, 2004). This supports the autoethnographic focus of the research and my role as researcher-practitioner.

First hand observation enabled me to collect the data needed to be able to describe the organisational environment, to understand the roles of different individuals within the organisation, to understand the current learning environment and to identify and understand relevant issues facing individuals. In my professional capacity as a practitioner I was in a position to observe interactions and learn from discussions in a variety of settings. For ethical reasons the researcher (observation) role was necessarily secondary to the professional role, which was the participant role.

*When the observation took place.* The formal observation period extended from February 2007 until the end of 2010. However, during the analysis of the data and writing up of the study (from 2010 until end of 2012) I continued to be an active participant in the research environment and to reflect on the data and to assimilate new information and ideas. These latter reflections were primarily concerned with validating and amending personal views and conclusions from the research, as well as filling in gaps in the data when reviewing certain aspects.

*What was observed.* Merriam (2004) puts forward the following checklist of elements likely to be present in any setting where observation is taking place: the
physical setting, the participants, activities and interactions, conversation, subtle factors and the researcher’s own behaviour. This research focused primarily on recording the conversations amongst participants. While some of the other elements were noted during the ongoing observations there was no concerted effort to focus on observing details of individuals’ behaviour and interpersonal interactions. Data included reflection on earlier observations.

Observational settings. The physical setting itself was not a formal part of the observation. Formal observation took place in a variety of settings within CSU and also outside the case study institution as opportunity allowed. There were inter-divisional/unit gatherings involving representatives from multiple divisions; technology-related project team meetings (inter- and intra-divisional). There were meetings with individual staff and meetings from school to faculty level. Observation and learning opportunities also included a number of conferences; local, national and international as well as internal and external workshops and finally, professional visits to other higher education institutions.

Who was observed. There were both active and passive participants in the study. The active participants included those such as interview participants who were actively engaged in parts of the research process. Passive participants included individuals and groups who were part of the engagement during observation periods and who were mentioned in Observation and meeting notes or the Reflective journal. Colleagues from a variety of areas and at a number of different levels in the University, colleagues and fellow professionals from outside the organisation, conference and workshop presenters (passive participants) were all part of the observation process. The contribution of some participants was as an individual, in particular those in senior leadership positions. The contribution of other participants was recorded as representative of a generic group. Interview participants were identified with individual codes. The coding symbols are summarised in Table 3.2. A detailed list of the codes used for each of the participants and participant groups, their affiliations and the contribution of each to the research is given in Table A 4.1, Appendix 4.
Table 3.2.  

<table>
<thead>
<tr>
<th>Code</th>
<th>Category of participant</th>
<th>Unique identifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP</td>
<td>Interview participant</td>
<td>IP1</td>
</tr>
<tr>
<td>P</td>
<td>Individual/ general/ professional staff</td>
<td>P1</td>
</tr>
<tr>
<td>G</td>
<td>Group, general/ professional staff</td>
<td>G1</td>
</tr>
<tr>
<td>A</td>
<td>Academic</td>
<td>A1</td>
</tr>
<tr>
<td>AG</td>
<td>Academic group</td>
<td>AG1</td>
</tr>
<tr>
<td>PE</td>
<td>External</td>
<td>PE1</td>
</tr>
</tbody>
</table>

There were some exciting and informative Observation and learning opportunities which were not covered by the ethics approval. Examples of these included chance encounters with colleagues and friends where casual conversation informed the research or normal operational meetings. In those serendipitous situations it was not always practicable, nor socially acceptable, to stop the momentum of a discussion to get approval from those present to use the discourse for research purposes. On those occasions use was made of the reflective journal to record personal responses to the particular events and issues. This approach was reflected in the ethics considerations (see Section 3.7).

3.6.4.2.  

Reflective journal.

A reflective journal was kept throughout the study. The reflective journal was an integral part of the research design, data generation, data analysis and interpretation process. As a method of data collection and generation, the reflective journal supports the interpretivist paradigm (Ortlipp, 2008).
The reflective journal was used for critical self-reflection and the data generated informed two key areas in the research. Firstly, it informed the research process and secondly, it was a vehicle for reflexivity which was an essential part of the research, contributing in particular to Study 2 - the Autoethnography. Throughout the course of the study, data from the reflective journal was used to inform changes to the research design, methods used and approaches taken. This is consistent with the adaptive approach to research design and data collection (Buchan et al., 2009).

The journal was recorded in two ways. Firstly in the form of rough notes made in a paper notebook during key meetings, conferences, symposiums and other encounters. These notes were later transcribed into digital format. Secondly, lengthier reflections were composed directly into a Microsoft Office Word™ document following certain events or during background reading that stimulated ideas.

3.6.4.3. Interviews.

The interviews were used to develop an understanding of the lived experiences of people in relation to the technology-enhanced learning environment. The investigation also explored a variety of issues that impacted on individuals; perceptions of what works and what does not work within the context of the case study institution and how individuals manage and respond to change. Hearing the stories of people within the real life context was seen as one way to do this.

A structured interview technique was used with the interview questions being designed as the instrument (see Appendix 3). The interviews were recorded and the audio files of the interviews were transcribed. Transcription was not fully verbatim.

The term interview participant has been used to capture the role of those who took part in the research. Other terms such as informant, interviewee and subject are common in qualitative research (Seidman, 2006). However, these have a more passive role and would have put me, as researcher, in a position of control and may not have adequately captured the learning experience for the person being interviewed. The feedback from interview participants was positive and many indicated that they enjoyed the opportunity to reflect on their work and the CSU
context. The term interview participant [abbreviated to IP, IP2 et cetera for reporting purposes] distinguishes them from those participants who were a part of the participant observation process, and those participants in the early participatory action research study into adaptive management (see Appendix 2).

In 2008, during the first year of the full introduction of the new online learning environment, targeted, structured interviews were undertaken with 16 staff. The interview participants were representative of a broad cross-section of staff who had been involved in the implementation and/or use of educational technology across the university. These included: academics, faculty members in leadership positions, support staff such as learning and teaching services staff, IT management staff and student support staff all of whom had a responsibility in supporting learning and teaching across the university (see Table 3.3). The focus of the interviews was to seek an insight into individual perceptions of the learning environment, how individuals adapt to change in general and to educational technology change more specifically. The interviews also explored aspects of educational management in order to identify issues which staff and students face in the current learning environment and to determine effective strategies that could be used in the successful implementation and support of educational technology.

Twelve months after the initial introduction of Interact, in late 2009 and early in 2010, follow-up interviews were conducted with six selected interview participants. These interviews explored the role educational technology had played in organisational transformation and explored strategies for managing technological change.

Purposive sampling was used to inform the choice of interview participants. The interview participants were selected for their potential contribution to the
exploration of the broad ranging research questions. The participants were chosen according to one or more of the following criteria.

- Leadership background
- Management experience
- Ability to be a spokesperson for a number of staff
- Teaching experience
- Discipline area
- Role in supporting academic staff in the use of educational technology
- Understanding of student experience
- Role in supporting student learning
- Role in, and knowledge of, university ICT systems
- Understanding of university systems and processes
- Length of time at CSU, contribution to historical background
- Attitude to change
- Availability

When selecting the interview participants a conscious choice was made to approach individuals who appeared to have strong opinions around educational technology and whom the researcher respected for their professional expertise. Most were colleagues with whom I had worked professionally and thus had an idea of their potential contribution to the research. Academics were sought from a variety of discipline areas and schools and from a range of leadership levels to try to get a broad perspective on attitudes to educational technology and change. In chance encounters in some university-wide, interdisciplinary workshops I met staff who held what appeared to be some interesting views on change. These staff became willing participants in the research.
Table 3.3. *Summary of Interview Participant Identification Data.*

<table>
<thead>
<tr>
<th>Interview participant</th>
<th>Interview Date</th>
<th>Role</th>
<th>Contribution focus</th>
<th>Interview questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jul-08/ Jan-10</td>
<td>ED, educational technologist</td>
<td>comment from academic support/educational design perspective in 2008, technology implementation perspective in 2009/10</td>
<td>Set 1/ Set 4</td>
</tr>
<tr>
<td>2</td>
<td>Jul-08/ Jan-10</td>
<td>ED, manager</td>
<td>comment from academic support/educational design perspective, technology implementation perspective, from manager perspective in 2009</td>
<td>Set 1/ Set 4</td>
</tr>
<tr>
<td>3</td>
<td>Jul-08/ Nov-09</td>
<td>academic, associate HOS</td>
<td>comment from academic perspective, school &amp; faculty leadership perspective</td>
<td>Set 2/ Set 3</td>
</tr>
<tr>
<td>4</td>
<td>Jul-08</td>
<td>ED</td>
<td>comment from academic support/educational design perspective</td>
<td>Set 1</td>
</tr>
<tr>
<td>Interview participant</td>
<td>Interview Date</td>
<td>Role</td>
<td>Contribution focus</td>
<td>Interview questions</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------</td>
<td>------</td>
<td>--------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>5</td>
<td>Jul-08</td>
<td>ED</td>
<td>comment from academic support/educational design perspective</td>
<td>Set 1</td>
</tr>
<tr>
<td>6</td>
<td>Jul-08/Jul-09</td>
<td>HOS, academic</td>
<td>comment from leadership of school &amp; faculty perspective</td>
<td>Set 2/ Set 3</td>
</tr>
<tr>
<td>7</td>
<td>Jun-08</td>
<td>academic</td>
<td>comment from academic perspective</td>
<td>Set 1</td>
</tr>
<tr>
<td>8</td>
<td>Jun-08</td>
<td>study skills advisor</td>
<td>comment from support staff, student support area perspective</td>
<td>Set 1</td>
</tr>
<tr>
<td>9</td>
<td>Jul-08</td>
<td>IT liaison officer</td>
<td>comment from IT systems support aspect, leadership in IT strategic directions</td>
<td>Set 2</td>
</tr>
<tr>
<td>10</td>
<td>Aug-08</td>
<td>study skills advisor</td>
<td>comment from support staff, student support area perspective</td>
<td>Set 1</td>
</tr>
<tr>
<td>11</td>
<td>Jun-08</td>
<td>academic</td>
<td>comment from academic perspective</td>
<td>Set 1</td>
</tr>
<tr>
<td>12</td>
<td>Aug-08</td>
<td>IT information</td>
<td>comment from IT systems support</td>
<td>Set 2</td>
</tr>
<tr>
<td>Interview participant</td>
<td>Interview Date</td>
<td>Role</td>
<td>Contribution focus</td>
<td>Interview questions</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------</td>
<td>------</td>
<td>--------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>architect</td>
<td></td>
<td></td>
<td>aspect, leadership in IT strategic directions</td>
<td></td>
</tr>
<tr>
<td>13 Jul-09 HOS, academic</td>
<td></td>
<td></td>
<td>comment from leadership of school &amp; faculty perspective</td>
<td>Set 2</td>
</tr>
<tr>
<td>14 Oct-08 academic, ED</td>
<td></td>
<td></td>
<td>Represented external university/ comment from academic perspective, comment from academic support/ educational design perspective</td>
<td>Set 1</td>
</tr>
<tr>
<td>15 Nov-09 ED</td>
<td></td>
<td></td>
<td>comment from academic support/educational design perspective in 2008, technology implementation perspective in 2009/10</td>
<td>Set 4</td>
</tr>
<tr>
<td>16 Nov-09 ED</td>
<td></td>
<td></td>
<td>comment from academic support/educational design perspective in 2008, technology implementation perspective in 2009/10</td>
<td>Set 4</td>
</tr>
</tbody>
</table>
I am aware of the possible bias in choosing participants with extreme attitudes (positive and negative) to acceptance of technological and process change, or change in general which might have contributed towards an outlier phenomenon. Where data at odds with the majority of data is considered an outlier it may be eliminated from the data set (McPherson & Thorne, 2006). However, it could have been a limitation to the validity of the study if an average attitude was sought because the processes of organisational and educational management in a large university need to be able to cater for the extremes. I thus sought to include some extreme views and did not necessarily seek the easiest pathway for interviews. The details of the interview participants and the interview question sets used are recorded in Table 3.3. There was one interview participant from an external university.

Four sets of interview questions were developed as instruments for this part of the research, one for each of the different groups of participants. Copies of the sets of interview questions are provided in Appendix 3.

*Set 1* was used for those interview participants who were not in formal leadership positions. These included academics and staff involved in supporting other staff in learning and teaching or in supporting students. The focus of these interviews was to understand how individuals adapt to change in general and to learning technology changes specifically. The interviews sought to identify issues which staff and students face in the current learning environment. The questions explored management strategies that could be used in the successful implementation and support of learning technology and to understand any limitations to the CSU approaches to the management of the implementation of educational technology.

*Set 2* was used for academic and support staff in leadership positions. The focus of the questions was the same as for Set 1 but included one extra question relating to the leader’s own strategies for helping others adapt to change.
Sets 3a and 3b were used for follow-up interviews with targeted interview participants in academic leadership positions and took place approximately a year after the initial interview. The aim of these interviews was to investigate the phenomenon of transformability of systems and transformation of learning and teaching and associated processes and systems as a result of the introduction of new educational technology at CSU. The interview sets were personalised to make use of the previous input from the two interview participants.

Set 4 of the interview questions was asked of four interview participants in the academic support area in November 2009/January 2010. These individuals had been involved with the implementation of new CSU online systems and other educational technology over the preceding two years (and for some, prior to this). The questions aimed to explore aspects of individual adaptability to changes in technology, to explore issues facing users and implementers of educational technology and to explore effective strategies that can be used in the successful implementation and support of learning technology.

**Integrity and validity of the interview data.** The following criteria were used to plan the choice of interview participants, the timing of the interviews, to develop questions to elicit the desired information from participants but not to constrain responses and to guide the interpretation of the data. These criteria were generated from information gathered from background reading over a period of time and across a range of texts in qualitative research (Merriam, 2004; Miles & Huberman, 1994; Seidman, 2006).

- How valid/authentic are the responses (are people being honest)?
- How does one know that an individual opinion is “right”?
- How representative of a broader population are individual responses?
- Could the timing of the interviews affect the outcomes?
- Are the opinions of individuals generalisable to a broader population?
- How many interviews are sufficient to gather enough data?
- How has my relationship with the interview participants affected the responses?
Each interview participant offered a personal opinion. It was a valid personal response but not necessarily representative of others in similar roles and comments could potentially have limited generalisability. The validity and generalisability of individual responses was determined through analysis of the data and corroboration of responses amongst more than one person.

In order to ensure that the interviewee sampling was representative of the broader population a leader-as-spokesperson technique was used to capture the perceptions and responses of groups of staff. Those in leadership positions were asked to respond to some questions on behalf of other staff with whom they worked closely. It is acknowledged that this is a personal opinion and a leader’s perception of staff capabilities and feelings might have some inaccuracies. However, the honesty perceived in leaders’ replies, combined with the integrity of their professional position, contributed to the accuracy and validity of the responses.

Interviews were conducted across the university from June 2008 to January 2010. During this time there was significant change in a number of areas of educational technology which may have affected the responses of individuals. The effects of other changes within the university during this time period also needed to be taken into account (see Chapter 5, Sections 5.3.2 and 5.3.3 Findings and Discussion on panarchy). This is consistent with the main focus of this research which looked at the impact of a variety of factors on people’s response to changing educational technology within an environment of constant change.

The first round of interviews (Sets 1 and 2) took place in mid-2008 (June to August) when CSU Interact had been in full use across the university for just over seven months. The new learning management system and associated processes could thus be expected to have been in a settling phase. Responses of staff interviewed in those early months could be expected to be coloured by the newness of the system and the big changes their teaching/work environment had gone through and feedback from the interviews confirmed this. However, it is not felt that the three month difference between the first interview and the last interview of the first round of interviews was sufficiently great to affect the validity of the individual responses. A
single interview with a faculty leader in July 2009 provided some insight into perceptions one year on.

The second round of interviews (Set 3 Interview questions) was timed for 18 months-plus post-Interact implementation to allow time for any perceivable technology-related change/transformation to have taken place. Perceived limitations on the validity of the responses in those interviews could be related to the impact of other factors, such as organisational changes and the introduction of other new systems, on the learning environment. Whether or not the timing of the second round of interviews provided sufficient time for any observable transformation to have taken place would be determined in the Findings.

The principles used to determine the optimum number of interviews were:

- careful choice in the range of participants to provide a broad spectrum of participant responses;
- collection of sufficient data to help answer the research questions; and
- that the study had to be completed within a realistic timeframe.

The number of interviews reflected the range of people who make up the general population in the case study. The general population referred to those people who were a part of the technology-enhanced learning environment in the case and the targeted sampling addressed this. The rationale for the choice of interview participants and the contribution focus of each participant has been given above.

One area where there is a possible limitation in the validity of the data is in the third set of interviews where only two interview participants were interviewed to explore the aspect of transformation. Of the three academic leaders interviewed in the first round interviews in 2008, only two were available in 2009 to comment on changes within their schools. The third leader had experienced significant changes in their faculty and the leader’s own role in the leader’s former school in the months following our initial interview. However, combined with triangulation of data from other sources such as participant observation and various internal reports there was
sufficient data from the detailed feedback of the two participants to form an understanding of the concept of transformation.

The ideal relationship between interviewer and interview participants is suggested to be an *I-thou* relationship where the *I-thou* is close enough to a *we* relationship that the participant can relax and share openly, while avoiding the familiarity that comes with the *we* relationship in which the interview may become a conversation (Seidman, 2006). As researcher I was able to establish an *I-thou* relationship with the interview participants. This was in part due to my many professional roles in the university over the previous seven years which had given me the opportunity to build up professional relationships and a degree of trust and mutual respect with staff.

Ethical considerations associated with the interview process included the risks to individuals associated with confidentiality and the time commitment to be made by interview participants. These are covered in more detail in Section 3.7.

3.6.4.4. *Documents.*

Over 400 documents were collected, spanning the time period 1998 to 2011. These included official university memos, minutes of meetings, miscellaneous reports, policies, strategic plans, emails, links to websites and personal communications. Documents from outside the university were mined for information that could illustrate the impact of external factors on the case study institution environment. In particular, open access references were sought from external institutions towards the triangulation of data that could confirm or refute the observations being made in the case study institution and thus add to the external validity of the study.

The records were collated and coded according to type of record, date of publication/writing, author, audience and key words. The full range and the coding used to describe the documents are listed in Appendix 5, Table A 5.9.

*Ethical use of documents.* I was aware of my privileged position as both researcher and professional in having access to institutional documents and as the scope of the data collection changed, corresponding changes were made to USQ and
CSU Ethics Committee applications (see Table A 3.1). The data provided a rich source of social discourse, intriguing images of institutional operational decision making and some very personal discourse around aspects of the organisational management. For ethical reasons, however, discourse analysis of internal documents could not be included in this study. To maintain professional integrity and to separate out the research from the professional interests the proposed use of internal records was limited to the following purposes:

- to compile a history of educational technology and to generate timelines of organisational developments related to educational technology;
- to identify key events across the university that contributed to an understanding of the impacts on the technology-enhanced learning environment over the timelines in this study;
- to build up an understanding of the formal and informal communications systems within the institution;
- to build up an understanding of the relevant strategic decision-making processes within the university system;
- to build up an understanding of university organisational systems (Variation to Ethics Application, March 2012).

3.6.5. Data Analysis

Miles and Huberman (1994) present the three types of data analysis activity as an interactive model whereby the researcher moves between the nodes of: data display, data reduction and conclusion drawing/verifying and the activity of data collection itself. Data reduction (data condensation) took place continuously throughout the duration of the project. The decisions made about choosing the data, coding and determining emerging patterns were an ongoing part of the data reduction process. Ways in which data reduction was done in advance included the use of systematic conceptual frameworks to identify and organise the variables and their relationships. Data reduction was also achieved through the development of the research questions which defined the object of inquiry, and case definitions which
defined the boundaries and focus of the case. Decisions about sampling were made (see Section 3.6.3) and finally instrumentation was decided upon and created.

**Data coding.** This study has been carried out by a single researcher and the validity and the ongoing usefulness of the study and a furthering of knowledge in this field lies in its ability to be replicated. Codes were used to assign units of meaning to the descriptive information in the study and to organise and retrieve the chunks of information from the large quantities of data which were generated in the study.

The interviews were transcribed before coding of other data began and a set of coded themes was developed for the interviews. This then informed the development of themes and coding for the notes and documents. *Open coding* was used in the early stages to break down, compare, and categorise data and to identify trends and preliminary results. *Axial coding* was then used to make connections between categories. Once the patterns had begun to emerge from the initial coding *selective coding* was used to identify core categories, to relate those to other categories and to confirm and explain those relationships.

The five social-ecological heuristics formed the basic conceptual structure for the coding of much of the data, but linkages within these helped ensure that there were connections across all the aspects of the study and an awareness of emerging relationships and themes.

The coding of data took place over a period of two years, with increasingly detailed coding procedures taking place during this time as part of the publication of preliminary findings. Some of the coding techniques included filling in, extension, bridging and surfacing (Miles & Huberman, 1994).

*Memoing* is “the theorizing write-up of ideas about codes and their relationships as they strike the analyst while coding” (Glaser quoted in Miles & Huberman. p.72) and is a technique used in the development of codes. This form of data collection contributes to the evolution of theory in the grounded theory approach (Cresswell, 2013). In this study the definition of memo also fits with the use of the *reflective journal* where actions, thoughts and concepts were intertwined. Memoing
included place holders where useful ideas were noted as they struck. Other memos became comments for actions to follow up on in the direction of research. Brief “one-liners” as well as lengthier reflection-style memos were used.

3.6.6. Data Display

Once the data had been collected, a variety of displays were used to draw and verify descriptive conclusions about the phenomena in the bounded context. Display formats generally fall into one of two basic types: either a matrix display or a network display and can be simple to complex and “as various as the imagination of the analyst” (Miles & Huberman, 1994, p. 93). Matrices involve the crossing of two or more variables, sometimes with sub-variables, to see how they interact. Matrices were used extensively to collate the broad spectrum data sources into themes or patterns. Matrices were created with an increasing level of granularity to address specific purposes, for example the five social-ecological heuristics and the sub-variables within those (see Appendix 5: Table A 5.1, and Tables A 5.4 to A 5.8).

Networks (nodes or points connected by links or lines) were used extensively during the data analysis and display as a way of identifying the relationships and multiple variables within the organisation. Networks were also used to describe processes, including chains of communication, and as a means of identifying gaps and areas for improvement. Some early development of networks and subsequent changes to networks have been included in this study because they show the progression of thinking, as well as the rapid on-ground changes within the organisation which became an essential part of demonstrating transformation in the case.

3.7. Ethical Considerations

3.7.1. Ethics Processes

Part of the learning experience during this Ph.D. study was that of growing as an ethical practitioner and researcher. That research journey was shaped by working through my responsibilities to the institutions with which I am affiliated; USQ as
researcher and CSU as a researcher and professional practitioner. The University of Southern Queensland and Charles Sturt University are committed to the Australian Code for the Responsible Conduct of Research, issued jointly by the National Health and Medical Research Council, the Australian Research Council and Universities Australia.

The Ethics in Human Research Committee (EHRC) at CSU oversaw the implementation of the Code. Similarly, the Human Research Ethics Committee at USQ oversaw the review of the ethical acceptability of human research and advised on ethical considerations for these proposals and ensured compliance with regulatory and legislative requirements relating to human research.

USQ HREC Approval References – HO2STU702 and HO9RE066

CSU EHRC Approval Reference - 2007/127

The key ethics-related activities and associated documentation which were undertaken and/or used during this study are listed in Table A 3.1.

Over the course of the study the range of ethical considerations considered in the study were examined at an institutional and at an individual level. Key ethical considerations are described below.

3.7.1.1. Institutional level considerations.

Institutional level considerations included:

1. Permission to use CSU as a case study

   In June 2007 written permission was obtained from the DVC (Academic) to use Charles Sturt University as a case study for this research and permission for the University to be identified in the associated publications.

2. Identifying divisions, faculties and units by name

   Permission to do this was sought from the appropriate senior management of divisions and relevant faculties. Because of my professional affiliation and focus, the
Centre for Enhancing Learning and Teaching (CELT) and the Division of Learning and Teaching Services (DLTS) were the units within which most of the research work was carried out and thus had the majority of relevant documents, and meetings and professional encounters. I was in contact with the Director of CELT and subsequently, the Executive director of DLTS from the early stages of the research.

Professional conflicts - In my multi-faceted professional capacity during the course of the study, I had access to a wide range of information and was conscious of the sensitive nature of much of the data that was accessed for the study, and the ethical requirements around the need to observe personal and organisational privacy and organisational protocols. Wherever possible peers from different sections of the university were invited to review early drafts of publications in order to ensure that all areas of the University were represented accurately and fairly in the publications arising from this research.

3. Data collection

Consideration during data collection was given to the following institutional aspects:

- accessing institutional (internal) documents;
- dealing with the practicalities of organisational structural changes affecting the reporting and use of documents;
- awareness of, and appropriate use of the privilege of access to a range of CSU staff including senior staff; and
- making and using records of meetings and professional encounters, planned and unplanned.

Once the bulk of the data collection was complete (at the end of 2010), in 2011 a final variation was sought to the original Ethics clearance in order to deal with the fine detail of the use of internal documents. Permission to use internal documents was obtained from the relevant heads of divisions or dean of relevant faculties in 2012. By supplying a full list of documents to the relevant senior staff
and meeting personally with them to discuss the ethical approaches in the research I received valuable insight and further clarity into events and timelines.

4. Data analysis and writing up

During writing up care was taken around accurate representation of the University image and the use of internal documents.

3.7.1.2. Individual level considerations.

Individual level ethical considerations related to the data collection methods and in particular ensuring confidentiality. A verbal assurance was given to participants of the confidentiality of information to be shared and this was confirmed through the Ethics Information sheet and Consent form. Protocols were observed around de-identifying data, through use of participant codes.

*Interviews* – The expectations of the amount of time participants would need to invest in interviews and an assurance of confidentiality of information shared was conveyed to participants prior to interview.

*Observation and meeting notes* - The following possible risks to individual participants were noted:

The case study approach, with CSU as the focus, means that there will be a wide range of people and divisions observed in at least a passive sense. The systems analysis that forms part of the study of social ecological systems within the context of CSU will look at links, work processes & communication within/between divisions/groups. I am aware that although such processes should be publicly available or at least in-house documented, individuals may feel challenged if their work practices are seen to be investigated (Buchan 2007 05 23 EHRC Ethics Application, USQ).

Practical steps taken to reduce the possible risks to participants included obtaining consent from participants in the relevant project and professional work teams to take notes during meetings which could inform my research; consent was obtained from senior staff to identify divisions and to use relevant internal
documents. Entries made in a personal reflective journal concerning individuals or groups were de-identified using participant coding.

3.7.1.3. *Changing scope of the research.*

As the scope of the research became clearer the need arose to be able to capture a broader range of data. Ethical considerations to reflect this were dealt with through the submission, in 2009 and again in 2011, of applications for a Variation to Research to both USQ (HREC) and CSU (EHRC), (see Table A 3.1). Some of the new ethical considerations ensured that records and reflections generated from the occasional serendipitous inter-divisional meeting where prior consent was not obtained to use records of discussion could be used in this research.

This description of the Methodology and Research Design has provided the background for the first of the two studies, the ethnographic study into the technology-enhanced learning environment which is reported in Chapter 4.
CHAPTER 4: STUDY 1, PART 1 - DESCRIBING THE CONTEMPORARY TECHNOLOGY-ENHANCED LEARNING ENVIRONMENT

4.1. Introduction

Study 1, Part 1 answers the research sub-question; “How can the contemporary technology-enhanced learning environment be described?” by investigating the technology-enhanced learning environment in Charles Sturt University over the time period 2007 to 2011.

This chapter has been structured as follows: Firstly, a brief rationale and background is given. Attention is then drawn to details of the Method unique to Study 1. The Findings are presented according to five themes which emerged from the data and these same five themes are then used as primary organisers, referred to as Dimensions, for the Discussion.

My own personal understanding of the learning environment, as it stood early in the research and prior to conducting any research interviews, was influenced by involvement in a research project into blended learning.

I’m coming to grips myself with what the learning environment actually is and there’s only one answer to that, it is that it’s different for everybody…You draw the boundaries for yourself, as to what you can deal with… I draw a distinction between the learning environment which is where the learning actually happens and the broader educational environment and those are the factors that are going to impact on [the learning environment] (Buchan et al., 2009, p. 50).

The lived experience of the blended learning project gave an insight into how other people perceived the learning environment (Buchan et al., 2009). Through identifying some of the issues facing lecturers and students in the CSU learning...
environment that project helped to provide a focus for the interview questions that would be valuable to this study.

Individual perceptions and understandings of the learning environment gleaned from interviews, university documents, a reflective journal and observation and meeting notes contribute to a snapshot in time of the technology-enhanced learning environment during the time period of the study.

The following definition of technology-enhanced learning environment is pertinent to the context of this research study (see Review of the Literature – Chapter 2).

*Definition* – *Technology-enhanced learning environment in context*

The environment in which learning that is supported and facilitated by technology takes place.

**4.2. Method**

The broader approach and methodology has been described in the Methodology and Research Design (see Chapter 3) and only those aspects of the method specific to this part of the study are described here. The learning environment was described at two levels - the institutional (university) and the individual.

Internal university documents were the primary data source used for exploring the institutional perspective of the learning environment. The primary data collection method for understanding the individual perception of the learning environment was through in-depth interviews. The participants were selected because of the range of experience and viewpoints they could potentially bring to the study and represented the variety of stakeholders in the technology-enhanced learning environment (see
Table 3.3).

Interview questions sets 1 and 2 (see Appendix 3) included the following four questions which explored the interview participants’ personal understanding and perception of the broader learning environment and the contemporary learning environment in the case study institution.

- What do you understand by the term learning environment?
- Describe the features of a learning environment with which you are familiar.
- What are some of the issues and problems facing you in your current role?
- What are some of the current issues and problems facing students?

The decision was made to focus on the broader learning environment rather than to confine the questions to the more specific technology-enhanced learning environment which this case study addresses. The reason for this was that, during early discussions and prior exploratory research, the focus of the study was premised on the assumption that there is such a thing as a learning environment and that this has intrinsic value. This study thus sought to understand what individuals in the case study institution understood by the term learning environment and how they perceived the technology-enhanced learning environment in the case study institution. It was felt that to limit the interview questions to the technology-enhanced learning environment would be to limit the scope of the study.

The richness of response from participants justified this approach, with the majority including references to educational technology in their responses. Participants were also aware, from prior introduction to the research process, that the focus of the study was on the technology-enhanced learning environment and some sought clarification during the interview about the required focus of the questions. Leading participants in particular directions was avoided and the interview participants’ personal understanding and perception of the technology-enhanced learning environment was allowed to emerge from the interviews, rather than to be drawn out.
The interview data was analysed first and patterns emerged with the findings being able to be grouped into a number of themes. These themes were then used as a framework for analysing the other data sources; reflective journal, documents and observation and meeting notes. By triangulating the findings using a number of data sources it was hoped to generate some rigour to the methodology and significance to the findings. The themes were broad groupings and should not be seen as definitive but as an attempt to provide some structure to the data analysis. It was found that sometimes data presented in one theme could be used to support other themes. The following five themes are used to present the findings associated with the individual perception of the learning environment.

1. Spatial
2. Temporal
3. Social
4. Technological (including educational technology)
5. Interactions

Extensive use is made of quotations from the interview data when reporting the findings. These are reported according to citation style, indented for quotations over 40 words, and attributed to the interview participant with the use of a code thus: [IP8].

4.3. Findings

When asked, “What do you understand by the term ‘learning environment’?” interview participants admitted that it was a broad and challenging question and necessitated; “A very broad answer for a very broad question” [IP6]. Some interview participants did preparatory work prior to the interview.

I did do a search on the term “learning environment” in Google and it typically brought up CSU, so it is not as if it is that widely used. The main thing that came up was *Interact*, [however], no definition as such was given of what a learning environment is. Though when I use the term I understand it to mean
the environment in which people are learning or are being facilitated to learn. *Interact* came up very strongly linking those two terms together. [IP13]

IP10, an experienced educator directly involved with student support, gave an all-encompassing, concise description of the learning environment with a particular focus on the online learning environment.

The interaction and the communication that go on in the various ways include the teacher and learners; include the computers; the technology and the internet. Of course it incorporates the whole *Interact* online learning environment as we call it, so it would include the *Interact* subject site Tools, the learning modules, the learning outcomes, the learning activities, the getting and giving of feedback, assessment tasks, the end of subject evaluation, OES [online evaluation survey], I guess it would include the support technologies, it would include the learning design, which in this particular [subject]… was built upon a constructivist model. I am sure it also includes learner expectations, their skills and attitudes as well. That is how I have summarised it all. [IP10]

This single comment is something of a microcosm of the whole learning environment as it came to be understood from the combined data.

The institutional perspective on the learning environment is described in Section 4.3.1 of the Findings. The description of the individual perspective is presented in Sections 4.3.2 to 4.3.6 through the five themes. Key concepts from each theme have been summarised at the end of the theme as *Key words*.

4.3.1. *The Learning Environment as Defined by the University*

The perspective of the learning environment that was promoted by the University was explored in Study 1. University strategic documentation contained the discourse which underpinned many of the management decisions at that time. The discourse revealed what senior management understood and wished to convey about the learning environment and also their expectations.
A primary reference was the CSU University Strategy 2007-2011 (Charles Sturt University, 2006). There were four key Plans which supported the CSU Strategy: the CSU Learning and Teaching Plan 2007-2011; the CSU Institutional Development Plan 2007-2011; the CSU Course Plan 2007 – 2011 and the CSU Research Plan 2007-2011 (internal documents). These have been used to compile a view of the vision for the learning environment at that time. The stated institutional shared values were:

- Intellectual independence and freedom of inquiry
- The discovery, refinement, preservation and dissemination of knowledge
- Engagement with professions and communities through responsiveness, partnerships and inclusiveness
- Social justice including ethical practice and global citizenship
- Economic, social and environmental sustainability, including the responsible stewardship of resources, and
- Its staff and students, their well-being and development.

(Charles Sturt University, 2006, p. 2).

The term learning environment was not used in the 2007-2011 Strategy although there was a strong focus on the student learning experience through the Objectives of the Strategy. The objectives included the provision of flexible delivery of learning and teaching.

The CSU Learning and Teaching Plan 2007-2011 provided an insight into the strategies proposed to help the university achieve its vision for the learning environment. Objective Two of the Learning and Teaching Plan was the “Creation of a more accessible and effective learning environment”. Strategies to achieve this included:

2.1 develop the flexible and distance learning resources of CSU, including the VLE, to enhance the learning environment;
2.2 strengthen learning communities, including those which link on and off campus students, including through the Learning Commons;

2.3 enhance professional development in the use of the VLE/Flexible learning to empower academic staff to make better use of digital technologies to support learning in all modes;

2.4 develop and promulgate improved assessment strategies, including for the on-line environment and to support the development of graduate attributes;

2.5 enhance the inclusiveness of CSU's learning environments, especially through the development and implementation of an Indigenous Education Strategy; a Western Regions Strategy; and enhanced international education strategies for domestic and international students;

2.6 review calendar to remove overlapping sessions;

2.7 refurbish learning spaces at CSU to support flexible use and use of the VLE.

(Internal document – CSU Learning and Teaching Plan 2007-2011. p.3. DVC Academic)

The stated strategies acknowledged the existence of multiple learning environments and learning communities. The online environment appeared to be viewed as a learning space. However, the use of the term *virtual learning environment* (VLE) came through in the documentation as a technology and resource and not a space. The stated expectations of the VLE were “to empower academic staff to make better use of digital technologies to support learning in all modes” and, “the functions which will be available in CSU Interact are intended to strengthen virtual learning communities” (Internal document – CSU Learning and Teaching Plan 2007-2011. p.3).

There were references to the technology-enhanced learning environment. Although the transition to the new online learning environment had already begun, throughout the 2007-2011 Strategy and associated Plans the term Virtual Learning
Environment (VLE) was used. This was consistent with terminology used in core documentation when the CSU Strategy was finalised (Rebecchi, 2004; Tulloch et al., 2005). The term *online learning environment* (OLE) was introduced in mid-2006 to describe the project called “The OLE Programme” which was established to implement the recommendations of the 2005 VLE Working Party. In August 2006 the OLE Programme Steering Committee endorsed the decision to adopt Sakai as the framework for the new Online Learning Environment at CSU to support learning and teaching related activities. This would become *CSU Interact*.

University-level initiatives to support the “Creation of a more accessible and effective learning environment” (Objective 2, CSU Learning & Teaching Plan 2007 – 2011) were noted as:

2.1 Establishment of Institute for Innovation in Flexible Learning and Teaching (2007);

2.2 Learning Commons Project (2007-9);

2.3 VLE Program (ongoing);

2.4 Enhanced staff development in assessment (2007-8);

2.5 Indigenous Education Strategy (2007);

2.6 Western Regions Strategy (2007);

2.7 Review of strategies, including virtual exchange and equivalence for offshore and partnership students (2007-8);

2.8 Session Calendar project (2007-8);

2.9 Learning space refurbishment (ongoing);

2.10 Review roles and resourcing of support divisions, especially DLTS, to enable them to improve their support for flexible learning on campus.
These ten initiatives were indicative of significant work and major change in a number of areas. The combined significance of many of these initiatives in the overall system will be explored in the section on Panarchy (see Chapter 5, Section 5.3.3) as one of the primary dynamics of the social-ecological systems approach.

Closely associated with the introduction of Interact in 2007 was the potential implementation of two other systems that were an integral part of the long-term vision for the technology-enhanced learning environment. i) The introduction of a Digital Object Management System (DOMS) which would facilitate the preparation and updating of learning materials and; (ii) The proposed introduction in 2007 of an eReserve and a Rapid Print system which would provide online access to high demand articles and a print-on-demand facility for students (Internal document - Review of Performance against the Learning and Teaching Plan 2007-2011. March 2007).

A postscript to this is that the original DOMS project underwent a number of metamorphoses and it was only in 2010 that a DOMS system (the software Equella called Collections in the CSU OLE) was finally rolled out live into full production for use in learning and teaching across the university (Internal document - Report on Learning & Teaching Innovation Project – Online & blended learning. February 2011. Buchan).

The eReserve and Rapid Print projects were affected by resourcing constraints and as at early 2011 solutions had still not been implemented. There was, however, an increase in the provision of online readings through links in Interact consistent with new University policy (Internal document - Provision of Readings Policy. February 2008. DVC- Academic).

4.3.2. Theme 1 – Spatial

Participants demonstrated a range of views and perceptions of the learning environment which were able to be classified into two broad areas. The learning
environment was perceived to be firstly; a space in which learning takes place and secondly, that learning can take place in multiple different spaces.

[The learning environment is] any place where the student learning happens, so that could be anywhere from online, to the tools and systems there, to the traditional lecture theatre, to the Learning Commons, to learning over the phone, or wherever [the student] happens to be. [IP9]

“A learning environment is just a space where you learn” [IP1] with the acknowledgement that;

Everyone usually has multiple environments…One learning environment that I have is Interact where you learn with others who interact. Another one will be a physical space within a classroom…Another one will be the online communities that I am involved in. [IP1]

The interview data showed that for some there was a separation between the student and academic (staff) learning environment. “There are two learning environments at university. One is the students’ learning environment the other is the academic learning environment” [IP11]. Implicit in many other responses was a focus on the student learning environment.

For some the learning environment was all-encompassing:

To me the learning environment is everything in the world that people are involved with… the learning environment is everything around us and virtually available to us that we can use as learning tools or mediums to help us enhance learning. [IP6]

Individual perceptions hint at the complexity of the environment. For example the learning environment was described as:

A space where learning has the opportunity to occur and all the conditions and circumstances and even the influences that are in that environment that affect the learners’ capacity to learn. Which means that a learning environment
would really include tangible and intangible elements; socio-cultural context as well as the physical environment and cyberspace. [IP10]

A key feature of the learning environment which emerged from the data was that the learning environment has a boundary and that within the case study context the boundary can be extremely broad. The boundary might be physical, for example an on-campus classroom, or virtual as in an online classroom. There was a suggestion that staff perceptions of the learning environment in some way appeared to set the boundary, not only for the learning environment but also for the quality of the learning experience.

I guess it is a place where we facilitate learning…Some people take that to be a full and rich thing…other people aren’t quite so interested, or their meaning of the term learning environment is a room. [IP2]

The variety of learning experiences possible within the CSU learning environment were highlighted as enablers of learning, while at the same time acknowledging that the particular learning environment boundary can be a constraint to effective learning.

The university system has lectures, tutorials and on-campus experience and luckily we can have the field based experience. But our distance students have a whole different experience, so the issue is to think about that holistic learning experience within the constraints of the environment, both physical and virtual. [IP6]

References to the boundary of the learning environment went beyond the student learning environment. This comment from an interview participant, whose professional area was IT management, suggested that the boundary of the learning environment is not necessarily limited by a physical delineation or by technology. “I drew a pretty large boundary around that personally. That would be the greater learning environment; not just the online one.” [IP9]
There were operational references to the management of university IT systems and the boundaries of the online learning environment drawn in the case study institution.

If we were to look at just the online learning environment then that would comprise the specific list of systems that we believe to be encompassed within that boundary. At a university just about every system can be linked to the ultimate goal of learning and teaching. [But] you have to draw a line somewhere and we typically do that when we start to get into the administration of teaching versus the actual business of teaching. [IP9]

The notion of the existence of a personal, technology-enhanced learning environment emerged from the study. The role of the internet in increasing access to information was highlighted by a number of interview participants as significantly influencing their personal learning environment [IP11, IP12, IP13].

The spatial element had a strong focus on the online (virtual) aspect of the technology-enhanced learning environment. University documents and professional involvement contributed data towards describing the physical learning spaces as part of the contemporary learning environment. On the physical space level, over the period 2006-2009 a new, innovative Learning and Teaching Hub was built on my local campus, CSU Albury-Wodonga. Modern, flexible learning spaces were designed according to a pedagogical vision and included the development of a campus-wide pedagogy space map (Internal document - 2006 11 10 Thurgoona campus. Teaching and Learning Hub. Information for the learning space types – ‘linking pedagogy and space’. Rubida Research presentation).

At a management level the need for collaboration between multiple stakeholders in the design and implementation of physical learning spaces was highlighted early in the project. These stakeholders included CELT, Library Services, Student Administration, Facilities Management and the four schools no campus. The Division of Information Technology was another stakeholder in the building of the new Learning and Teaching Hub and became a key player in the
various iterations of a Users’ Working Group (the 2010 Teaching Space Working Party).

At the institutional level there was an expectation that new learning and teaching spaces would contribute to improving student learning. A number of workshops were held with stakeholders with the initial intention to obtain feedback on learning and teaching outcomes of the new, state-of-the-art spaces. At the first workshop in 2009 it became clear that the more aspirational goals of the spaces could not be realised until some of the more practical concerns had been dealt with during the settling in phase of the new buildings. These practical concerns highlighted the importance of the physical elements of a learning space. Some of those physical elements included; climate control technical operations, security access, rearrangement of furniture, hardware and software access, arrangement of the computers and data projectors to suit individual classroom seating arrangements and lack of training in the use of the technology and building controls such as air conditioning (Internal report: Report of July 2nd, 2010 Follow-up Workshop at Thurgoona on the Evaluation of the Use of Innovative Learning and Teaching Spaces at CSU).

Theme summary key words: Boundaries, space, personal, community, formal, informal, inside-outside the learning environment, physical, virtual, constrains, enables.

The data recognised the existence of physical and virtual learning spaces and that access to those was dependent on a number of other factors. The second theme which emerged from the data was time, or the temporal aspects of the learning environment.

4.3.3. Theme 2 – Temporal

The notion of a temporal dimension to the learning environment is highlighted in this response.
A learning environment encompasses the physical aspect – the timing of that, or the availability of the environment and an understanding of that from the student’s point of view. [IP12]

Of particular intrigue is the notion of the “availability” and “timing” of the learning environment. One cannot necessarily assume that the learning environment is readily available at any one time and temporal access should perhaps be part of the design. The availability and timing worked at two levels, virtual and physical.

IP12 had a senior role in IT services with a background in enterprise systems architecture and brought a systems approach to the discussion around the availability and timing at a virtual level, more specifically with Interact. IP12 related the challenges in having to create the IT “backend” which formed the virtual learning environment and the linkages of the technical aspects of Interact (SakaiCLE) with other university enterprise systems all of which needed to work together to ensure timely access to the subject learning environment.

The temporal aspects of the availability of the physical (on-campus) learning environment were raised when interview participants were asked about issues and problems that they themselves or their students faced. A lack of an electronic timetabling system led to issues in scheduling classes and students being able to find the class and the classroom [IP6]. The quality of the learning environment for part-time students and those staff taking evening classes was also raised [IP11].

The importance of the temporal aspect of the learning environment was highlighted in the discussions about blended learning. It was suggested that the online environment could not completely replace certain aspects of a face-to-face class and that students appeared to find that temporal restrictions in their modes of learning impacted on the learning experience.

If we have a blended mode, then when we want them [students] on campus, when we need them on campus, and we expect them to be on campus and it is very purposeful and strategic and that has come through a lot from students. “What am I here for? Why can’t I just do this online. Why can’t I just do that
online? What is it that requires me to be here doing this?” And so the blended is really going to highlight, “we need you here now because we need you to do this group work. We need you to collaborate with peers”, or whatever, which is quite different to expecting someone to be on campus for thirteen weeks to attend tutorials or lectures. [IP6]

University documents were a source of data that contributed to the understanding temporal features at an institutional level. During 2008/2009 the university undertook a major initiative, the Unified Session Model (USM) project, to rationalise the university calendar sessions (semesters) across the local and international calendars and to move towards a unified session model. Three shorter principal trimesters replaced the two major domestic semesters with trimesters. This change was essentially a temporal change and affected operations across the university; from all faculties to Student Administration, to the Division of Information Technology and Division of Learning and Teaching Services necessitating changes to operations, processes, software and timelines. Some of the implications for the learning environment were a decrease in student engagement hours which affected staff workload formulas (2008 04 07 Blended learning meeting – meeting notes). In those subjects requiring extensive work-integrated learning (practicum placements) the changed university calendar increased the complexity for staff and students in completing the required practicum hours (Using Interact to manage internships for final year advertising students. CSU Internal presentation. ICT-Community of Practice Forum. 25 May 2011). The issues faced by practicum students and staff could also be noted as belonging to the third theme, that of social.

In the latter stages of the research, consistent with the university’s increasing focus on practice-based education, the importance of the learning environment outside the university, which did not conform to the temporal and spatial constraints of the subject/unit based approach, became evident (Lecturer in Communication and Creative Industries – internal presentation ICT-Community of Practice, 25 May 2011).
Theme summary key words: Timing, availability, access, timetabling, constrains, enables, formal, informal, experience.

4.3.4. Theme 3 – Social

Factors which fell under the theme of social included aspects to do with people and their activity in the learning environment. Interactions between people and aspects of the environment have been separated out into a different theme and the significance of this will be explored in the Discussion.

The following people were seen to have an active role in creating and supporting the university’s student learning environment. Firstly teaching staff; including senior faculty staff, academics, tutors and markers, and secondly, support staff. These included learning skills support, educational designers, faculty administration and IT support staff in a broad ranging capacity, from Help Desk to systems development and administration (Internal document – 2006 05 29 CSU Program Strategy document v1.1).

The notion of a personal learning environment opened up a broader perspective on the learning environment [IP2]. This included the institutional perceptions and commitment to personal learning in line with enabling staff to effectively carry out their jobs (CSU Human Resources, 2011).

One aspect which emerged from the data was that the learning environment can be, and indeed needs to be, designed and created.

For me it means developing an ideal environment for students to learn in, one where students are engaged [with their subject] and where the material they are studying is interesting and relevant and adds to their learning. [IP9]

It is whatever you use to create or facilitate. It is what you wrap up your learning design in I suppose. [IP2]

We need to look beyond [support and guidance] in the sense that learning, if it really is going to be learning, is an active process and that means that learners really interpret and reshape that learning environment themselves, so we
shouldn’t see learning environments strictly as an objective reality but as a subjective reality that is a lived experience, or a lived reality, by the learners themselves. [IP10]

A significant observation was the suggestion that the learning environment is a “subjective reality”. This puts into context much of the other input from the interviews and raised the point that individuals in the same class may have a different learning experience.

Academics expressed a sense of responsibility for creating the learning environment as well as the need for a degree of control over that learning environment. The multi-modal, multi-campus CSU structure added to this challenge.

I have three cohorts in this subject. I teach on campus at Thurgoona, on campus at Wagga Wagga and distance education. It’s the same subject material but is delivered differently through those three different cohorts through different media I guess. So to me I have the core of the subject which is the information or the ideas I get. The learning environment for me is how I send it out to them which depends on which cohort they are and what technology they can access. [IP11]

The importance of a learning pathway and people interacting with a variety of components in the environment was raised. “Did the person engaged in the environment understand the paths they could take and where they were trying to get to in the end?” [IP12].

An awareness of individual student needs was also acknowledged as important in creating a supportive learning environment.

When I was teaching at TAFE and doing contract work you try and quickly get a grasp of where the individual was and where they are coming from so that you might be able to help them take the next step or not be afraid of [taking] the next step or [opening] it up wider for them so that they can [grasp] it. So how people learn, or what helps that learning environment and freeing them up
a bit from any anxiety. It is a lot about people and the other factors that create the environment. [IP12]

The Social theme included attitudes to change and to learning and teaching. Individual attitudes (staff and student), expectations, cultural aspects of a profession and academic discipline all appeared to affect the quality of the learning environment.

For me the learning environment in my discipline is a constant challenge because we are dealing with accountants who are completely instrumental and they just want the [qualification] and to know what is going to be in the exam. [IP11]

Individual attitudes to change appeared to influence interview participants’ approach to the use of new technology. Some members of the faculty of which IP6 was a member were noted for their innovation and participation in trialling new technology, especially during the rollout of CSU Interact. IP6 admitted: “I get bored easily…I like to create new challenges for myself...students needed change so we gave it a go to do something different. We know it may not work perfectly but it was a good learning experience.”

IP9 provided comment from an information technology management perspective and had this assessment of his role in, and acceptance of, change in general and in technological changes:

I can see that more often than not I have a strong hand in creating the change rather than reacting to it…[it is] excellent and I wrote a note to myself here and said if it wasn’t then I wouldn’t have this job any more. It really is that simple. If I am not au fait with the latest and greatest i.e. a doctor of technology then I really couldn’t carry the role very effectively. [IP9]

In contrast, IP8 admitted to being generally cautious in her use of technology.

I was interested in the seminar today when the mention was made of VOIP phones for instance and…I felt myself challenged...I mean, this was only
momentary but I just thought, “I don’t think I like that idea” – I felt that resistance without even knowing enough about it to form an educated opinion of it. I think I am not an early adopter in that sense. [IP8]

Despite this cautious approach to technology, IP8 was positive about the potential for the (then) new CSU Interact in 2008. “I think Interact here will be a life-saver when we are all completely familiar with it.” This was confirmed in the follow-up interview in 2009:

We had over 600 students in first and second year…taking on a subject cross-campus all new staff, casual staff who didn’t know the system, there is great potential for problems. Interact has been a lifesaver. [IP8]

There was, however, this reality check which confirmed that the expectations of technology in the technology-enhanced learning environment can be very personal.

Interact has provided a tool for something but it is [just] a tool. It has not influenced my learning environment as much as provided something that was perhaps long overdue. [IP6]

Students themselves were noted as the drivers for the uptake of new technology and IP9 hinted at the consequences for the university where staff may not be engaging with the technology.

By far the largest [problem] seems to have been to get the academics to make full use of it…That is a real challenge being faced by students. They are really quite adept and ready and keen to go. They have adapted to technology much quicker than the university has been ready to catch up with the staffing. [IP9]

The 2008 Association for Learning Technology UK conference (ALT-C) in Leeds had the theme - Rethinking the digital divide. Exposure to top researchers and a range of experiences of other institutions at an international level confirmed many of the socio-cultural factors that have been identified in this research. It also
illustrated that these factors operate at a number of levels: international, national, institutional, faculty/division and individual.

Theme summary key words: people, students, teachers, community of learners, contributions, personal attributes, roles, functions, knowledge.

4.3.5. **Theme 4 – Technological (including Educational Technology)**

The technology theme includes the findings related to the individual understandings and perceptions of the technology-enhanced learning environment in the case study institution. The findings described within the theme encompass those operational aspects of technology in its broadest sense, which were used to support learning and teaching activity, including some references to networks and systems that fell outside the definition of educational technology and ICT’s.

While interview participants brought their own unique perspectives of the CSU technology-enhanced learning environment to the study, IP10’s summary gave a concise, well-informed, holistic perspective of the technology-enhanced learning environment in the case study institution. IP10 provided comment from the perspective of student support staff (as teacher) and had had lengthy involvement in implementing new technology at CSU from the earliest days in 1998 when CSU moved online. IP10’s experience in designing and teaching a core Study Skills subject *Skills for Learning Online* from its inception in 1999 was valuable because the essence of that subject was to enable students to use the CSU online learning environment effectively for their learning, with whatever the current software and systems might be. There was this insight into the online learning environment of a subject.

*Skills for Learning Online* – and that has always been a fully online course from its beginning, I think in 1999. Currently it’s situated within *CSU Interact*, the online learning environment. So I guess the features of that learning environment… include social presence, just taking off the idea that cyberspace

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1 Consideration was given as to whether IP10 may be able to be identified from the role description and specific contextual information and permission was sought to publish the specific quoted comments
is a lived reality and it does include social presence, although students and lecturers may not often be aware of that...The interaction and the communication that go on in the various ways include the teacher and learners; include the computers; the technology and the internet. Of course it incorporates the whole Interact online learning environment as we call it, so it would include the Interact subject site tools, the learning modules, the learning outcomes, the learning activities, the getting and giving of feedback, assessment tasks, the end of subject evaluation, OES [Online Evaluation Surveys], I guess it would include the support technologies, it would include the learning design, which in this particular case...was built upon a constructivist model. I am sure it also includes learner expectations, their skills and attitudes as well. [IP10]

The notion of the systems and software which comprise the technology-enhanced learning environment as having a boundary was raised under the Spatial theme. A practical understanding of the boundary of the CSU technology-enhanced learning environment was provided from an institutional management perspective by IP9.

If we were to look at [just] the online learning environment then that would comprise the specific list of systems that we believe to be encompassed within that boundary...At a university just about every system can be linked to the ultimate goal of learning and teaching. [But] you have to draw a line somewhere and we [at CSU] typically do that when we start to get into the administration of teaching versus the actual business of teaching. [IP9]

The need for an all-encompassing view of the learning environment from an IT enterprise systems level view was highlighted [IP12]. The operational complexity, from the backend of IT systems management in a university, of effectively turning the name of a subject (unit of study) into a virtual learning environment with a physical presence (the subject site) and including the right people (staff and students) and the right tools (educational technology) to enable interaction and information sharing was highlighted.
The following individual perceptions of the technology-enhanced learning environment were noted. 2008, the year when many of the interviews were conducted, was also the year when Interact was in its first full year of operation. Although the technology-enhanced learning environment at CSU was not limited to Interact, interview participants showed a strong focus on Interact, particularly amongst those interview participants with a direct responsibility for supporting Interact in some way (IT support, learning and teaching support, student support).

There was a range of perceptions or understandings of the technology-enhanced learning environment and the perception of Interact as a set of tools, or tool box emerged strongly.

The technology is all very exciting, with a set of tools where one may choose whichever one wants – a tool box is the way I think of it. [IP13]

Interact is fantastic, where you [used to] float around on the computer trying to get forums etc. now you have this one-stop-shop that is possible. I think that that is absolutely fantastic. You can put your lectures up there, you can put your notes up there, you can put [up] any emails to your students and they get them. [IP8]

IP4 had had a lengthy association with CSU in the academic support area, spanning the introduction of a number of different technologies and provided a broader view of the technology suggesting that:

There are a lot of tools that make up the learning environment for example a philosophy lecturer uses teleconferences extremely successfully, also IVT [interactive video teaching]…Multimedia is part of the learning environment. [IP4]

The technology was noted as an interface or portal to the learning environment. Consistency in the use of technology was an important factor in influencing the learning experience. The availability of institutional guidelines (formal) and guidance (informal) around the use of technology through the design of the learning experience contributed positively towards the learning experience - when used:
Interact has become more prescriptive and in many ways that is good because it gives consistency between the students [and] between different classes. The technology is what is really exciting and makes [the learning experience] as transparent as possible for a student. [IP13]

In the early days of Interact there was evidence to suggest that where the use of technology was not supported by appropriate design of the learning experience, that the use of technology could be a potential complicating factor in designing a coherent learning experience. [IP5]

IP14 brought experience of involvement in the implementation and recent use of two different learning management systems to the study. “I think of [the learning environment] as the stage or the platform for learning and teaching.” [IP14]. His description of WebCT, as one of the original and traditional learning management systems, highlighted the tools-based nature of the LMS in commercial systems and was consistent with the participants’ experiences of the CSU equivalent, Sakai. The evolving nature of learning management systems was also highlighted.

WebCT stands for Web Course Tools and it’s about 25 tools with different roles, capabilities and affordances and so the features can let you put content up and a range of other features that allow interactive engagement with concepts, tools for supporting students and engaging with them. [IP14]

The design of the learning experience to include effective use of the technology contributed to the effectiveness of the online environment. This view was also shared by the external participant [IP14] who had been a former employee of CSU prior to 2000 and whose experience in the CSU context thus pre-dated the newer online systems.

When I was at CSU… there was a system that had a common look and feel and basic strategies promoted to enrich it and to make best use of different mediums, print, learning resources etc. Here [reference to IP14’s current university], it is hard to understand the range and diversity of practice…there is not the same quality approach, it varies with individual academics. [IP14]
Technology such as *Interact* played an important role as an *enabler* towards meeting student needs in the increasingly complex learning environment. IP6 related a successful teaching experience in the 2007 pilot of *CSU Interact* in response to student needs.

The use of self-paced online modules through *Interact*, sourcing online readings, some on-campus classes and an authentic leadership experience proved a successful formula for giving on-campus students more flexibility in their learning opportunities to accommodate student work commitments. [IP6].

Two basic student needs that were identified as factors affecting the learning environment were; “not knowing when your classes are and not getting your grades” [IP6]. The lack of suitable technology-based solutions to meet these needs were noted as contributing to a less than favourable student learning experience, and also to increased workloads for staff.

In 2008 one faculty began moving away from the campus-based course delivery to a single cross-campus course, offered on three different campuses. The previously separate cohorts were merged into large cohorts. This notably increased the complexity of the administrative aspects of teaching. Administrative aspects included finalising student grades and timetabling the technology-enabled classrooms for interactive video teaching. In the absence of an electronic grading system in 2008, IP6 related the experience of manually trying to resolve some 976 outstanding student grades at the end of semester. This involved laying out down the school corridor six metres of “pyjama sheets” - the striped computer printer paper on which student grades were printed and reconciled.

Expectations and needs cannot, however, always be met by improvements in educational technology. An example of this was interactive video teaching (IVT), a technology which had been in use at CSU for a number of years. Faculty requirements to address the on-campus delivery of courses across multiple campuses saw an increase in numbers of users as well as numbers of campus sites. IVT had not been without its technical and organisational problems and since 1999 IVT systems
had undergone regular hardware and software upgrades in line with the changing demands of users.

A DIT representative in an IVT cross-campus teaching workshop suggested that there might be a ceiling or limit to how effective a particular technology can be at meeting user needs. “This is as good as it can get for CSU” (2008 11 10 IVT Cross campus teaching workshop. Observation). Once this ceiling is reached alternative solutions need to be found. In the case of CSU this alternative came in the form of web-conferencing software (Wimba software) introduced late in 2010 (Internal document – 2011 04 Affordances of CSU educational technology).

The issue was raised as to who is responsible for managing the physical and technical requirements of campus spaces [IP9; Internal document 2010 12 08 - DIT / DFM / DLTS Teaching Space Working Party Minutes].

The notion was expressed that the tools in a technology-enhanced learning environment should not be limited to those provided by the institution and that lack of access to suitable educational technology could limit the learning experience.

There are tools out there that we can use and it does make sense sometimes to make use of those, instead of feeling that everything has to be institutionally owned. [IP1]

That was the original big picture of having everything [as] a centralised Learning Management system. Once you take the philosophical approach that that is how we are going to do it, you are tying everything down, then you don’t have the ability for people to be able to go in and use other tools. [IP2]

Tools in the technology-enhanced learning environment at CSU fell into two main areas: those provided by the institution (mainstream) and those which were not yet part of the mainstream university systems. In line with the evolution of technology at a global scale, this latter category was rapidly changing throughout the duration of the study (Johnson et al., 2009).
A number of limitations to the CSU suite of educational technology, noted from the interviews in 2008 - 2009, have since been rectified with the acquisition of new technology. This included an electronic gradebook, an electronic timetabling system and web conferencing. The current state of play in the CSU online learning environment had, since early 2009, been visually depicted in the Dashboard prepared by the (then) Director Strategic Learning, Teaching and Innovation. At the time of this study the Dashboard was regularly updated and made accessible from the Division of Learning and Teaching website, openly available from http://www.csu.edu.au/division/landt/resources/documents/l-and-tsystemsdashboard.pdf. Copies of the Dashboard (circa 2009 and 2011) have been included in Appendix 6.

Tools which were not available mainstream within CSU systems included tools which were available “out there” through means such as external hosting, cloud computing and free and open source software which staff and students could, within the limitations of university firewalls and other technical restraints, access. Discussions with academics about their practice generated this rule of thumb: if the software was unavailable mainstream from within the CSU systems but students and staff could access the application/tool from outside of the university system from home or elsewhere, then the technology could be thought of as freely available “out there”. Some of the innovators and early adopters admitted to using “out there” tools such as Facebook or portfolio tools to fulfil needs which were unable to be met by (then) current technology (Buchan et al., 2009).

Theme key words: facilitates connectedness, processes, interactions, communication, creates virtual spaces, boundaries, enables, limits.

The final theme which emerged from the data is Interactions.

4.3.6. Theme 5 – Interactions

There was evidence that learning was understood to be an active process and that interactions within the learning environment were important. Interactions fell primarily into three areas: 1) interactions between people, 2) interactions between
people and their environment, and 3) interactions between people and the learning resources or study materials. Firstly, insights into interactions between people are reported.

4.3.6.1. Interactions between people.

IP1’s insight as both a current post-graduate student and educational designer was valuable.

A lot of my experience is mostly what I see as a student … [In terms of] the features of a learning environment there has to be people there, whether it is face to face or whether it is in a virtual way, that you can interact with and you can bounce ideas off and share ideas and share resources and so on…[Thinking of] other features, usually there has to be some way of sharing those things… whereas if you are in a physical environment you can share things by passing them across or share things by expressing it, articulating it. [IP1]

Equality of person to person interaction was valued.

The learning environment should be a community of learners, not necessarily divided into experts and novices, but rather a community of learners in which there are lots of opportunities for interaction and conversations. [IP8]

The variety and value of interactions in the learning environment was described from the teacher perspective thus:

We need to recognise what value we have for the student. What value the student has in collaborating with other students by collaborating with one other student, working alone and being self-directed, working in a larger group, working in a whole class (Buchan et al., 2009).

The importance of interactions which went beyond the normal institutional boundaries of the learning environment was highlighted:

Using the Wiki in my course at [external university] was just an amazing eye-opening thing for me. Being able to have an environment outside of an LMS
which I still go into... It was a great way of developing a community that drew in more than one subject. We had five different subjects working in there. The people that I got the most interaction from and learnt the most from were actually outside of my subject. [IP1]

The technology was, however, a limiting factor in being able to achieve a similar level of interaction in the case study institution at that time.

4.3.6.2. Interactions between people and the environment.

IP11 gave a lengthy description of the three learning environments with which she was involved. The primary focus for this lecturer was the creation of opportunities for interaction in the learning environment. In the physical teaching spaces this involved adapting to the physical arrangement of particular teaching rooms and, where possible, re-arranging furniture to create spaces for interactive group activities. Where timetabling limited face to face contact (due to weekly travel between campuses for a single class) the lecturer actively used technology such as online forums. In 2008, with the advent of Interact, IP11 was experimenting with ways to increase communication and sharing of resources with the students. This active communication online was extended to the distance education cohort with the use of online Chat.

4.3.6.3. Interaction between people and learning resources.

Interaction with learning resources was noted as an important part of the learning process which provided challenges for teaching staff in getting students to engage with the study material. Subject material, learning material, study guides, media and modules were some of the terms commonly used to describe learning resources within the context of the case study institution.

We give [the students] the material and they think that is all they need. The students are not encouraged to engage with the material at a higher level. And it is a constant battle and argument amongst the teaching staff as to how to get the students to engage the material more fully. [IP11]
The development of learning resources was part of the lived experience in this study. A high portion of responsibility in my daily role during the time period of this research concerned the operational aspects of learning resource development, production, dissemination and access.

The availability of the new online technology empowered academic staff to be able to develop their own online resources and to try different ways to engage with their students. The quality assurance issues associated with the new technology were mentioned by a number of participants. The four educational designers interviewed in 2008 all expressed unsolicited concerns surrounding quality assurance of the learning experience in the online environment. “You can’t have it both ways. You can’t have total control over it and then not be responsible within it.” [IP4]

Online modules were used to create a more flexible approach to learning for on-campus students. “The students who really liked it were the high-achieving students who were self-motivated, autonomous independent learners and liked self-pacing. Strength in online modules was that they could go back to it again and again.” [IP6]

Active teaching and social presence emerged as the essential factor which could encourage the right mix of interaction with learning resources and people (Kehrwald, 2007).

You have to set it up, you have to work it all out in advance and structure it so that they know what is the appropriate behaviour or the structure of what is going to happen…if you are not going to be there - otherwise you have to have some sort of presence and that affects how and what the students do in that learning environment a huge amount. [IP2]

There was an acknowledgement that different groups of students, or cohorts, required different modes of delivery and different forms (media) of subject materials [IP7].

Theme key words: learning resources, interactions, relationships, dependencies, processes, interdependencies.
4.4. Discussion

From the analysis of the data various patterns began to emerge which have been described in the Findings as five themes. The allocation of data to specific themes was somewhat subjective. For example, although the social aspects of technology such as issues relating to attitude, acceptance, experience and expectations of educational technology were classified under Theme 3 – Social, there was no distinct boundary in this artificial construct between the social aspects of technology and the operational aspects as outlined in Theme 4 – Technology, or some of the connections as outlined in Theme 5 - Interactions. Similarly, connecting a complex cross-campus environment through technology, as in Theme 1 – Spatial, could not be separated from the technology itself.

In order to describe the key themes which emerged from the data the term Dimension has been used to try and capture the discourse of the Findings into a reusable model. At its simplest “dimension” is an “aspect” or a “level of reality” and includes references to “spatial extents”, “duration” and the “magnitude or scale of an abstract thing” (Oxford University Press, 2007a). The five themes thus become the five Dimensions of the technology-enhanced learning environment.

Although I had been working with the learning environment and its complexities for many years and had been drawing diagrammatic representations of the learning environment with its various components and interactions, the connection had not yet been made of this representation being a complex system in the theoretical sense of the term. It was only once the theoretical foundations of complex systems had been explored in depth in the light of the identification of the Dimensions of the learning environment, that the learning environment as a complex system was revealed (Reflective journal – 18 May 2011).

There were a number of basic themes in the learning environment and the features which emerged from the data could be grouped according to these basic
themes. *Figure 4.1* represents the first attempt to create a visual summary of the Dimensions of the technology-enhanced learning environment.

![Figure 4.1](image)

*Figure 4.1*. The Dimensions Model of the Technology-Enhanced Learning Environment.

4.4.1. **Spatial Dimension**

It emerged from within the discourse around the spatial dimension of the learning environment that the learning environment is a place or space where learning takes place. According to the different individual and institutional perceptions, multiple learning environments exist within the case study institution. These range from separate student and staff learning environments to a learning environment which could be all-encompassing and might include people and spaces outside the university. A primary focus was on the formal student learning environment but non-teaching staff in support roles provided insight into the possibility of learning spaces existing outside that formal environment. The notion of what is inside or outside of the learning environment was raised. There was an
awareness that there is an outside space with which students engage, that informs who they are and thus impacts on what students bring in “from the outside” [IP2, IP12]. This could be personal characteristics, attitude and prior learning experiences. There is also a personal learning environment which is separate to the formal learning environment [IP1]. This is consistent with the literature (Attwell, 2007).

The learning environment was described as having a boundary. The natural boundary was the formal classroom, subject or study unit situation. This boundary could be physical - the classroom, campus, home or work spaces; or virtual - that space created through the use of educational technology hardware and software. The academic can be seen as having a responsibility for, or needing to have some control over defining the boundary of the learning environment during the design phase. People effectively draw their own boundaries for their personal learning environment, and this connects to the informal learning environment.

The existence of a boundary to the learning environment has considerable significance. The boundary was shown to be a constraining factor in limiting the learning experience [IP2, IP11]. Similarly, if the design of the learning environment envisioned a broad boundary it could significantly enhance the quality of the learning experience by bringing in a range of social and temporal factors, which in turn could encourage a variety of learning interactions [IP1, IP5, IP6, IP12; internal document – CSU Learning & Teaching Hub Functional Brief August 2008]. This appeared to hold true for both the physical environment as well as the virtual learning environment.

The institutional perception of learning environments supported the notion of a spatial element to the learning environment. The multiple learning environments were viewed as being on or off-campus and could also be spatially aligned to regional/international locations. There was a suggestion that the learning environment can be culturally aligned, partly through the development and implementation of an Indigenous Education Strategy. The objective to “enhance the inclusiveness of CSU's learning environments” was an acknowledgement that the
learning environment could be more extensive and inclusive than it currently was (Internal document – CSU Learning and Teaching Plan 2007-2011).

From a management perspective the operational importance to defining the boundaries of the technology-enhanced learning environment was determining who was responsible for managing the physical and technical requirements of that environment.

4.4.2. Temporal Dimension

The data highlighted the existence of a temporal dimension to both the physical and the virtual environments. The temporal dimension may be more significant in the formal (classroom) learning environment than in the informal environment. In the subject/course-focused model of operations in the university the university calendar determines when the learning environment needed to be available. However, curriculum requirements such as workplace learning or professional experience, which might not correspond to the standard university calendar, were an important consideration.

Key properties of the temporal dimension were timing and availability [IP12, IP6]. In the physical, on-campus classrooms the space exists but was not necessarily always available. The appropriate time should be according to the way in which the learning experience has been designed which was usually – but not always – when a class is in progress, people are present and interaction can take place. Timetabling was an important factor. There were the administrative and technological aspects of the university operations controlling timetabling. There was also the personal aspect such as students not being able to attend a class at a particular time because of work commitments [IP 8, IP13]. Another influence was the unsuitability of the time to maximise student engagement in the learning experience, for example the timing of evening classes [IP11].

Designing the learning experience for blended and flexible learning options were some ways in which temporal constraints were overcome [IP6, IP1]. In some
cases the impetus of flexibility for adopting new approaches enhanced the learning experience in other ways.

It was shown that effective learning experiences could be designed to encompass people, places and experiences outside the classroom. Aspects of the learning environment could also be designed to continue beyond the time span of a single semester as in the case of practice-based education.

Technology emerged as a vital factor in creating the formal, virtual learning environment because it underpinned the online subject site which provided the means of communication, sharing resources and enabling interaction amongst staff and students. For some distance education students this could be their sole means of communication. There were challenges for staff who wanted to design learning experiences with temporal boundaries outside the normal university calendar, boundaries which determined the timing of availability of normal online subject and course Interact sites. In these cases the boundary became a barrier. The difference between boundary and barrier could be the degree of control one has over the boundary, which perhaps can be described as its permeability.

4.4.3. Social Dimension

The data demonstrated that the social dimension of the learning environment in this study was extensive and complex.

For discussion purposes the social aspects of the learning environment have been divided into two broad categories:

- *the people* – the actual individuals who have a role in the learning environment, and
- *the people’s contribution* - what people contribute to the learning environment; their personal attributes, knowledge, and their functions - what they do.

The social dimension could be considered to include another dimension, that of interactions. However, interactions emerged as a separate theme during the data analysis and form a separate dimension because interactions are a part of all the
dimensions. This is discussed further in Section 4.4.5 on Interactions and Connectedness.

4.4.3.1. The people.

People who have a role in the learning environment were not necessarily members of the defined, formal, bounded learning environment of a class or study cohort. There was evidence to support the importance of the influence of people outside the defined and bounded learning environment. An example of this was the formative impact on a student of prior life experience which affected the knowledge, attitude and experience they brought to the learning environment (Buchan et al., 2009). This relates back to the spatial dimension and the requirement that has been identified for the boundary of the learning environment to be drawn or defined. When considering the people who have a role in the system which is the learning environment one needs be aware that there is an inside and an outside to the bounded learning environment and that people outside a learning environment may have a direct, or less direct role. How the boundaries of the learning environment are perceived thus has implications for the design of the learning experience.

The people who were identified as playing a part in the learning environment are illustrated in Figure 4.2. This is just one representation for the data in this case study and in other institutions there will be other people and in different combinations.

The concept of a community of learners confirms that learning should not be an isolated experience but could be enhanced where the environment was designed to encourage interaction between students, academics and support staff, among others (Fraser, Anderson, & Walberg, 1982).
Figure 4.2. The groupings of people in the learning environment.
4.4.3.2. The people’s contribution.

From the key social aspects which emerged from thematic analysis people’s contribution to the learning environment has been organised broadly into two areas: personal attributes, and what they do/their actions.

*Personal attributes* included personality, attitude, experience, acceptance of change and agreement with reasons for change. These attributes appeared to affect the way people responded to change in general and to the operational aspects of the introduction of new technology. This included how individuals incorporated technology into the design of learning experiences. People’s sense of responsibility for their students and desire for control over the learning environment appeared to affect the way in which they might design the learning pathway or experience. Social presence was a key factor in the learning environment. Personal attributes were explored further in the data in the heuristic of *adaptability* (see Chapter 5, Section 5.5).

*Functions of people.* People have an active role in creating the learning environment. Key social functions included that people: bring attributes and experience into the learning environment, learn, teach, co-create the learning environment, make connections, communicate, manage technology, control, set expectations, design learning environments and experiences, support staff and students, facilitate learning, interact and introduce change.

4.4.4. Technological Dimension (including Educational Technology)

The broad term *technology* has been used to describe the dimension because the data showed that the range of technology which is required to support a learning environment extends more widely than the defined use of educational technology in this study. The technology encompassed all university IT systems and some systems beyond to the university. However, for the purposes of this study the focus was primarily on the operational aspects of the technology used to support learning and teaching, which is *educational technology*. 
The discourse suggested that technology has an active, facilitative function and is part of the process. Some of the affordances of technology were that it could be used to create virtual spaces and to facilitate communication and learning activities (Internal document – April 2011. *Supporting learning and teaching strategies with educational technologies*. Division of Learning and Teaching Services, CSU).

Technology can be a bridge or connection between physical spaces [IP4, IP10] as well as an integral part of interactions within a single (classroom) physical space. Technology was used to create the boundaries of the learning environment. This boundary is explicit in the online learning environment which is created through a learning management system such as the SakaiCLE (*Interact*). The online learning environment consisted of the individual subject site with its staff, students and included additions such as learning resources and the use of tools to facilitate opportunities for a variety of interaction and communication [IP10, IP14]. However, through good design of interactions and use of resources the boundary of a subject can be extended to encourage students to interact outside the formal, virtual classroom boundary.

Technology was also shown to be a significant limiting factor, or even barrier, in the learning environment. This could be because the design of the learning experience did not clearly articulate the expectations for students and staff in the use of educational technology [IP5, IP4], or that the proposed use of technology was inappropriate for the particular learning activity [IP2]. The technology itself (hardware and software) could be a limiting factor in terms of interface design factors such as usability, reliability, accessibility and availability.

4.4.5. *Interactions and Connectedness*

Interaction was identified from the data as a basic theme and has been reported as such in the Findings. This section of the Discussion unpacks the importance of interactions as a link between all the dimensions and the contribution of this dimension to the systems approach in this research.

By definition a system is a “group or set of related or associated material or abstract things forming a unity or complex whole” (Oxford University Press, 2007b).
In a social-ecological system the system functions because of its connectedness, where *connectedness* refers to the relationships, dependencies and interactions between the individual components of the system (Walker, Anderies, et al., 2006). Drawing on that original definition, the term “connectedness” has been chosen to describe the Dimension associated with the theme of interactions. Connectedness is an overarching term which incorporates interactions whilst also accounting for many of the broader aspects that arose from the complex relationships and interdependencies of the social systems in the case. This also establishes the link to complex systems theory which seeks to understand how order and stability arise from the interactions of many components according to a few simple rules (Mason, 2008).

Although interaction is implicit in the functioning of a system, the learning environment system is an artificial construct and as such needs to be designed and created. There also needs to be connectedness between the relevant dimensions for learning to happen. In the technology-enhanced learning environment the importance of connectedness is magnified because interaction and relationships are facilitated by the medium of technology with significant dependencies associated with the technology.

Learning is an active process. The discourse revealed that interactions in the learning environment were noted to “generate complexity”, “enable active learning and engagement with the environment”, “enable communication” and to “create the learning pathway”. There was the suggestion that in order to guide students along a certain learning pathway interactions need to be facilitated by teachers and students and did not necessarily occur naturally in the learning environment. Interaction was the key to communication at all levels and communication was noted as being particularly important amongst the many stakeholders, including non-teaching staff, active in creating and supporting the learning environment.

There was a large number of possible interactions and groupings of interactions. As a start these were grouped according to the following types of connectedness and the dimensions which the interactions support:
person – person (social); person – physical (social-spatial); person – technology interface (social, technological); person – resources (social, technological/spatial); physical – physical (spatial); internal – internal (spatial); internal – external (spatial, technological).

It is beyond the scope of this part of the research to make an exhaustive list of all the connectedness. Rather, the relationships, dependencies and interdependencies which are part of the feedback loops in a system have been integrated into the systems-level analysis of the technology-enhanced learning environment through the application of the social-ecological heuristics (see Chapter 5).

4.4.6. **Resources**

The data made mention of resources where resources refer to the physical resources or aspects of the learning environment which were required to support the learning experience. Both on and off-campus these resources included buildings, furniture, furnishings, IT hardware and software, personnel, financial and physical resources. A resources theme has not been explicitly extracted from the analysis of the data supporting the learning environment. However, the role of resources in the learning environment was a component of the data with a particular focus on learning resources (see Chapter 5).

*Learning resources* distinguishes between physical resources and those which are part of the learning experience within the context of the case. Resource-based learning was a core pedagogy which had evolved from CSU’s lengthy commitment to distance education. This commitment began in the era of the correspondence model of distance education (King, 1999) when printed study materials were posted out to students and pre-dates the availability of the digital media and extensive online systems.

Learning resources which were created by the academic can be seen as an output of the system (the learning environment) which may then be used within the system. The resources were created in conjunction with other people in the environment such as CSU’s Learning and Teaching Services’ Production section, or
a collaborative online effort with students. Resources such as readings, created outside the system, were an *input* into the system. The position and function of learning resources, as part of the learning environment system, will emerge in the investigation into the five heuristics in Chapter 5, in particular in the reporting of the heuristics of transformability (see Section 5.6) and Resilience (see Section 5.7).

Barron’s work provides insight into the place of resources (in the broadest sense of the word) in learning, and the notion of interest-driven learning activities which are boundary-crossing and self-sustaining. Barron (2006, p. 195) uses a learning ecology framework to progress our understanding of learning “across the life spaces of home, school, community, work, and neighbourhoods”.

The findings from Barron’s study demonstrate that learning to use technology is not confined to the classroom but the development of fluency of use takes place in a variety of spaces including: – home, community, school, work, physical and virtual. It also takes place across time and is not confined to school hours and time is related to the informal spaces. Learning involves interaction and interdependencies within and between multiple social groups or communities. The setting, or space, is important and leads to the theory and practice surrounding the crossing of boundaries (Jasman, 2010). This perception supports the Dimensions of the learning environment which have been established in this study.

### 4.5. Conclusion

*Research sub-question:* How can the contemporary technology-enhanced learning environment be described?

*Answer:* The technology-enhanced learning environment is a ‘Complex System’.

The proposal to investigate the potential of environmental management strategies in managing the learning environment was premised on the assumption that, like the natural environment, the learning environment has intrinsic value. The data demonstrated that people were aware of their learning environment and its
value. Part of the intrinsic value of the learning environment emerged as the place or space where learning happens. It is significant that the learning environment needs to be co-created, it does not occur naturally. It appears that where assumptions are made about the natural existence of a particular learning environment, misunderstandings can arise and key factors and processes might be forgotten in the design, development and support of the technology-enhanced learning environment.

For this research, however, the real value that has emerged from the focus on the learning environment is in establishing that the learning environment is a complex system. There is significant value in being able to “simplify” a complicated, amorphous entity of parts and interactions into a complex system. The five dimensions of the system: temporal, spatial, social, technological and connectedness (see Figure 4.1) are effectively the variables of the system. The technology-enhanced learning environment which was described in the case forms the complex system that was examined in the next stage of this research; Study 1, Part 2 – The investigation into the application of the social-ecological systems approach to the case.

The concept of a learning ecology (Barron, 2006; Brown, 2002; Looi, 2000) contributes further to the emerging picture of the technology-enhanced learning environment system. The Dimensions Model of the Learning Environment complements and adds to previous work on learning ecologies. While it is beyond the scope of this study to explore learning ecologies and associated theories of learning further, this would be an area for future research.

This investigation into describing the technology-enhanced learning environment explored new areas of semantics, taxonomy and terminology. Descriptors were adapted and developed for use in making sense of the data which was collected (see Glossary). Although developed within a single case, the findings appear to be generalisable beyond the case study. The value of a new concept comes from how it is received in the professional field. The Dimensions Model has been well received in the brief airings where it has been shared with peers. It was modified and presented at the 2012 CSU Educational Technology Futures Forum for 2020.
This is reported on in the Autoethnography (Chapter 6). The Dimensions Model was also simplified and used for CSU Ed 2012 in a visionary presentation in the style of Pecha Kuchka (Buchan, 2012b). The topic “Keeping our feet planted firmly in the air” was well received.

Finally, after examining the data and developing the theoretical underpinnings of the complex system that is the learning environment in the case, I return to the focus of this study - the learning environment. In order to ground this ethnographic study in reality and to set the scene for the next stage of the research an autoethnographic narrative has been created. The narrative draws on the lived experience of the case study. This narrative is “A Week in the Life” (see Appendix 7). The account of a week of teaching and learning presents authentic examples of staff and student experiences across the CSU technology-enhanced learning environment. The account represents a snapshot in time. From the time of writing the narrative in late 2009, to the time of completion of the thesis there were changes in technology, learning spaces, students and staff. It is based on the lived experiences of the researcher and draws wholly on research data from interviews and observation. Fictitious names have been used to protect individual privacy. Similarly, some licence has also been taken in protecting the identification of specific campuses, schools and faculties.

Individual staff and student experiences across such a large and diverse institution will vary and I take full responsibility for this account, acknowledging that it may not represent the views or experiences of all staff and students in the University. There is no intended criticism of CSU in this attempt to describe the authentic, technology-enhanced learning environment in the case study.

The narrative, “A Week in the Life”, is presented in Appendix 7.
CHAPTER 5: STUDY 1, PART 2 – INVESTIGATING THE APPLICATION OF THE SOCIAL-ECOLOGICAL SYSTEM APPROACH TO THE CASE

5.1. Overview of the Chapter

The five heuristics of the social-ecological system can be used to explain patterns of change in complex social-ecological systems. The *dynamics* of a social-ecological system can be described and understood by two heuristics: the *adaptive cycle* and *panarchy*. The *properties* which determine the dynamics of the social-ecological system are *resilience*, *adaptability* and *transformability* (see Figure 5.1.). Chapter 5 describes the in-depth examination of the application of the five social-ecological heuristics to the case. This forms the second part of Study 1. The theoretical background for each heuristic has been included in the relevant sections.

![Figure 5.1.](repeat of Figure 2.6) The five heuristics of the social-ecological system.

The five heuristics are linked and build on one another. They cannot adequately be studied and described in isolation and simple, sequential description is inadequate. In order to avoid repetition and to make the key connections between the
theoretical and practical application of the heuristics, key aspects will be cross-referenced and the reader will be directed to the relevant sections of the thesis to get the necessary background to the findings or discussion.

The dynamics of social-ecological systems; panarchy and the adaptive cycle are described first. The focus then moves to the three properties; firstly to the individual level with a description of the property of adaptability, and then to the system level with the properties of transformability and resilience.

5.2. Method

The learning environment of Charles Sturt University is a large complex system and a mix of numerous, smaller complex systems, each of which can be defined by its own boundaries and dimensions. To confine the data collection, analysis and reporting it was necessary to limit and clearly define the particular systems and sub-systems. The approach adopted to analyse and report on the extensive data collection was that of Snapshots. Each Snapshot describes a certain system in detail and uses the lens of a particular person (role) or group to analyse the specific heuristics (see Table 5.1). The Snapshot systems under scrutiny have been defined by determining their boundaries.

The boundaries of the Snapshot systems were determined by using the following criteria: functions (purpose), feedbacks (connectedness), structure and identity. These criteria were drawn from the descriptions of the heuristics (properties) of transformability and resilience where resilience was defined as the capacity of a system to experience shocks and to absorb disturbance, while retaining essentially the same function, structure, feedbacks and therefore identity (Walker, Anderies, et al., 2006).
The Snapshots were chosen to demonstrate that the social-ecological systems approach can be applied at many different levels and to illustrate the range of complex systems which exist in the case study institution.

Table 5.1. *Summary of Snapshots used to examine the Heuristics in the Case.*

<table>
<thead>
<tr>
<th>Snapshot</th>
<th>Description</th>
<th>Heuristic addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snapshot 1</td>
<td>The lens of institutional project management was used to apply the concept of panarchy to understanding the impact on people of institutional events and educational technology projects</td>
<td>Panarchy</td>
</tr>
<tr>
<td>Snapshot 2</td>
<td>The transformational impact of learning technology at an institutional level</td>
<td>Adaptive Cycle</td>
</tr>
<tr>
<td>Snapshot 3</td>
<td>The introduction of a new subject outline tool (Mandatory Subject Information Policy) in two schools in a faculty. Shows application of panarchy and nested adaptive cycles and Revolt and Remember connections between adaptive cycles</td>
<td>Panarchy &amp; Adaptive Cycle</td>
</tr>
<tr>
<td>Snapshot 4</td>
<td>Describing the changing learning and teaching support services system for the use of educational technology related to the provision of digital media learning resources to students</td>
<td>Transformability &amp; Resilience</td>
</tr>
</tbody>
</table>
The broad approach has been described in the Methodology and Research Design (see Chapter 3). Important aspects of the method specific to individual heuristics are highlighted below.

5.2.1. **Panarchy: Method Highlights**

For the purposes of evaluating the application of panarchy for describing and understanding the technology-enhanced learning environment in the case, the panarchy investigation focused on two snapshots; Snapshot 1 and Snapshot 3. Extensive use was made of university documents as a historical data source to build up a picture of the changing learning environment historical. Observation and meeting notes provided insight into the impacts of events on individuals.

5.2.2. **Adaptive Cycle: Method Highlights**

*Snapshot 2 was used to illustrate the adaptive cycle.*

Prior publications and presentations resulting from this research provided background for the application of the concept of the adaptive cycle to the case study institution. The Adaptive Cycle Framework was first presented to an academic audience during the 2008 *Ascilite* Conference in Melbourne – *Tools for survival in a changing educational technology environment* (Buchan, 2008b) where the theme was “Where are you now in the landscape of educational technology?”

Extensive use has been made of the 2011 publication, *The chicken or the egg? Investigating the transformational impact of learning technology* (Buchan, 2011). The paper was written for submission into a special issue of the *Research in Learning Technology Journal* where the theme was: “The transformational potential of learning technology”. There is a broad range of potential applications of the adaptive cycle and more specifically, the Adaptive Cycle Framework. For the purposes of this write-up, the focus will be on the application of the adaptive cycle under the theme of “transformation”. Just how far the concepts of transformation, transformability and the changing states of systems can be applied to the case study
and what value this application might have for educational management is important to this research.

Data was coded according to the four phases of the adaptive cycle (see Appendix 5, summary data, Table A 5.1, Table A 5.7 and Table A 5.8). The data was also coded and analysed with a variety of particular foci in mind. These foci corresponded with the themes or focus of the workshops, conference presentations and papers from 2008 to 2012 where the Adaptive Cycle Framework was used (see Professional Presentations and Workshops arising from the Research, page xxiv). This contributed towards a triangulation of the data. Data associated with the detailed findings from the application of the Adaptive Management Framework in workshops and seminars, including the poster representations from those workshops, are illustrated in Appendix 8.

5.2.3. **Adaptability: Method Highlights**

Interviews were a primary method of data collection for this heuristic. The questions in Sets 1 and 2 of the interview questions (see Appendix 3) targeted the interview participants’ personal understanding, attitude towards, and role in change. The following three questions probed an understanding of the adaptability of individuals and how they approached change in general. The questions also attempted to elicit ideas about personal strategies for coping with and managing change.

- Interview question 8 - Describe your ability to adapt to change? Give an example which illustrates your view.
- Interview question 9 – How would you rate your ability to adapt to technological change? Excellent, average, poor, other.
- Interview question 10 - What strategies do you personally use to manage change in general?

How individuals approached technological change and the personal strategies they adopted for managing technological change was probed through the following question:
• Interview question 11 - What strategies do you use to manage technological change in the learning environment?

Institutional processes and strategies for managing change in general, and more specifically the management of technological change, were probed through the following two questions:

• Interview question 12 - How would you rate CSU’s management of technological change in relation to the learning environment?
• Interview question 13 - What are some strategies institutions can use to better manage technological change?

The interview participants in leadership positions (Interview Set 2) were asked:

• Interview question 14 - What are some of the strategies/techniques you use in your leadership position to help others adapt to change?

Further insights relating to factors and strategies which were perceived as contributing towards an understanding of how people adapt to change in general and to technological change more specifically were synthesised from Observation and meeting notes and reflective journal entries.

5.2.4. Transformability: Method Highlights

Characteristics which could be used to describe the system and to quantify/measure or compare in order to demonstrate transformation were initially allowed to emerge from the data. Data was then sorted according to those characteristics (see Appendix 5, Table A 5.6). During the initial sorting process these characteristics were interrogated by reviewing the factors which were used to describe the Dimensions of the Learning Environment System (see Chapter 4). A preliminary analysis of the data was done by examining the function, structure, feedbacks and identity of the system under investigation. This data was then used to describe Snapshot 4, the system or stability landscape, of the learning and teaching support services system for the use of educational technology related to the provision of digital media learning resources to students.
The Dimensions of the Learning Environment were identified as: *spatial, temporal, social, educational technology* and *connectedness* (see Section 4.4). These were used to interrogate the *Institutional System Variables* which emerged during the analysis of heuristic of transformability (see Section 5.6.2).

The variables were used to analyse the functional system which had been defined according to its purpose. The data was coded and analysed according to these variables. The heuristics of transformability and resilience are closely associated and in order to prevent repetition, certain aspects of the findings related to the functions, structure, feedbacks and identity of the system are covered in the transformability section and other aspects are covered in the section on resilience. These have been cross-referenced accordingly.

5.2.5. **Resilience: Method Highlights**

The same system which was used in the application of transformability has been used to investigate the application of the heuristic of resilience. This was Snapshot 4 - the learning and teaching support system for the use of educational technology related to the provision of digital media learning resources to students.

The main sources of data which informed the resilience investigation were university documents, observation and meeting notes and the reflective journal. Follow-up interviews conducted with two leaders explored some aspects of resilience in depth. The detailed questions had multiple parts and rating scales for the participants to complete. See Interview questions Sets 3a and 3b (Appendix 3).

The data on resilience was collected concurrently with the data contributing to understanding the heuristics of adaptability and transformability. The Institutional System Variables identified in the investigation into transformability were applied to the case through the heuristic of resilience.

The findings were reviewed using the lens of my own sphere of influence, or locus of control from within the scope of my professional role at that time (see Figure 3.4). Thus, the locus of control of any shock/disturbance at the Faculty/division level or above was external to my system – although the effect of a
shock/disturbance which originated outside that locus of control may have had an impact across a number of levels. This provided a means of confining the data collection and analysis and focusing the investigation; although it is acknowledged that there is a degree of personal interpretation in this method.

For the purposes of distinguishing between the heuristic of resilience and the more general over-arching concept of Resilience the following convention (see Glossary, p. xxvii) was established for the use of terminology. Resilience (capital R) is used for the overarching concept and resilience (small r) refers to the heuristic. The more general application of resilience outside of the environmental management field (in this study) is denoted by resilience (small r).
5.3. **Heuristic 1 - Panarchy**

5.3.1. **Background**

Panarchy is an all-encompassing approach to observing systems. It requires one to look at the big picture and interactions of systems at a variety of temporal and spatial scales. One of the essential features of panarchy is that it turns hierarchies into dynamic structures (Bunnell, 2002). Panarchy is a systems analysis tool used for describing and understanding the dynamics, complex interrelationships and the influences of a variety factors on the environment.

The term *panarchy* stems from work by Gunderson et al (1995) and Holling, Gunderson and Ludwig (2002) who have developed and tested theories that explain transformational change in systems of humans and nature. They coined the term *panarchy* to describe their developing theory. The original promise of the theory was that it would be capable of being used to organise the understanding of economic, ecological and institutional systems and would help to explain the situations where these three types of systems interact. The theory thus has a cross-scale, interdisciplinary and dynamic nature (Holling, Gunderson, & Ludwig, 2002). The interdisciplinary aspect of the theory is particularly relevant to the research problems posed in this study since it provides a way to integrate across disciplines to enhance the understanding of linked institutional, social and economic systems.

The theory attempts to “rationalize the interplay between change and persistence, between the predictable and the unpredictable” (Holling, Gunderson, & Ludwig, 2002, p. 5). In nature this change takes place across space (local to regional and global levels) and time (months to millennia). The growing impact on the Earth’s atmosphere and on international economic patterns has led to the study of cross-scale influences. Such examples include the impact of climate change on regional ecosystems and on local human health, or of economic globalisation on regional employment and the environment.

The use of terms such as *millennia, panarchy, regional* and *global* and the scale of the original use of these theories of adaptive change may seem too
theoretical to be of practical use in the field of educational technology. However, what these terms signify is that panarchy potentially brings to educational management a systems perspective which includes a focus on *time* or *temporal* aspects of a system - both short and especially the long-term focus. It also focuses on the *spatial aspects* of systems at local and global levels. Some examples of the application of panarchy in natural systems are given below.

*Figure 5.2* is a representation of the Everglades system from micro- to macro-level in time and space. It captures a hierarchy of factors such as vegetation, landform structures and weather that affect the system over time scales varying from hours to thousands of years.

![Figure 5.2. Hierarchy of vegetation, landform structures and the atmospheric processes for the Everglades system.](image)

(Holling, Gunderson, & Peterson, 2002, p. 67)

Holling, Gunderson and Petersen (2002) identify the phenomenon of *nested cycles*. At different scales of operation in nature, each element (plant, patch of vegetation, ecosystem or landscape) has its own adaptive cycle. Nested cycles refer to these adaptive cycles at different scales. The rate of cycling and the size of the element establish it in the space-time hierarchy.
The concept of panarchy was developed in an attempt to move away from the rigid, top-down connotations that the term *hierarchy* brought to understanding complex adaptive systems. Panarchy captures the adaptive and evolutionary nature of adaptive cycles which are nested within one another across time and space scales (Holling, Gunderson, & Peterson, 2002). The three levels of nested cycles are illustrated in *Figure 5.3*.

![Figure 5.3. Panarchical connections shown as three levels of nested cycles.](http://www.sustainablescale.org/ConceptualFramework/UnderstandingScale/MeasuringScale/Panarchy.aspx. Accessed 16 June 2013).

The features that distinguish panarchy from hierarchical representations are firstly, the adaptive cycle and secondly, the connections between levels. Three selected levels of a panarchy are illustrated, to emphasise the two connections that are critical in creating and sustaining adaptive capability. One is the “revolt” connection, which can cause a critical change in one cycle to cascade up to a vulnerable stage in a larger and slower one. The other is the “remember” connection, which facilitates renewal by drawing on the potential that has been accumulated and stored in a larger, slower cycle (Bunnell, 2002).
Panarchy theory essentially describes categories of change in those social components responding to ecological changes. These changes include gradual change, which is those human responses to ecological changes that do not involve a regime shift, and transformative change of social and ecological components into new regimes (Gunderson et al., 2006).

The decision was made to introduce the heuristic of panarchy first because it forms an over-arching view for the organisational system at temporal and spatial scales. However, a full understanding and application of panarchy requires background to the heuristic of the adaptive cycle. The reader is directed to Section 5.4.1 for background to the adaptive cycle. The application of the nested cycles of panarchy to the case will be revisited in the discussion on the adaptive cycle reported in Section 5.4.3.1.

### 5.3.2. Findings

Panarchy requires one to look holistically at the picture of space, time, people, shocks and disturbances and is an extremely broad area to research. In the environmental field, decades of research by many researchers continue to contribute to a panarchical-inspired understanding of systems in the natural environment. One cannot describe such a broad and all-encompassing theory within a single Ph.D. study which is pioneering the interdisciplinary use of the concepts. These findings present only a selection of key data and associated discussion in support of the application of the theory of panarchy to the technology-enhanced learning environment. The findings also highlight those areas which are of particular significance in grounding and linking the components of the social-ecological systems approach. The focal points are:

- factors impacting on the environment - shocks and disturbances;
- the change in educational technology and associated administrative and teaching systems at CSU; and
- para-analysis and the institutional impact scale of educational technology and teaching administrative systems.
5.3.2.1. **Factors impacting on the technology-enhanced learning environment:**

*shocks and disturbances.*

The reader is directed to the discussion on the heuristic of resilience in Section 5.7 of this chapter for more background to the identification of shocks and disturbances which underpins the investigation into panarchy (see Table 5.10.

Locus of Control/Sphere of Influence Classification of Shocks and Disturbances in a System.). Impact factors and change in systems are examined in detail in the heuristic of transformability (see Section 5.6).

A summary is presented of those events, initiatives and decisions which had an impact on the learning and teaching environment at Charles Sturt University over the time period 2007 to 2011 (see Table 5.2).

5.3.2.2. **Change in educational technology and associated administrative and teaching systems.**

The following data summarises key information concerning changes in educational technology and the associated administrative and teaching systems at CSU over the time period 1998 to 2011. This time frame corresponds to when online provision of learning resources for students was first mandated through policy in 1998, with a particular focus on the time period of this study 2007 - 2011. The teaching and administrative systems and tools used by staff at Charles Sturt University as at the end of 2011 are listed in Appendix 8, Table A 8.3. This serves as the legend for Figures 5.4, 5.5 and 5.6. There was a gradual increase in the number of systems from 1998 to 2007. After the introduction of Sakai and Web 2.0 capabilities in 2007/2008 there was a rapid increase in the number of systems and tools. This is represented in Figure 5.4, Figure 5.5 and Figure 5.6. The types of data which were used to analyse the temporal background to the technology-enhanced learning environment in the case are summarised in Table A 5.4, Table A 5.5 and Table A 5.6.
Table 5.2. *Events and Changes which Impacted on the Learning and Teaching Environment.*

(Adapted from Buchan, 2012a)

<table>
<thead>
<tr>
<th>Level of sphere of influence</th>
<th>Event/change</th>
</tr>
</thead>
<tbody>
<tr>
<td>University</td>
<td>2010 - Introduction of a new unified session model (USM) of teaching sessions; 2009 - new MSI policy and Online Subject Outline system; 2009 - Change in staffing profiles and salary ceilings; introduction of new educational technology <em>CSU Interact</em>; 2009 CSU – SCU Feasibility study</td>
</tr>
<tr>
<td>Faculty/division or unit</td>
<td>2006 onwards faculty &amp; school restructures; 2007 strategic voluntary separation – academic staff; 2008 cross-campus courses beginning; 2009 formation of new Div. of Learning &amp; Teaching Services; changing student profile; move from print to online learning resources (ongoing); lack of adequate timetabling system to support flexible delivery modes; implementation of a new OLE <em>CSU Interact</em>, introduction of new educational technology, 2009 Subject Outline Tool; 2010 – curriculum renewal; 2008-2011 CSU Ed conferences</td>
</tr>
<tr>
<td>School/division or unit</td>
<td>Academic staff shortages; changing student profile; perceived increase in workloads; course reviews and changes; research directions; increase in numbers of sessional academic staff</td>
</tr>
</tbody>
</table>
5.3.2.3. Panarchy, para-analysis and the institutional impact of educational technology and teaching administrative systems.

In order to represent panarchy within the context of the institutional technology-enhanced learning environment more accurately, a new tool, which has been named para-analysis, was developed (Buchan, 2010b). Para-analysis was described first in a publication in 2010 within the context of institutional project management for e-learning which was the theme of the journal (see extract below). The name of the tool reflects its potential application. The prefix para- suggests all-encompassing and reflects the need to look beyond and more widely than the existing organisational perspectives on project management. Analysis describes a systematic process. The intention behind the development of para-analysis was to put the people and social aspects back into e-learning considerations.

Para-analysis is a management tool that can be used to map projects in time and institutional space. It is a tool that can help an institution make decisions not simply according to physical and financial resourcing, but importantly, the potential impact the outcome of the project might have on individuals.

Panarchy was applied to the case by mapping the temporal aspects of changing technology against the perceived impact of the implementation of the technology using para-analysis. Initially the measurement criteria were relatively subjective.

The first data required are how long the event will exert an influence. This might be open-ended or have well defined timelines. Secondly, a determination of the scale of influence of the individual events is needed. In the institutional context the latter equates to how many people in the institution, or the part of the institutional population being measured, will feel the impact of the event…The impact of an event will vary according to the population…
Panarchy and para-analysis involve mapping events and thus creating a visual representation of a system over time and space. In nature the time axis (x) is usually a log scale. In this institutional context the linear time scale is years. Unlike the natural environment where there is a real physical space, the space continuum in this representation of panarchy is the levels of influence within an institution. The boundaries of the “ecosystem” or observation area, need to be determined (Buchan, 2008a). This could be the whole higher education sector, a single institution, or restricted to a certain ‘population’ within that institution. In the case study scenario the populations considered are the academic staff i.e. the teaching population only [Figure 5.4] and the Learning and Teaching Services educational design staff [Figure 5.5] (Buchan, 2010b, p. 60).
Figure 5.4. A para-analysis view of the impact scale of teaching and administrative systems used by academic staff in 2010.

(Buchan, 2010b Figure 2. p. 64)
Figure 5.5. A para-analysis view of the institutional impact scale of teaching and administrative systems used by educational designers in 2010.

(Buchan, 2010b Figure 3, p. 65)
Figure 5.6. A para-analysis view of the impact of teaching and administrative systems used by academic staff in 2012.
The data used to develop the para-analysis representation in Figure 5.4 includes only those educational technologies (tools/systems) or administrative systems used by academics in their teaching or which academics needed to be competent in using in order to deal with administrative duties associated with teaching; student grades and course administration. Similarly, Figure 5.5 illustrates the impact of those educational technologies which educational designers needed to be competent in using in order to support academic staff in e-learning delivery and learning resource development.

Differences in the perceived impact of new educational technology on educational designers and academics were illustrated by adopting a panarchical approach, through para-analysis. These differences have significance in the application of the data to management situations. Academics were required to be familiar with more systems than were educational designers, in particular systems supporting the administrative aspects of the role which included grade management and course administration. The move to the use of new technology for some administrative work opened up new areas of need. These included support for academics and administrative staff by way of training and adequate workload (time) allocation to become familiar with the new technology and to carry out the necessary course and subject administration. The new administrative technology also had an impact on educational designers who became increasingly involved with supporting the use of the new administrative systems, where previously they had not been involved with supporting academics in that aspect of academic work.

The 2010 representation of para-analysis (see Figure 5.4 and Figure 5.5) attempted to capture the impact of individual Interact tools. Some tools had a relatively small impact compared to larger systems such as Interact as a whole or MSI (subject outline tool). However, these are important measures because within the context of project management for e-learning, each of these represents a single project and a particular investment for the university. The impact of individual tools and events was observed to vary between academics and educational designers. It was apparent that there can be no single measure of the impact of a technology. What might have had a major, negative impact in one school or faculty was less negative
and even had a positive impact in some other areas. This is aligned with the heuristic of resilience and is covered in more detail in the investigation into Resilience of the system.

Panarchy was used as a way of providing a contextual overview to the changing learning and teaching environment at CSU as part of a research project on learning leadership and transformative processes (2012) (Buchan, 2013). Para-analysis was used to analyse the impact on academics of the changes in educational technology between 2010 and 2012 and the para-analysis map was updated for the educational technology used by academics (see Figure 5.6). At a fairly advanced stage of writing up the findings of this research this was a timely opportunity to reflect on the value of panarchy, through the use of para-analysis. Also to review the accuracy of some of the predictions made in 2009 about the timing and impact of technologies.

In keeping with the DE HUB project context, which focused on learning leadership and the educational (teaching) environment, the 2012 para-analysis representation included the educational technology, but not the administrative systems used by academics. The new analysis showed that there were changes in the predicted timelines for the implementation of some technology as well as changes in planned systems. For example Sakai 3 became the SakaiOAE Project. This would form CSU’s Interact2 Project with a planned implementation date of the end of 2013\(^2\) for Interact2. New technologies were introduced to the horizon (Online meeting tool, Student Experience Survey tool) and there was investment in initiatives such as mobile learning through the mLearn Project (Klapdor, 2012). Some technologies or initiatives such as the online subject outline tool which supported MSI, were observed to have a greater impact than predicted. Others had a shorter than predicted impact time frame, such as the faculty restructure and the semester realignment through the Unified Session Model.

\(^2\) In September 2012 the Interact2 Project took a new turn with CSU withdrawing from the SakaiOAE Project, due to circumstances beyond its control, and the search for a new LMS solution for Interact2 began.
5.3.3. **Discussion**

Panarchy requires one to look at the big picture and interactions of ecosystems at a variety of temporal and spatial scales. The natural environment has a distinct physical and spatial aspect to it and the temporal and spatial scales are typically represented in a relatively simple form (see Figure 5.1), although there are a number of more complex aspects underpinning this simple representation. The investigation into describing the learning environment (see Chapter 4) demonstrated that the technology-enhanced learning environment is a complex system with a number of Dimensions: spatial, temporal, social, technological and connectedness. Using only the spatial and temporal dimensions of panarchy to represent the learning environment did not accurately capture all of the key aspects of the technology-enhanced learning environment. Drawing parallels between the spatial aspects of the natural environment and the technology-enhanced learning environment presents a particular challenge because the technology-enhanced learning environment encompasses both physical as well as virtual spaces.

Panarchy was able to be applied to different populations, or groups of people, and at different times through the use of para-analysis. The outcomes of this application demonstrated that the implementation of new technology might impact differently on different groups of people. This social aspect of the technology-enhanced learning environment and the impact on people of the constantly changing technology and the shocks and disturbances affecting their broader environment emerged as an important dimension. Para-analysis has been shown to have potential as an analytical tool for applying aspects of panarchy to the technology-enhanced learning environment. The disruptive influence of technology can be positive (Balacheff et al., 2009) and this needs to be able to be captured. Some projects, such as the subject outline tool introduction (MSI project) had a widespread, and in some cases negative, disruptive impact in the early stages. After the first year when the majority of subject outlines had been entered into the new system, staff had become more familiar with the tool and more efficient processes and guidelines had been set in place within the various stakeholder domains: faculties and schools, and Learning and Teaching Services. This led to widespread efficiencies in most areas and an
increasingly positive impact as the system and processes matured over time. The positive impact of having a single source of several thousand subject outlines in a database, drawing on data from many different institutional administrative systems, was only beginning to be understood some years later with the introduction of a mandatory Annual Course Performance Report (Internal report: CSU Academic Processes and Outcomes Working Party, 2010) and increased reporting requirements in response to the new Australian national TEQSA requirements (Australian Government. Tertiary Education Quality Standards Agency, 2013). Further recommendations that could guide research into improvements and the application of para-analysis are described in Appendix 8.

5.3.4. Conclusion

Panarchy is a broad-scoping theory. The development of the theory and application of panarchy in environmental management has taken decades of work by numerous researchers and the body of research continues to grow. This study has only scratched the surface of the exploration into the application of panarchy. The other four heuristics of the social-ecological systems approach are strongly linked to panarchy and the rest of this research study will continue to build on the application of panarchy to the case.

The original promise of the theory of panarchy was that it would be capable of being used to organise an understanding of economic, ecological and institutional systems and would help to explain the situations where these three types of systems interact. Beyond the theoretical, the study of panarchy has been shown to have a practical application.

By applying a panarchical view of the learning environment to the case, the events and changes which impacted on the learning and teaching environment could be identified (see Table 5.2). The different spheres of influence include the external level, University level, Faculty/division/unit level and the school/unit level. Identifying these impacts contributes to understanding the various factors which might influence the successful implementation of new educational technology and other initiatives.
A unique contribution of this research to our understanding of the application of panarchy is the development of the tool called ‘para-analysis’. Panarchy has contributed to the development of para-analysis which is a practical tool that can contribute to developing a panarchical view of the technology-enhanced learning environment in a higher education institution. Figure 5.2 (p.150) illustrates a typical panarchical representation of a particular ecosystem. This representation is extended and applied to the technology-enhanced learning environment through para-analysis. Para-analysis can be used to map the temporal aspects of institutional technology implementations against the impact of other shocks and disturbances. Para-analysis can be described as a litmus test for understanding the institutional impact of educational technology.

Panarchy, through the development of para-analysis, has been successfully applied to project management for e-learning and provides a way to plan holistically for the successful implementation and ongoing use of educational technology (Buchan, 2010a, 2010b).

Significant investment and advances were made at CSU in the strategic management of educational technology from 2007 to 2011. Tools such as the Dashboard of Systems for ICT Enabled Learning and Teaching (see Appendix 6), the Educational Technology Framework and the Educational Technology Plan evolved over the course of the study (Philip Uys et al., 2011; Philip Uys, Keppell, McKinney, Morton-Allen, & Nelson, 2010). Plans, frameworks and lists of technologies however, are unable to capture the panarchical view, which highlights the social impact of technology over time. At the time when the educational technology projects and university initiatives were mapped using para-analysis (see Figure 5.4, Figure 5.5 and Figure 5.6), no one had yet mapped all the educational and administrative technologies by factoring in the dates of introduction and the impact of the technology on people.

By putting the concept of para-analysis out to a critical audience for peer review and input, within the institution as well as with national and international audiences, the tool and its application have been refined (see Appendix 1 - Annotated
list of Publications Arising from the Research.). Para-analysis was especially well received in the case study institution.

Understanding and applying panarchy requires a detailed understanding of the second dynamic of the social-ecological system, the adaptive cycle, which will now be reported on.
5.4. **Heuristic 2 - The Adaptive Cycle**

5.4.1. **Background**

The adaptive cycle is a key dynamic of the social-ecological systems approach. It is grounded in ecological studies and describes the dynamics of an ecosystem and how such a system might respond to changes in the environment. The adaptive cycle was introduced into the literature by Holling, Gunderson and Ludwig (2002) as a way to represent ecosystem succession and to capture the properties that appeared to shape the future responses of ecosystems, agencies and people. The authors note that their initial goal was to develop a framework of adaptive change that would have generality. “Such a framework is hardly a theory, therefore. Rather, it is a metaphor [emphasis added] to help interpret events and their gross causes” (p.33).

That early formulation of the adaptive cycle described the following general properties:

- the potential available for change – which determines the range of options possible;
- the degree of connectedness between internal controlling variables and processes – a measure that reflects the degree of flexibility or rigidity of such controls;
- the Resilience of the systems – a measure of their vulnerability to unexpected or unpredictable shocks;
- innovation occurs in pulses, there are surges of innovation when uncertainty is great and controls are weak so that novel combinations can form. Innovations are tested, some survive and adapt into the new [rapid growth] phase.

(Holling & Gunderson, 2002; Holling, Gunderson, & Ludwig, 2002)

In nature potential and connectedness are noted as being two dimensions of change.

At its simplest the adaptive cycle has two opposing modes; a development loop - the fore loop, and a release and reorganisation loop - the back loop (see Figure 5.7)
Figure 5.7. A Simple representation of the adaptive cycle.

(After Walker & Salt, 2006, p. 82).

The fore loop is characterised by the accumulation of capital, by stability and conservation. The fore loop is made up of the $r$ and $K$ phases (see Figure 5.8). The first phase is the *exploitation* ($r$) phase, a phase of rapid growth. This is characterised by readily available resources, the accumulation of structure and processes, relatively loose connections between components and the existence of high resilience. As structure and connections in the system increase, more energy and resources are needed to maintain them. In nature this corresponds to the establishment of opportunist species such as weeds and consequent ecological succession with an increasing variety and change in dominance of species. In societies and organisations this could equate to a period of rapid growth when people begin to exploit new opportunities and available resources.

The second phase is the *conservation* ($K$) phase which is usually the longest phase. The potential of capital, resources and energy stored in the system increases over time as a system moves towards the peak of the conservation phase. Net growth slows and the system becomes increasingly connected, less flexible and thus more vulnerable to external disturbances.
Figure 5.8. The first version of the adaptive cycle.


The back loop is characterised by uncertainty, novelty and experimentation. “The back loop is the time of greatest potential for initiation of either destructive or creative change in the system” (Walker & Salt, 2006, p. 82). Disturbances and changes lead to the release ($\Omega$) phase in which bonds and relationships are broken or change and the accumulated structure collapses. There is a release of bound-up resources. This is followed by the fourth phase, the reorganisation ($\alpha$) phase, in which innovation and novelty can take hold, eventually leading to another growth phase in a new cycle.

5.4.1.1. Application of the adaptive cycle in practice.

In nature. If an area of native forest is logged and clear-felled it will go through a number of predictable succession stages before it returns to a state similar to the original (if ever). Similarly, if a flood or a fire moves through an ecosystem there will be a period of disruption followed by reorganisation, then a rapid growth stage with a gradual return to a stable state, which may be different to the original state.

In human systems. The adaptive cycle can be applied to human systems (The Center for Resilience, 2009). Walker and Salt (2006) describe the example of a new business. The business begins by building up its market with new and innovative
ways of doing things (reorganisation and rapid growth phase). Over time, as it 
becomes more successful it has to become more efficient at those areas it does well 
and so invests in resources to increase efficiency. Resources such as equipment and 
personnel can become locked up in doing things in the most efficient manner, or 
 focusing on products for a particular market niche – this equates to the conservation 
*phase*. The business becomes less resilient as it concentrates on particular products or 
 modes of operation - the trade-off against retaining flexibility and possibly less 
efficiency if it retains a wide range of products. Eventually, in the face of increased 
competition, unless the business changes the way it does things, it will go broke and 
 enter the release phase. The market share it held is released and its personnel and 
capital are released to the broader industry and made available to others. These may 
be the innovators who will begin a new cycle with the rapid growth phase.

When applying a concept or theory from one discipline to another one should 
be cognisant of the potential limitations of the concept in its original field. Scientists 
note that the adaptive cycle is not an absolute or a fixed cycle but that many 
variations may exist in nature. The length of the phases, how different parts of 
ecosystems move through the phases and the factors that influence each phase will 
differ (Holling & Gunderson, 2002; Walker, Holling, Carpenter, & Kinzig, 2004).

The adaptive cycle is closely linked to the heuristic of transformability which 
is reported in Chapter 5, Section 5.2.4. In its original context transformability is 
defined as “the capacity to create a fundamentally new system when the existing 
system is untenable” (Walker, Anderies, et al., 2006, p. 8). The heuristic of 
transformability has been kept in focus throughout the investigation into the adaptive 
cycle.

The findings from this research contributed towards refining the heuristic of 
the adaptive cycle to produce the *Adaptive Cycle Framework* (Buchan, 2008b). The 
Adaptive Cycle Framework is a new tool for organisational analysis within the 
context of the technology-enhanced learning environment. Snapshot 2 - The 
transformational impact of learning technology at an institutional level; and Snapshot
3 – The introduction of a new subject outline tool, are used to explore the application of the adaptive cycle to the case.

The following questions guided this part of the research.

- Can the adaptive cycle as a dynamic of the social-ecological systems approach be applied to the case study?
- How can the adaptive cycle as a dynamic of the social-ecological systems approach be applied to the case study?
- Can the adaptive cycle be used to represent transformation and/or changes in the (defined) system and to capture the properties that appeared to shape the future responses of systems?
- Can the four phases of the adaptive cycle be used to illuminate the case?
- Can/how can the adaptive cycle be used to understand the Resilience of a system to unexpected or unpredictable shocks and disturbances?
- What is the role of innovation in the adaptive cycle as identified within the case?

5.4.2. **Findings**

5.4.2.1. *Snapshot 2 - The transformational impact of educational technology at an institutional level.*

Snapshot 2 involved investigating the transformational impact of educational technology at an institutional level. There is a broad range of potential applications of the adaptive cycle and more specifically, the Adaptive Cycle Framework. For the purposes of this write-up, the focus will be on the application of the adaptive cycle under the theme of transformation. It is important to this research that it can be understood just how far the concepts of transformation, transformability and the changing states of systems can be applied to the case study and what value this application might have for educational management.

The findings from the investigation of the transformational impact of learning technology at an institutional level are now presented. In order to demonstrate the
application of the concept of the adaptive cycle to the case extensive use will be made of the 2011 publication, *The chicken or the egg? Investigating the transformational impact of learning technology* (Buchan, 2011).

The heuristic of the adaptive cycle was developed into the Adaptive Cycle Framework in work done in 2008. The extract below describes that original representation.

No system exists in isolation but is part of the dynamics of a bigger system in both space and time...The Adaptive Cycle Framework [*Figure 5.9*] has been developed as a modified version of the original adaptive cycle. It is a framework for understanding our educational environment within the context of a case study of Charles Sturt University focusing firstly and briefly on the whole University environment, and then in more detail in the context of CSU’s online learning environment (Buchan, 2008b, p. 104).

*Figure 5.9.* The original representation of the Adaptive Cycle Framework.

(Buchan, 2008b, p. 104)

There was ongoing development of the framework in response to peer feedback and further data analysis. One area which was modified as a result of using
The framework in practice was the understanding and representation of connectedness in the system (Reflection: May 2009 LTS Learning Resource Development Workshop). Subsequent to, and independent of, the development of the Adaptive Cycle Framework the importance of connectedness has emerged from the data as an important part of the system which is the learning environment (see Chapter 4).

By actively using the framework with peers in workshops and presentations over the course of this study, by reflecting on the feedback and by relating this to the data the definition and application of the terms or descriptors was refined.

Extract from *The chicken or the egg? Investigating the transformational impact of learning technology* (Buchan, 2011, pp. 157-159)

The author has developed the Adaptive Cycle Framework [Figure 5.10] as a systems analysis tool for understanding and managing the dynamics of a changing environment, in particular the technology-enhanced learning environment, when an educational institution moves through a period of transformation brought about by the introduction of new learning technology.

The Adaptive Cycle Framework will be used here to contextualise the findings of this study and to illustrate the transformation at an institutional level that can be attributed to learning technology. The findings and deep thinking associated with this phase of the research have contributed to the further development of the framework.

The Adaptive Cycle Framework uses descriptors which are being developed as the notable factors which can be used to build up a picture of the transformation process at the institutional systems level. Because the Framework was adapted from another discipline area, the environmental management field, the original descriptors have been modified for this new applied use (Buchan 2008b). Potential refers to the capital, resources and energy stored in the system and the overall capacity to carry out the core business of
teaching. For a university the resources include the physical infrastructure; structural assets such as buildings and equipment, IT infrastructure – hardware and software; and the people i.e. staff and students. Connectedness refers to the relationships, interactions and dependencies between the individual components of the system. In technology enhanced learning environments these connections and interactions include those between the academic staff and learning and teaching support staff, connections between staff and students, the connections between IT support areas and staff and students amongst others. Stability in this context means staying the same, largely unchanging, balanced, lasting. Policy and processes are the day to day formal processes and procedures at micro- and macro-lehvels that enable an organisation to run efficiently.

Because it is a “cycle” there is effectively no beginning or end...with respect to the introduction and implementation of learning technology there is also no single ideal place in the adaptive cycle to start transforming and this will vary for each individual situation (Buchan & Uys, 2009). This research investigates how different parts of the institutional systems move through transformation since different parts of a system may move at different speeds. The Adaptive Cycle Framework is presented as a metaphor to view and understand a changing system. It provides a way to predict what is likely to happen next and to manage for this in order to provide a smooth transformation. Similarly, although all individuals will need to ‘weather’ the changes in a system during periods of change, some individuals may be better suited to operating in one phase than another.

There are four phases in the Adaptive Cycle Framework: Institutionalisation, Creative Destruction, Reorganisation and Rapid Growth [emphasis added]. The Institutionalisation (conservation) phase is usually the longest phase. The potential of capital, resources and energy stored in the system increase over time as a system
moves towards the peak of this phase. Net growth slows and the system becomes increasingly connected, less flexible and thus more vulnerable to internal and external changes.

Disturbances and changes lead to the release phase, referred to as the creative destruction phase. In this brief release phase the dynamics are chaotic, but the destruction that ensues has a creative element (Walker & Salt, 2006). Stable relationships, processes and institutional structures will be shaken up. This is a period of release of bound-up resources in which some existing structures fall apart. In nature the transition from conservation to release phase, can happen quickly for example when a fire or flood goes through the ecosystem, or more slowly for example climate change. In higher education the change may be gradual - universities responding to economic trends and competition in the sector. Sudden change can be initiated - for example changes driven by new government agendas or external environmental factors such as the Global Financial Crisis.

The creative destruction phase is followed by the reorganisation phase in which innovation and renewal can take hold. Learning technology, innovation and experimentation are the order of the day with early adopters likely to play a key role.

In order to harness the power of innovation and experimentation for long term transformation and renewal of the system, an institution needs to move into the rapid growth phase which begins the ‘mainstreaming’ of new processes. In the case of learning technology this might include new ways of teaching and new modes of support for teaching. The rapid growth phase sees an increase in potential and connectedness between the components of the system associated resources. Rapid growth is characterised by the activity of ‘opportunists’ that capitalise on the existing conditions and
opportunities (e.g. the availability of new learning technology, special project funding, professional development etc.) to help embed the learning technology as part of the mainstream, institutional system.

*Figure 5.10. The Adaptive Cycle Framework.*

(Buchan, 2011, p. 158).

The transformational impact of technology can be described in a number of ways. The transformational impact of learning technology at an *individual level* is illustrated by comparing some of the changes seen in academics and in Learning and Teaching Services support staff (see Table 5.3).

The four phases of the adaptive cycle were used to frame the transformational impacts at an *institutional level*. The phases of the Adaptive Cycle Framework have been used to contextualise some of the evidence to demonstrate the events and features related to the introduction of the new online learning environment that characterise each of the phases of the Framework. For reasons of economy only a snapshot of the evidence is provided. This evidence is presented in Appendix 8 in;
Table A 8.4, Table A 8.5, Table A 8.6 and Table A 8.7 and is discussed in Section 5.4.3. This is only a brief summary of some of the data which was analysed. The absence of a change or characteristic does not mean that it might not be exhibited by other members of that group or sample population.

Table 5.3. *Summary of Transformational Impacts of Learning Technology at an Individual Level.*

(Adapted from Buchan 2011. Table 1. p.161).

<table>
<thead>
<tr>
<th>Academic staff</th>
<th>Learning &amp; Teaching Services</th>
<th>Support Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>More adaptable to new technology, prepared to try new things</td>
<td>More critical of new technology, more accepting of technology</td>
<td>---</td>
</tr>
<tr>
<td>More (constructively) critical of new technology, higher expectations of technology</td>
<td>New skills in designing learning experiences for online medium, designing digital media - heading towards a base level technology expertise</td>
<td>---</td>
</tr>
<tr>
<td>New skills, LMS &amp; wide range of Web 2.0 tools,</td>
<td>New skills in a range of LMS &amp; Web 2.0 tools, &amp; digital media tools</td>
<td>---</td>
</tr>
<tr>
<td>New skills in designing blended learning experiences, designing learning experiences for online</td>
<td></td>
<td>---</td>
</tr>
<tr>
<td>Awareness that learning needs should drive the technology, <em>Interact</em> is only a set of tools</td>
<td>Stepping up in providing professional development around use of technology</td>
<td>---</td>
</tr>
<tr>
<td>Academic staff</td>
<td>Learning &amp; Teaching Services</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Support Staff</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp; embedding subjects in the e-learning environment</td>
<td></td>
</tr>
<tr>
<td>Increased workloads</td>
<td>Increased workloads</td>
<td></td>
</tr>
<tr>
<td>Enabling the use of new pedagogies and learning approaches with students</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Lack of trust in university IT systems (where some new tools have not worked well)</td>
<td>Lack of trust in university IT systems (where some new tools have not worked well)</td>
<td></td>
</tr>
</tbody>
</table>

5.4.2.2. **Snapshot 3 - Introduction of a new subject outline tool (Mandatory Subject Information Policy).**

Panarchy was used to examine the application of nested adaptive cycles and the Revolt and Remember connections between adaptive cycles during the introduction of a new subject outline tool in two schools in a faculty in 2009. The varying speeds at which different parts of the university moved through the adaptive cycle during the period of transformation was observed during the introduction of the new online subject outline tool. This initiative, driven by the new Mandatory Subject Information Policy (MSI), has been analysed in depth and some key reflections are reported in the Autoethnography (see Chapter 6).

The introduction of new policy and new technology meant that a new system with all its variables had to be created for the provision of subject information to students (see heuristic of Transformability, Section 5.6). New policy, new technology and new processes for publishing outlines affected academic staff, school administrative staff and learning and teaching services support staff.
The difference in speeds of the adaptive cycle was seen where some schools were observed to move more quickly through the phases than the entire faculty. Faculties in turn moved more quickly through the phases than the entire university. Schools that demonstrated successful transformation by moving more quickly through the adaptive cycle phases during the introduction of MSI were able to pass on their experiences to other areas of the faculty as well as to lobby higher authorities for improvements to the system and processes (Internal document. MSI Subject Outline System. Memo from Sub-Dean Learning & Teaching to DVC-academic and Executive Director DLTS). This is consistent with the theory behind panarchy and illustrates the remember phase in the Revolt and Remember cycles which suggests that fast levels invent, experiment and test (see Section 5.3.1, Figure 5.3).

The data showed that there needed to be a conscious managerial effort to capture the knowledge and experience of those people successfully transitioning to change. Experimentation, innovation and the development of processes and guidelines to “mainstream” that innovation towards the institutionalisation phase was noted as an important function of academic development support units such DLTS during the implementation of new educational technology and new university learning and teaching initiatives. Features which contributed to the Revolt and Remember capabilities of an institution have been summarised in Table 5.4.
Table 5.4.  *Summary of Features Contributing to the Revolt and Remember Capabilities of an Institution.*

<table>
<thead>
<tr>
<th>Revolt</th>
<th>Remember</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change agents introduce new technology/initiatives</td>
<td>Conscious managerial effort to capture the knowledge/experience of those successfully transitioning</td>
</tr>
<tr>
<td>Encourage innovators and early adopters to use new systems</td>
<td>Development of feedback loops</td>
</tr>
<tr>
<td>Experimentation and innovation are part of core role and/or culture of the school/unit etc.</td>
<td>Well-developed existing processes, stability assists changes in the variables</td>
</tr>
<tr>
<td>Feedback loops, designed and intrinsic/organic</td>
<td>Limit the number of variables changing at any one time e.g. don't change policy, process and technology at the same time</td>
</tr>
</tbody>
</table>
<pre><code>                                                             | Interdisciplinary &amp; inter-divisional committees                         |
                                                             | Focus on connectedness                                                  |
</code></pre>

5.4.3.  *Discussion*

5.4.3.1.  *Snapshot 2 - The transformational impact of learning technology at an institutional level.*

The following extract is taken from the discussion section in the 2011 paper (Buchan, 2011) and forms the bulk of the Discussion in this section.
Prior to the introduction of the new online learning environment, there has always been an extremely active learning and teaching focus at the university with school and faculty-based opportunities for people to share practice, along with regular learning and teaching conferences. From the early days in the use of learning technology (1990’s) the introduction of new tools has been accompanied by sound research and a striving for continual improvement (Cargill, 1995; Chan, Lee, & Mcloughlin, 2006; Kolowich, 2009). This study was limited to looking at the transformational impact of learning technology over a particular time frame that coincides with the introduction of a new online learning environment and the move to Web 2.0 capacity within the university to support university strategic directions.

When investing in new technology, institutions often look to a demonstration of the ‘value for money’ and want measurable, tangible benefits. This research suggests that the benefits go beyond new ways of teaching and improved student learning.

At the individual level there is evidence of transformation in a number of areas [Thesis reference, Table 5.3 and Table A 8.4 to Table A 8.7]. There has been a transformation in the skills of academic and support staff in using technology and Web 2.0 tools specifically and an increased capability in designing a variety of learning experiences to make use of the new tools. For educational designers the core role has changed and has necessitated a significant increase in skills and knowledge. Student support services staff noted that the access to technology has transformed the way they can teach and support students. There have been changes in individuals’ attitudes to technology. A pertinent transformation that has been noted is that some academic and support staff are now more discerning and aware of technology, have higher expectations and report less tolerance of systems that do not match up to expectations. For IT programmers and developers there has been a major increase in individual skills.
consistent with the development of new collaborative processes in the Sakai community for the open source software development (see Sakai website accessible from http://sakaiproject.org).

Institutional level. The implementation of the new OLE, CSU Interact, across the whole of the institution during 2007-2008 affected the entire university in some way, from faculties to student support services and staff administration…

If one were to position the case study university in the Adaptive Cycle Framework with respect to learning technology - more specifically Web 2.0 technology - the status quo in 2006, prior to the beginning of the implementation of CSU Interact, would have been in the late institutionalisation phase. At this time, because of its lack of Web 2.0 capacity, the university was extremely vulnerable to changes in the external environment (Buchan, 2008b). The beginnings of the implementation of CSU Interact in 2007 can be said to mark the start of the creative destruction phase associated with the move to the new OLE and Web 2.0 technology. At that time this was not the only phenomenon to cause ‘creative destruction’ for faculty restructures and university-wide staffing rationalisations targeting academic staff made an impact in 2006/07 and for some faculties this continued in 2008/09. Each year following the initial implementation of CSU Interact new university initiatives have been identified as having caused some degree of disruption…Some stakeholders such as the academic staff appeared to be affected by more changes to systems, processes and technology than others.

There has been constant innovation and renewal in all key areas. For those responsible for implementation of the new OLE, IT services and learning and teaching services, the innovation and renewal has taken place earlier than the ‘receivers’ of the new technology i.e. the faculties. There were ongoing new initiatives associated with learning
technology and an associated need for constant innovation and renewal in a variety of areas including institutional structures and operations. Evidence from the CSU ED 2005, 2008 and 2009 internal conferences demonstrate that innovation and renewal in learning and teaching with technology are strong in most faculties. ICT-enabled Community of Practice Forums initiated in 2009 have provided the opportunity for staff to share their innovation and use of learning technology. Some faculties and schools demonstrated a tendency towards a constant, self-generated state of innovation and renewal while for others, innovation and renewal in learning technology has been the consequence of a more ‘involuntary’ move into the creative destruction phase and the ensuing innovation and renewal as a result of the introduction of the new OLE.

There is less evidence to illustrate widespread progress through the rapid growth phase. The evidence illustrating rapid growth tends to be made up of the many small initiatives that began ‘mainstreaming’ the use of the new technology and associated support processes. At less than two years after the introduction of CSU Interact this may be expected, especially considering the other external factors and technologies [see para-analysis Figure 5.4 and Figure 5.5] that have impacted. The introduction of a new, university-wide, online subject outline system (MSI) in 2009 has been a significant impact factor that has caused a major disruption for faculties and learning and teaching support staff and appears to have affected the ongoing consolidation of the use of the new OLE and other technologies. It has also been difficult to clearly distinguish between innovation and renewal, the rapid growth phase and the move towards the early institutionalisation phase. This is an area that requires more exploration in order to refine the model.

There is evidence to confirm that parts of the system have moved into a new institutionalisation phase with respect to learning technology. There is the beginning of building-up of resources such as learning and teaching support services and professional development programmes.
There are IT staff dedicated to learning technology development, Flexible Learning Institute programmes and fellows to promote the scholarly use of learning technology. There has been major structural change at institutional level (learning and teaching services and IT services) to support ongoing strategic directions in learning technology….The system has, however, not yet reached a stability phase with respect to learning technology. This is to be expected since the institution is still in a rapid growth phase with respect to new learning technology (Buchan, 2011, pp. 167-169).

5.4.3.2.  **Snapshot 3 - Introduction of a new subject outline tool.**

Understanding and applying panarchy requires a detailed understanding of the adaptive cycle. It is now timely to re-visit an important aspect of panarchy: the application of nested adaptive cycles and the *Revolt and Remember* connections. This was done through Snapshot 3, which looked at the introduction of a new subject outline tool and associated Mandatory Subject Information Policy in two schools in a faculty 2009. Nested adaptive cycles refer to adaptive cycles at different scales. The rate of cycling and the size of the element establish it in the space-time hierarchy.

There are two connections that are critical in creating and sustaining adaptive capability. One is the revolt connection, which can cause a critical change in one cycle to cascade up to a vulnerable stage in a larger and slower one. The other is the remember connection, which facilitates renewal by drawing on the potential that has been accumulated and stored in a larger, slower cycle. These Panarchical connections are shown as three levels of nested cycles and are illustrated in the background to panarchy in Section 5.3.1, *Figure 5.3.*

The introduction of a new online subject outline tool (MSI policy) described in the findings of Snapshot 3 meant that in reality schools, faculties and an entire division – which are all different systems - had to move from one stable state system of providing subject outlines to students in print and online to the provision of fully online outlines using the database driven subject outline tool. Some schools adapted
more quickly to the new system than others. Those more autonomous schools which were not restricted by cross-campus and inter-school courses demonstrated faster cycling, with small cycles, akin to the revolt phase. Where schools shared courses, especially in a cross-campus situation, it took longer for the system to settle and the cycle took longer. However, a whole-of-faculty approach provided stability and continuity of process.

For management purposes, it was important to be able to identify those features which may play an active part in causing a critical change to cascade up to the next level. Similarly, it was valuable to be able to identify those features which enabled renewal in the system by drawing on the potential that has been accumulated and stored in a larger, slower cycle. Some of the features which have been observed to contribute to the revolt and remember cycles and capabilities of an institution have been summarised in Table 5.4 using the analysis of the MSI snapshot.

5.4.4. Conclusion

The origins of the adaptive cycle is as a metaphor taken from an environmental management context. The Adaptive Cycle Framework is a unique framework which is a direct outcome of this research. Unlike the adaptive cycle, the Adaptive Cycle Framework has distinct context-specific descriptors. It borders on being classed as a model in that measurable elements have been distinguished. This makes it generically applicable and enables it to be used to predict the patterns of development and movement through the cycle.

The questions which framed this section of the research were answered through the extensive investigation. The findings demonstrated that the heuristic of the adaptive cycle, as a dynamic of the social-ecological systems approach, can be applied to the case. This was done by using two Snapshots which were a way of defining a certain focus or lens through which to view an event or transformational process.

The adaptive cycle was successfully used to demonstrate transformational change at a variety of levels in the university through the investigation into the
transformational potential of educational technology. The four phases of the cycle were effective ways to analyse a transformational event. It was possible to extract and generalise distinct features that appeared to characterise each phase. These are listed below.

*Features of the Phases of the Adaptive Cycle Framework* (adapted from Buchan, 2011, p. 167)

*Creative destruction* – Loss of normal connections, changes in interactions amongst stakeholders, inefficiencies in operations, loss of dependencies, changes in roles, freeing up of resources/people from old ways of doing things.

*Reorganisation* – Innovation, trying new ways of doing things, trial and experimentation in day to day operations, sharing of ideas, questioning of status quo, pilots and trials of new technology, teams/communities of practice set up, inefficiencies, leadership emerges.

*Rapid growth* – New processes and procedures developed, sharing of practice, acceptance of technology, improved efficiency, leadership cemented, creating and taking opportunities to make the most use of new technology and available support opportunities, new connections, interactions and dependencies forming, collaboration.

*Institutionalisation* – Improved efficiencies in operations, long lasting relationships develop, ongoing development of processes, ongoing small-scale renewal and review and improvement of processes, building up of resources, centralised services have well developed processes and procedures.

In conjunction with panarchy the adaptive cycle was applied to the examination of nested adaptive cycles and Revolt and Remember connections. This contributed to the understanding of Resilience in the case systems. The existence of different systems and speeds of cycles within systems was determined. The cascading effects typically seen during transformation in natural systems were also observed. Further insight into the Resilience of systems to unexpected or unpredictable shocks and disturbances will be given in the Autoethnography (see Chapter 6).
The following extract from the 2011 investigation into the transformational potential of educational technology study highlight some of the key findings and insights relevant to the more generic application of the adaptive cycle to managing change in institutions.

Extract from Buchan, 2011 (pp.169-170)

Conclusions and future directions.

Transformation is not always smooth and predictable…different parts of an institutional system appear to move through the phases of transformation at different speeds. For maximum transformational benefit of major technological change, the change agents responsible for implementing new learning technology and associated support processes (IT support staff, learning and teaching services, faculty leaders, etc.) need to be prepared for regular periods of creative destruction; to spend time in the innovation and renewal phase; and to develop the necessary skills and processes to assist their own areas to move quickly through the rapid growth phase in order to reach the relative stability of the institutionalisation phase for those whom they support. In reality…there were many different initiatives and changes taking place at any one time in the university, the combined impact of which appeared to affect the realisation of the transformational potential of new learning technology…

With the need to constantly upgrade systems and to keep pace with emerging learning technologies, institutional systems need to be responsive and to have sufficient support structures in place at the institutional level to be able to quickly and effectively implement new learning technology. An assumption was made…that for institutional transformation to take place the starting point for the institution would be in the institutionalisation phase…transformation can begin at any phase in the adaptive cycle. The initiation of transformation can come effectively from areas strong in innovation and with a need for constant renewal. However, the effectiveness of that transformation will depend on how well the process is managed and supported in the institution.
A time frame of less than [five] years appears to be too short for a complete transformation to take place in the case-study institution and for the institution to return to something resembling the institutionalisation phase; that is, stability, building up resources and connections, developing policies and new processes...The original characteristics/properties by which the stable, institutionalisation phase was defined have also been questioned...The institutionalisation phase can perhaps be better described as “a period when normal business operations, i.e. effective teaching and student learning, can efficiently take place while withstanding minor internal and external changes”. Innovation and change is a good thing, but can be costly in time and resources. This does not necessarily mean that there should be no change in the institutional processes, but that the processes and the people are adaptable and resilient (i.e. able to absorb change). In terms of the Adaptive Cycle Framework, a possible “stable” but dynamic institutionalisation phase situation could be illustrated by rapid cycling (adapting) within the institutionalisation phase...and occasional generation of transformation from within the reorganisation (innovation and renewal) phase. This would facilitate innovation and renewal while retaining productivity and stability. Learning technology should never be stable and unchanging. A stable state is perhaps more effectively described as one of dynamic stability (emphasis added). This is an area for further study through the exploration of two more properties of the social–ecological systems approach – resilience and adaptability.
Figure 5.11. A Representation of a dynamic and stable institutional [system].

(Buchan, 2011, p. 169).
5.5. **Heuristic 3 - Adaptability**

5.5.1. **Background**

“Adaptability is the capacity of the social components in a system to manage resilience” (Gunderson et al., 2006, p. 62). Complex adaptive, natural ecosystems are primarily self-organising. However, because humans have the capacity for foresight and deliberate action, self-organisation in complex social-ecological systems is different. Humans’ actions will affect the system and the adaptability of the system will be influenced by the individuals and groups managing them.

Social adaptability and transformability are complex self-organising processes that involve interactions among the key actors in the system, knowledge and understanding of the system, and the provision of conditions or opportunities for change (Gunderson et al., 2006, p. 62).

The data discourse included references to *adaptability*, *adaptation* and *coping* and the interview participants used these interchangeably when responding to the questions. The environmental research literature makes a distinction between the human abilities of *adaptability* and *coping* in response to changing environmental and social conditions. The distinction between the two appears to be in the *temporal dimension*. There is a suggestion that adaptation is a longer term measure, whilst coping reflects a short term strategy (Thomas, Twyman, Osbahr, & Hewitson, 2007). Humans use both short and long term measures.

The primary aim of this part of the study was to understand the property of adaptability and how it could be applied to an understanding of the technology-enhanced learning environment in the case. This part of the study examines the capacity of the *social components* in a system to manage resilience. These social components, or actors, are the people. While individual adaptability is important, individuals are part of the institutional system and do not exist alone. The influence of the institution on individual adaptability was thus also investigated.
This research has its origins in institutional change and was premised on the notion that adaptability is an important component of being able to manage change. The questions which guided this part of the research were:

- How can one understand and measure the adaptability of individuals and how they approach change in general and educational technology change more specifically?
- What are individuals’ personal understanding, attitudes towards, and role in change?
- What is the ability of individuals to adapt to change?
- What are some of the personal strategies for coping with and managing change?
- What is the ability of individuals to adapt to technological change?
- How can the institution contribute to the adaptability of the individual?

5.5.2. Findings

The first five guiding questions probed individual perspectives on change and technological change and framed the reporting of the first part of the Findings. At the individual level four distinct patterns of responses to change and adaptability emerged. These were:

- feelings about change/attitude to change;
- personal assessment of ability to adapt to change;
- personal strategies for managing change; and
- personal strategies for managing technological change.

The final guiding question probed institutional perspectives relating to individual change and technological change. At the institutional level the following three areas emerged as contributing to adaptability of the individual:

- institutional strategies which assist individuals in managing change;
- institutional strategies which assist individuals in managing technological change; and
perceptions of/personal assessment of institutional approaches to managing change.

The findings have been grouped according to these patterns of response. The responses for adaptability at the individual level have been summarised in Table 5.6, Section 5.5.2.6.

5.5.2.1. Feelings about/attitude to change.

A range of individual attitudes and feelings towards change was recorded in the data and a selection of the data illustrating attitude and feelings is presented here.

A Leading Change Workshop was developed by CSU as part of the overall action plan to assist staff to cope with the many changes associated with the implementation of the 2007-2011 Strategy. One activity in the workshop involved sharing personal responses to a recent change in each participant’s life and there was great depth in personal sharing.

Reflection 2008 03 25 Leading Change Workshop

In a group exercise we looked at recent change that has affected us. Discourse – very powerful, “stepping outside the comfort zone”, “feel as though we are constantly trying to catch our breath”, from [School of x] where a number of staff have taking voluntary separation packages the following comments: “make us matter, show you care”, “it’s about caring, really caring”, “it’s about the humanness of the organisation”, in group discussion around change the metaphor of a tsunami was used. Another metaphor used was that of “change can be stealthy, the poison in the pond”.

In 2009, in the first two months after the formation of the new Division of Learning and Teaching Services, I provided my team with the opportunity to express their feelings. Two team members with completely new roles (administrative staff) admitted: “I am panicking this week, feeling overwhelmed.” [G7], and “It has been a
slow start …School of [x] is out of control.” [G7]. However, despite the individual moments of panic and concern, there was a positive attitude, “I like this job.” [G7]

Talking about change with people evoked distinct emotions and feelings that were captured from the discourse and discussion around change and events leading up to change.

Acceptance of change was mentioned frequently in the interviews and emerged in the data as an important focus in a number of different spheres of influence. A self-confessed change agent [IP9] admitted that “Change is inherently stressful” and identified a personal strategy for dealing with that stress. “So for me I think I reduce that stress by trying to understand the bigger picture, trying to understand that it is inevitable, that it is going to happen one way or the other. It is just a matter of time really.” [IP9]

Individual acceptance of change in general appeared to be dependent on a number of things, which differed from person to person. One interview participant in a leadership position suggested that “it is just a mind-set. Change will happen.” [IP13]

There was the suggestion that the mind-set, and thus acceptance, can be influenced by the way in which the institution communicates about a particular change (technological or otherwise).

Communication to me is what it is all about, selling it and making the [users] feel they have ownership of the new technology or the change going on…If I sat back and didn’t say anything [about faculty changes] or just gave people a bare minimum of information then people wouldn’t feel engaged but now I believe they are accepting of the fact that there is going to be change…Even though it is not what they want, they can see the benefits of the change and how it is going to work. If you went out there now and asked people what they think, they would say that they hate it but they can accept it. [IP13]

While a number of interview participants expressed the need to understand the reasons for the change in order to accept it, one interview participant expressed the
view that they personally needed to agree with the proposed change in order to accept it.

Change is such a broad area. It depends on how well the change is conducted and whether the change is something which I agree with. I think that is the bottom line. When we have things imposed on us, which invariably happens…I am not good at adapting. [IP11]

By his own admission [IP11] put forward the following strategy for managing change, “If I don’t agree with the change then I resist it actively.” There was, however, a qualification of why the individual held this position in relation to certain institutional processes. [There is] the new system of producing subject outlines 8-10 weeks in advance in some cases, when we don’t even know which courses we will be teaching on. [IP11]

A number of people suggested that they could accept change if they understood the reason for it. Associated with this was a need for institutional change to be clearly communicated.

Even if I do not agree with the reason, if at least I understand where it is coming from…I think the changes which are most difficult to deal with are those that are just dropped [on you] that you don’t know why, that you don’t appreciate where they are going with it or what the next steps are. [IP9]

Personal feelings appeared to affect attitude and ability to change. There was some resentment expressed towards technological change when viewed as being “imposed” from a higher institutional level where it was perceived that the change affected how the individual worked.

Yes there has been resistance and the reason for that was that the technology was released too early… but [also] it constructs the subject outline in a different way with different implications and people do not always understand that…and it is back to that idea of the second level of the introduction of any technology, there are unintended aspects that do need to be coped with in the long run and also just because of the workload. [IP16]
The university is imposing another unworkable system on the staff and continues to push them to use it…I am always trying to do the best job I can and so get a bit resentful or frustrated that I am not satisfying the authorities. [IP11]

Some people’s attitude to change, in particular technological change, was to approach it as a personal challenge. Attitude to change from those interview participants in leadership positions included:

I like to create new challenges for myself, students needed a change so we gave [the new approach to teaching] a go to do something different. We know it may not work perfectly but it was a good learning experience so embracing change in order to develop your own learning is a really good thing. [IP6]

I think the major change would be the move to online support and the shift away from individual consultations into group work and online support. And that has been a big shift and there is something very satisfying for both the student and the advisor, I think, to work through together. [IP8]

It appeared that people can become more accepting over time and that technological change was not always as bad as anticipated. There were the following responses when asked how they adapted to change:

On a good day, excellent. And on a bad day, probably average. And if it is really terrible day you are going to be poor, but that is the day you go and turn the [@#*] thing off and come back tomorrow with a fresh head… and then I am back to excellent [again]. I think it is happening inside yourself and how you respond to things. Maybe that is an age thing. [IP3]

“Is this it, is this all there is to it?” [staff member who had not engaged with the technology yet, pleasantly surprised] [Observation and meeting notes 2007 10 30 School Interact training session]

Using the technology oneself, creating empathy with other users, and experiencing the technology from both staff and student points of view had value.
5.5.2.2. *Personal assessment of ability to adapt to change.*

Personal assessment of ability and attitude were in some cases intertwined. Interview participants were asked to rate their own ability to adapt to change in general and to technological change more specifically. This was rated on a scale of poor to excellent (Appendix 3. Interview Sets 1 and 2). These results are summarised in Table 5.5. Interview participants demonstrated a strong self-awareness of their perceived strengths and weaknesses in their ability to adapt to change and to face technological change.

I think the demand and the expectation that I can translate what I do face to face to those other [online] environments has probably been the biggest shift I have had to make and I think I am still working through that. But initially I think I would have had a bit of resistance to that. But what I do is go away and work through it. [IP8]

I have [written down] average for me. I could have almost underlined poor, but I think that would be a bit unfair to me actually, to underline poor, because I think I often initially have some resistance in my mind to change in general but I am aware of that and I work through it. [IP8]

I am not quick to jump and run [with change]. Sometimes I don’t even recognise it as change. I need to have a purpose for it [before using it]. I would say I’m average at adapting to change. Sometimes I don’t want to change because I have to invest time in learning how to use it. It depends on the goal and the benefit of the change. [IP12]

My ability to adapt to that I suppose is interesting in that I am more often than not the agent of change not the recipient. So my adaptation to that, one would hope, is okay because I am more often than not the cause. [IP9]

Brief comments are used to identify some of the key factors or strategies noted in interview participants’ personal assessment.
Table 5.5. *Interview Participants' Ratings of Ability to Adapt to Change and Technological Change.*

<table>
<thead>
<tr>
<th>Interview participant</th>
<th>Rating – change in general</th>
<th>Comment</th>
<th>Rating – technological change</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP1*+</td>
<td>good, adaptable</td>
<td>did reconsider in follow-up interview a year later following further changes in their area of work</td>
<td>open to it</td>
<td>understated, a change agent</td>
</tr>
<tr>
<td>IP2*+</td>
<td>good</td>
<td>open to change, need to reflect down the track</td>
<td>good</td>
<td>open to it, but capacity affected by overload and other factors</td>
</tr>
<tr>
<td>IP3+</td>
<td>good</td>
<td>lots of personal change, excited about it</td>
<td>excellent-average</td>
<td>depends on the day &amp; what else is happening</td>
</tr>
<tr>
<td>IP4</td>
<td>good, adaptable</td>
<td>doesn't embrace it</td>
<td>average</td>
<td>has seen the introduction of online systems at CSU</td>
</tr>
<tr>
<td>IP5</td>
<td>good, adaptable</td>
<td>average</td>
<td>included reference to advent of computers and online at CSU</td>
<td></td>
</tr>
<tr>
<td>Interview participant</td>
<td>Rating – change in general</td>
<td>Comment</td>
<td>Rating – technological change</td>
<td>Comment</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------</td>
<td>---------</td>
<td>------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>IP6+</td>
<td>excellent</td>
<td>likes change and its challenges, leadership position</td>
<td>average</td>
<td>initiates technological change</td>
</tr>
<tr>
<td>IP7</td>
<td>average (implied)</td>
<td></td>
<td>average (implied)</td>
<td></td>
</tr>
<tr>
<td>IP8</td>
<td>average - poor</td>
<td>aware of resistance so can work through it</td>
<td>excellent - average</td>
<td>aware of resistance so can work through it</td>
</tr>
<tr>
<td>IP9*+</td>
<td>good-okay</td>
<td>a change agent</td>
<td>excellent</td>
<td>role, a change agent</td>
</tr>
<tr>
<td>IP10*</td>
<td>very adaptable</td>
<td>migrant childhood experiences</td>
<td>good</td>
<td>part of role, long history in educational technology</td>
</tr>
<tr>
<td>IP11</td>
<td>very adaptable</td>
<td>selects what changes IP want to engage with, range of skills</td>
<td>excellent - poor</td>
<td>excellent if IP has to, poor if IP does not</td>
</tr>
<tr>
<td>IP12</td>
<td>average</td>
<td>dependent on the goal and immediate need</td>
<td>average</td>
<td>dependent on pace of change, wait &amp; see</td>
</tr>
<tr>
<td>IP13*+</td>
<td>implied good</td>
<td>positive attitude, does not block change out</td>
<td>excellent</td>
<td>discipline area, leadership need, gadget freak</td>
</tr>
</tbody>
</table>
I would say it is excellent. I will actually go out to find new technologies and buy [new] technologies even [when] I don’t need [them] – [a bit of] a gadget freak. [IP13]

I would say average here too; it depends on the pace of change. I’m not always right in there at the [forefront] playing with [every new thing]. I rather watch to see what benefits the technological change could bring. [IP12]

There was an acknowledgement, however, that one’s self-perception can change over time and can be profoundly influenced by current circumstances.

5.5.2.3. **Factors affecting ability to adapt to change.**

In making an assessment of their own ability to adapt to change a number of interview participants made a qualification or justification of that assessment by suggesting factors which may have contributed to their adaptability to change.

I feel very adaptable to change. I know that is a general statement. Maybe it came because when I migrated to Australia as a boy and that was quite a big change and so you really had to learn how to roll with the punches and I guess as a family we developed the capacity to adapt and so change hasn’t ever been a fearful thing to me. [IP10]

Other things which were noted about personal assessment of ability to adapt to change were that personal capacity may change and people can get better at adapting to change. There was the admission that one can make an erroneous judgement on
one’s own ability to adapt to change which might only become apparent when circumstances arise that challenge one to put that ability into action [IP3]. In some cases this was negative and individuals were less adaptable than anticipated. In others it was positive, as seen when someone had to step up in a leadership role to guide staff through a major change in the school.

The notion of respect emerged as a factor which affected individual acceptance of institutional change. This included the perception that individuals need to be respected as professionals and that as professionals they are able to make their own judgments, as well as to question institutional decisions and processes.

Participants demonstrated different levels of adaptability to change and technological change. The correlation between ability to adapt to change in general and technological change was affected by acceptance of bureaucratically driven change. Some institutional approaches to technological change appeared to affect the adaptability of the individual to change. It was reported that poorly managed change processes can destroy the credibility of change agents [IP2] and also affect individuals’ capacity to adapt to new technology over time.

What I think staff find difficult are top down impositions. If someone says to them – “you have to do this”, they will, and you would expect them to question it. – They are academics…So I would expect that our academics don’t just get fed whatever and be expected to swallow it. I would expect them to say – “why do we have to do that?” But in terms of technology, that is why Interact was not an imposition for them. It was something they had been waiting for to enable them to do what they wanted to do. If someone came along and said “here is a new technology, you must use it” then I would expect them to say “why”…that is probably the most important in terms of working with people who have intellectual engagement with academic content and they need to be respected for their expertise. [IP6]

The increasing diversity and demands of evolving roles, for example those of educational designers, were noted as factors which made it difficult to adapt to/keep up with changes.
Some of the issues facing us are the changing role of the ED. In the early days our role was clearly defined, but there is so much diversity now we can no longer keep tabs, there are so many changes throughout the university system. [IP4]

5.5.2.4. **Personal strategies for managing change.**

A wide range of strategies were identified as being useful in assisting individuals to manage change in general.

Effective communication at all levels was seen as important to the acceptance of general and technological change.

I think that part of the process of change in an organisation is the communication. Unless there is effective communication then people won’t accept that change…It doesn’t matter whether the change has to do with technology or anything else, communication is critical. [IP13]

Change agents involved with educational technology communication were challenged.

One of the challenges of my role particularly is very often communication. It is a very human problem. It is quite simply that it is communication, it is the expectations and the management of those and much of my role is about understanding a little bit about how the business of teaching occurs and what is needed there. [IP9]

The necessity for a collaborative approach towards ownership and buy-in was noted thus;

I don’t mind change at work if people are informed, and if people are respected. It is when change occurs and you have somebody implementing change who is “well, this is how it is, and you’ll do it” as opposed to “let’s have a look at this, can we come together and see how we can do it well. [IP3]
Personal capability to change or adapt when needed was noted and an awareness of personal capacity to adapt to/cope with change emerged as a personal strategy.

That most endearing quality is the ability to adapt to change ...I quite like change and the challenges that it offers. [IP6]

We are all under pressure...But I surprise myself with my own ability to adapt to the change. I find it quite exciting, when I see the changes [in myself] and that I am handling it alright. [IP3]

There was a perception that individuals needed to somehow feel in control of a change. There was a variety of ways in which it was suggested this could be done; by selecting what one responds to;

So when you have worked in the area for a while you are able to discern things that offer more substantial and offer longer term value than just once-offs. The educational graveyard is full of failed technologies so you have to pick the ones that have sustainable longer term value. [IP14]

It was also done by analysing one’s position in the change;

One strategy I use is to try to appreciate that it is change I am experiencing and to work out at what stage I am in during the process of change. There is change happening everywhere. In my role I am working with people who in their own change cycle of activities. You need to remember that time is important and I can’t solve all problems in a day. One needs to be realistic. [IP12]

Getting personally involved was suggested as a good strategy for understanding and accepting change.

Once you are informed about change you have investigated it and you have decided what is driving it, you have worked out why the change is happening and you have tried to understand these things then that is the second step which leads on to the third step, that basically you are in control of the changes…and
if possible then you try to be personally involved in the process of change. [IP10]

Reflecting on the change in order to understand the change and one’s personal position in it was also an effective strategy.

Well, reflection…and analysis. Often my initial reaction I won’t accept as the final one. So I will reflect on my own – both my thoughts and my feelings – recognise what they are and then re-think what it was I was reacting to and make sure it is more balanced or more complete and then reach a new level of understanding for myself. And this is something I have just worked out that I need to do because of the pace of change. [IP8]

Another personal coping strategy was that of drawing on inspiration.

When change is happening I have a quote which I read which helps me when I feel stressed. If I need to deliver, it helps me. I had the quote stuck in my diary to remind me on those days when I am feeling a bit stressful. [IP12]

Another strategy for coping with change was using change as an opportunity for learning. “Looking at change as an opportunity for learning is really useful for me.” [IP6]

So my strategy is to see myself as a lifelong learner. And to see that as a regular part of what I need to do to be affective…I do like to attend training and seminars. I take opportunities when I see them as relevant to me. [IP8]

In adapting to change it is a matter of being aware of smart processes and how you incorporate these into your own practice. [IP14]

Having a range of skills was seen as contributing to individual adaptability.

I would say that I am very adaptable to change because I have a range of different skills. I have a very different approach to teaching [subject X] compared to my approach to teaching [subject Y]. [IP11]
One senior staff member [G10] shared the following personal strategy around managing change within their school; “I don’t confront the detail until it is time to do it.” [Observation and meeting notes 2009 03 09 Sch of [X], Head of School meeting]. Supplementing this strategy was [G10’s] ability to co-opt others to help out at the last minute, by engaging volunteers or employing extra staff. It is noted that this particular school reported significant issues during the implementation of the new subject outline tool [2010 03 31 Memorandum MSI Subject Outline System. Internal report].

5.5.2.5. Personal strategies for managing technological change.

Interview participants used a range of strategies for managing technological change in the learning environment; such as accepting the technology and not questioning it. You just learn it. If I don’t know I just go and get help. And most software now is so well designed that once you get into the habit of using it, it becomes very obvious how it works. [IP11]

When you are with technology all the time you just accept that change is going to occur, for example that your iPhone or iPod is going to be upgraded - or anything – you should just accept it. Once you start trying to question it or say that you don’t understand it, then you’re lost. [IP13]

Some interview participants sought others’ advice about choice of, and how to use, technology. Even those in leadership positions made use of others’ expertise.

Because I am not inherently technological myself I have to rely on other people’s expertise in the use of technology so I am enthusiastic about using it but I really do like to have people explain to me not the what, not why but how…I need to surround myself with people who are much more technically competent than I am to make things happen. [IP6]

Observing what others are doing before adopting technology oneself, was another strategy.
I have watched other initiatives in the school and wanted to see how those go mainly because I am trying to juggle my PhD as well as do everything else but you have got to be sensible about what you do take on. [IP3]

Some individuals acknowledged actively resisting technological change in the early stages.

All of us experience the change with systems such as the university’s decision to change over to Vista [sic Office 2007], which caused quite a few problems with those systems that have been working in Excel. I am trying to resist that change until I have time [to do get it working properly] and until more people are using it. [IP11]

Others admitted to actively seeking out new technology. Those in this category often had a leadership or change agent role. I will actually go out to find new technologies and buy new technologies even [when] I don’t need them – I am a bit of a gadget freak.’ [IP13]

Data was collected on the experience of the technology from both staff and student points of view. During a review session with pre-service teachers on a cyber-bullying role play subject, students reported that they got a good deal of empathy and understanding of the technology by using it so can relate to how their pupils might feel. [2009 08 12 Cyber bullying feedback session with students. Observation and meeting notes]

Being critical users of technology emerged as a significant factor.

The main strategy, because I have been in this area for a while is to ask, is it going to value add and help to advance on present practice, I keep a watching brief on what is happening and eventually make a decision about whether [the technologies] value add to what you are doing now. [IP14]

I think the trick is to accept. Not blindly accept, but to look at [what a new technology] can do for you. If I critically analyse something [then I am able to see] what it can do for me now. [IP13]
People demonstrated the ability to learn how to be critical users of technology.

I am not an early adopter but am average to above average. I am never phased by them, I look at what they offer, but the skills are not my natural bent, but I can get help and learn how to use them myself. Because I read a bit in this area I can discern what is really worthwhile looking at and offers value in learning and teaching. [IP14]

The pressure of lack of time to learn to use the new Interact system was illustrated through the “emergency management” strategy demonstrated in this response to the question about personal approaches to using new technology.

Well its disaster management really. Emergency management…But you do what you have to and you find things [in Interact] when you have to rather than learning about them properly and doing them nice and systematically. [IP7]

Aligning oneself with a team for support was suggested.

So it seems to me in terms of adapting to change it is a matter of looking at the agendas that you become involved in with your work and often you are part of a team so you see it in the contribution of a range of people for different things that we bring to the team. [IP14]

Strategic collaboration across institutions was noted as a way for a self-confessed “non early adopter” to improve his capacity to adapt to technological change and to improve their capacity as change agents with technology.

Getting involved in projects & collaborating with others helps you to manage change. I was with an ALTC project on groups assessment and we developed a site that is publicly available on a range of ways academics assess group activity. By doing projects and going to conferences you get ideas about change and how you can get involved with it. [IP14]

The interview participants generally demonstrated very clear insight about their ability to adapt to change and technological change. There was also valuable sharing of a variety of personal strategies for managing change and technological change.
5.5.2.6. **Assessment of others’ ability to adapt to change.**

Individuals’ personal assessment of their ability to adapt to change was not the sole data source for constructing a picture of people’s ability to adapt to change. In order to provide rigour in the data collection two follow-up interviews were conducted (IP6 and IP2) to elicit information from a leadership perspective as to how those particular leaders viewed others’ ability to adapt to change. Another aim of the follow-up interviews with the leaders was to gain an understanding of how the system was changing and just how far the concepts of resilience and adaptability could be applied to the learning environment. The following questions probed aspects of individual behaviour.

*Interview question 6* (Follow-up Interview Set 3, see Appendix 3)

Rate the adaptability of the members of your school to technological changes in terms of these aspects (rating from 0 to 6 with 6 the maximum).

1. **Latitude:** the maximum amount a system can be changed before losing its ability to recover (before crossing a threshold which, if breached, makes return to the old status quo difficult or impossible – although crossing the threshold may be desirable).

2. **Resistance:** the ease or difficulty of changing the system; how resistant it is to being changed and moving into a new state.

- Speaking for your staff in general – how receptive are they to change in general?
- Speaking for your staff in general – how receptive are they to using new technology?’

One leader suggested that their staff were extremely adaptable.

It is not like most people could not be put in a very difficult situation and do good stuff. Most of them would. Like, if tomorrow our buildings were knocked down but we still had students and we had to teach them, the staff could do that. Even without *Interact* and with no technology, sitting under a tree our
staff could still teach, because that is where they come from – that is what they know. It would be challenging, it would be different but we could do it. [IP6]

In relation to technology the following rating was noted along with some possible factors contributing to achieving this rating;

I think 3-4. And this comes back to having the resources in place and I think our head of school has been fantastic in bringing new people in and employing people and promoting and putting a priority on the attendance at cross-campus workshops which helps. [IP3]

Acceptance of change appeared to change over time and in relation to change in general it was noted that;

We have done well. A year ago I would have given us [a score of] 2. But now generally I would say 4…One of the other things you do when you look at it as impact scale - acceptance changes. As an outsider you hear their stress in the beginning and you watch them across the semester until they begin to feel comfortable and the staff begin to feel positive. [IP3]

If I sat back and didn’t say anything or just gave people a bare minimum of information then people wouldn’t feel engaged but now I believe they are accepting of the fact that there is going to be change; that it is going to occur. Even though it is not what they want, they can see the benefits of the change and how it is going to work. If you went out there now and ask people what they think, they would say that they hate it but they can accept it. [IP3]

It appeared that the innate capacity or ability of an individual helped them adapt to a particular change in role or requirement to take on a new task. For example, when working through operational detail around digital media workflows and further changes to the educational designer and educational technologist roles [P3] noted that; “The vision is to make the most of the role of the ED, the role it is designed to be, need planning & workload control. [Observation and meeting notes. 2009 02 20 Faculty Managers, Digital Media workflows.]
However, I noted at the time that;

In my opinion, those EDs who have the ability are taking their work to a different level and stretching the boundaries no matter what the workload, or the school disorganisation. BUT can be unsustainable if not managed carefully. [Reflection 2009 02 20 Faculty Managers, Digital Media Workflows meeting].

Data collection encompassed interdisciplinary opportunities. In a Faculty Teacher Education Forum a number of school principals were invited to share ideas about preparing pre-service teachers (undergraduates) for their future careers. The principals noted that some of the key attributes should be:

To have people with the right emotional intelligence; that the best teachers are born but must be prepared to learn throughout their professional lives; that graduates understand the syllabus when they go out to schools and can design L&T programs. [Observation and meeting notes. School Principals’ addresses at Faculty Teacher Education Forum February 2010]

Professional judgement is the central notion in understanding how leaders can best teach students in all circumstances. i.e. if one of the objectives of the course is to empower our students to make good professional judgements they are then independent. [Observation and meeting notes. [G9] Faculty Teacher Education Forum February 2010]

It was suggested that teacher educators have a “learner dependency” issue and that instead of telling them what they need to know, they need to be able to work it out for themselves, and to work out how to gain the skills. [ [G9] Faculty Teacher Education Forum February 2010. Observation and meeting notes.]

These words of wisdom for teachers of pre-service teachers were applicable to other professionals such as educational designers whose role includes professional development, and where the topic and skills change frequently. It is also a useful perspective for managers, who have a responsibility around professional development for their own staff.
Observed adaptability – critical user.

In 2009, towards the end of the implementation of the new subject outline tool (MSI), interviews were conducted with four educational designers who had been involved in supporting academics through the change to MSI during 2009 as well as the change to Interact during 2007/2008 (see Appendix 3 Interview questions, Set 4). One aim of the interviews was to explore how institutional strategies for managing (technological) change might affect individual adaptability to technological change. This was done by attempting to understand individual responses to a second major technological change. Care has been taken to avoid making a qualitative assessment of the case study institution’s processes, but rather to draw on the extensive professional experience of the interview participants to synthesise their valuable hands-on experience.

In answer to the question “Have you found any resistance to the acceptance of MSI?” (see Appendix 3, Interview question 10, Set 4) there was this;

Yes there has been resistance and the reason for that was that the technology was released too early and there are institutional histories in that and also because the presentation of the information is not just for a technology school but it constructs the subject outline in a different way with different implications...and it is back to that idea of the second level of the introduction of any technology, there are unintended aspects that do need to be coped with in the long run and also just because of the workload. [IP16]

Another aim of the interviews with educational designers in a professional development role was to determine if any change could be perceived in individual capacity to adapt to new technology over time. Interviews probed the insight of participants on whether people were more open to changes in educational technology at CSU in 2008-2009 than they were in 2006-2007, prior to Interact (Interview question 11, Set 4).

I think they are open to change that they see is open and valuable, I don’t think they are more open to change per se. [IP1]
There was evidence that people increased their awareness of, and willingness to try, new technology.

I think people are more open to “what’s in it for me” than they might have been initially. I am thinking of a number of academics who I work with who if I had told them two or three years ago that they would be doing what they are actually doing now with technology they would have thrown up their hands in horror. But all of them are looking at ways of how they can use the technology we have got to improve what they do while keeping workloads at a manageable level. [IP15]

Thinking about some of those people who were resistant and made the biggest noise, they are changing, they don’t admit that they are changing but you see them doing stuff that shows that they are and okay it has taken them longer to change and may be they as individuals are very resistant but they are also acknowledging that this is the new system and so they have to change, and they are changing. Or they are changing their position. [IP3]

The focus of the question as being “open to change” elicited a broader, but more useful, response than anticipated.

I don’t know whether they are necessarily more open to change but there is an element of shell-shock and the “oh, here’s another technology that CSU is foisting on us so what’s the point of arguing because we have got no say in it and it has got to be done. I think there is that element of the peoples’ reaction to change but I think that then if there are some positive things then they get on board enthusiastically. [IP16]

However, despite apparent negativity [IP16] also offered that his school could be rated a five out of six on a scale of being receptive to MSI; “Despite the pain of having to put the stuff in there [the subject outline tool] themselves…in the school where I work the academics are quite excited about having control over their own subject outlines.”
Exposure to a range of educational technology appeared to lead to a more critical awareness of technology.

I think that now they have been exposed to a wider range of tools they can see more possibilities now than they could before so that makes them more open so they are willing to explore more, or more comfortable in exploring more but I think also they have more technological knowledge than they had before so they are perhaps more critical than they were before as well, especially if the technologies don’t meet their expectations. A bit of both. [IP1]

I think also they have got more to do now so they have more responsibilities etc. so they are more critical about things that are useful to them. [IP2]

Improved digital literacy and use of educational technology by academics was commented upon by a number of interview participants.

[Academics] are not just more digitally aware, they are more digitally literate and I am not getting any comment of “oh, I am no good with computers I can’t do this but I think there was an element of that before the introduction of Interact. [IP15]

I think…that people are more aware and so that construction is becoming part of their world news so they are able to cope with it and so that means if it works they will have a go if it does not work then they won’t worry. [IP16]

The Findings for adaptability at the individual level have been summarised in Table 5.6.
Table 5.6. *Summary: Adaptability at the Individual Level.*

<table>
<thead>
<tr>
<th>Pattern of response</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feelings about change/acceptance of/attitude to change</td>
<td>Positive, negative, excitement, enthused, bring it on, impatient, dread, grief, frustration, resigned, resentment, scared, overwhelmed, resignation, pride, unsure, cautious, anticipation and/or impending doom, trying to understand that it is inevitable, want to be in control of the change</td>
</tr>
<tr>
<td>Personal assessment of ability to adapt to change</td>
<td>Self-perception can change over time; ability can be profoundly influenced by current and personal circumstances; dependent on agreeing with reasons; dependent on understanding why; dependent on being able to see the benefit for oneself; dependent on how well change is conducted at institutional level</td>
</tr>
<tr>
<td>Personal strategies for managing change</td>
<td>Communication; collaborative approach towards ownership and buy-in; self-awareness of personal capacity; innate capacity or ability to do the specific job; control the change - by understanding and recognising the change; by selecting what you respond to; by analysing one’s position in the change; having a range of skills; confront detail at the last minute; try to understand the change and your position in it; know what you don’t know; be able to work it out; have a range of strategies - barnacle or cork; innate capacity/ability to do the job helps people adapt</td>
</tr>
</tbody>
</table>
### Pattern of response

<table>
<thead>
<tr>
<th>Personal strategies for managing technological change</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don’t question the technology itself; just use it and do it; ask others’ advice about technology; observe what others are doing before adopting technology oneself; actively seek out new technology (leaders, change agents); people become more accepting over time; technological change not always as bad as anticipated; use it yourself to be able to empathise with and help others; be critical users of technology; people can transform into critical users of technology; the emergency management strategy; align oneself with a team for support; strategic collaboration; good leadership introduces and uses technology itself</td>
<td></td>
</tr>
</tbody>
</table>

At the *institutional level* the following three areas emerged as contributing to the understanding of adaptability at the individual level:

- institutional strategies which assist individuals in managing change;
- institutional strategies which assist individuals in managing technological change; and
- perceptions/personal assessment of institutional approaches to managing change.

5.5.2.7. *Institutional strategies which assist individuals with managing change.*

Individuals’ capacity for adaptability appeared to be related to, or affected by institutional strategies. The following institutional position was noted:
We know change is difficult, but if managers use the best possible management methods at their level, then good practice is in use. [2009 11 Personal meeting, Manager Culture and Change. Observation and meeting notes]

Notes from the above meeting highlighted:

Need good evidence to use; Need a management skill set; Academics don’t respect administration and hate bureaucracy; Can possibly bridge the divide, but down to people & their expectations; Look for the pockets of successful examples of managing change. Appreciative Inquiry – a useful strategy to talk about change. [2009 11 Personal meeting, Manager Culture and Change. Observation and meeting notes]

Managing change. CSU had a formal Change Management process which was enacted during significant restructuring. When going through a major change there was a range of help available from the human resources division to support staff including online information as well as face-to-face information and support sessions.

During a time of change to both people and process, good or poor processes can impact on the success of change strategies. However, the evidence suggested that human factors played a part in the success, or otherwise, of introducing new processes and/or technology.

We have had lots of meetings on operational aspects of the new division, just small processes, getting ongoing improvements. Need to separate the real from the human/personal aspects. i.e. those where there is a fundamental process issue, not just human factors preventing good practice. [2010 10 25 Reflection]

There was the opinion offered by [G4] who suggested that robust processes can withstand a change of staff (role). “It is just the person who has changed, not the process.” [Observation and meeting notes. 2009 02 16 MDCs meeting.]

Communication and cooperation - at the right levels in the institution contributed towards acceptance of institutional change. During the period following a
major change to processes and communication, in this case following the formation of the new Division of Learning and Teaching Services in 2009, the development of a new role (Media Development Coordinator, MDC) and associated processes appeared to be facilitated by having a single point of contact for common queries [Observation and meeting notes 2009 02 10 EDM Managers meeting].

When *Interact* was being implemented a representative of senior management in CELT was tasked with travelling to all campuses in a “roadshow” to introduce the new online learning environment formally and give the broader background from the university (institutional) perspective prior to the implementation and on-the-ground training by educational designers. The presentation was variously received (and attended).

Following [the] presentation here at Thurgoona there was a fair amount of concern, anxiety and confusion perceived amongst staff and the Learning and Teaching Committee felt it would be useful to get people to voice their concerns and to identify issues so that these issues could be aired and ways to address the issues sought. [Reflection – 2007 School of [X] ]

The Head of School made the decision that the learning and teaching committee of the school should drive the introduction of *Interact* in the school, rather than it coming from the institutional representative, the educational designer. A productive introductory session on *Interact* was facilitated by an academic experienced in social research and facilitation methods.

*Team approaches*. There appeared to be an assumption that people work well in teams in an academic environment. This was observed in some initiatives involving engineering a team approach to certain processes/activities. However, there were a number of instances where a team-based approach was not working. This was noted where teams bridged different units and faculties, as in the multimedia development area [2007 11 22 Multimedia meeting. Observation and meeting notes].

With the availability of the new online learning environment, one faculty invested in the development of a cross-campus (internal) course with cohorts across
campuses merged into a single cohort. The approach made use of subject teams who worked closely together in developing and delivering their subject. The educational designer had a lead role in the coordination of the project and provided valuable insight and feedback into the processes throughout the course implementation. Issues were raised around the team-based approach and how individuals adapt to working in teams (Internal report. 2010 01 11 Reflection on 2008-2009 cross-campus delivery. Faculty of [X])

Some of the strategies used to create a new team of Learning Media Lab. Coordinators included a two day face-to-face bonding and planning session. De Bonos hats (De Bono, 2008) were used to analyse the teams’ feelings and history of the unit in order to find an agreed path forward. Mentoring took place through regular, short, individual meetings by teleconference with the new supervisor. This helped set the scene and allow the opportunity for questions and information sharing [2009 01 27 [P2] meeting. Observation and meeting notes]. During the 2007 preparations for the implementation of Interact the use of a coordinated, team based approach to implementing a big change brought a degree of excitement and ownership.

Final meeting of CELT-ALL prior to release of Interact. Final briefing. All primed and getting down to the specific details of the system & access & release dates. [2007 12 04 CELT-ALL videoconference. Observation and meeting notes]

Developing self- sufficiency. There were strategies which helped to develop a degree of self-sufficiency and which decreased the dependence on the formal, institutional systems such as educational design services. These strategies included communities of practice and professional development.

Communities of practice. Developing a range of different communities of practice (CoPs) was another strategy used to support transition and implementation of new processes (Campbell & Uys, 2005). These included CoPs of educational designers, school-based CoPs and disciplinary groups. A university-wide virtual community of practice, the ICT-Integration Community of Practice was set up to
facilitate communication and sharing around good practice (Philip Uys, 2010). The ICT-CoP evolved to include real-time sharing sessions using videoconference and teleconference facilities to connect staff across campuses.

[P2] organised this inaugural CoP forum taking in cross-campus venues. Venues included Thurgooon, Wagga Wagga, Bathurst, Orange, Goulburn, Parramatta Study Centre, teleconference participants. There were some 40 participants overall, representing academics, EDs, LTS staff involved in ICT management & use, Library, Student Services, Flexible Learning Institute and DIT. Some just observers. The wide range of participants indicated the wide area of interest around educational technology from both users as well as ‘support’ staff. [2009 06 03 Reflection. Inaugural ICT-Enabled Learning CoP forum]

The ICT-CoPs continued into 2012 in the same successful format and with similar numbers of attendees.

Professional development. Another institutional strategy was the provision of professional development opportunities to prepare the change agents for their role in implementing new technology. The primary change agents for educational technology were the educational designers. They appeared to be aware of their changing role and some expressed difficulty in accepting it.

We are still called EDs but it seems to me that we are being turned into educational technologists, because I have to learn how to Captivate, Interact etc. The expectation used to be that EDs’ role was to design subjects. I fear that I am supposed to be becoming a technologist who will do these things for them. [IP5]

In 2007-2008 the move to Interact and other new educational technology was accompanied by intensive professional development for educational designers. Identifying the key skills which would prepare people for their future role was a necessary step in working towards developing the professional skills to enable people to carry out their job effectively. In early discussions about strategies for preparing
educational designers for their roles in the new division (2009) it was suggested that, “We need to stretch people in their pedagogical understanding because we want them to go into the new division with a good understanding because many won’t have the strong pedagogical background.” [P1. 2007 12 14 Management meeting. Observation and meeting notes].

Change agents. Educational designers became associated with discourse such as change agents, professionals, professional services, professional development, service provision, the bearers of bad tidings and political pawns [IP1, IP2, P1, P2]. Over the course of the study educational designers increasingly took on the role of change agent. Professional development associated with the introduction of new educational technology became a primary responsibility of the educational designers.

While “formal” change agents had been recognised as valuable, there appeared to be significant, untapped potential in “informal” change agents such as those early adopters of technology; “Why should the early adopter have to challenge the system? We need to work with them.” [Prof. Cathy Gunn, Head of eLearning Group, University of Auckland. Presentation at ALT-C Conference Leeds September 2008]

5.5.2.8. Institutional strategies which assist individuals in managing technological change.

Institutional strategies which assisted individuals to manage technological change were investigated. A summary of the strategies is presented in Table 5.7 at the end of this section.

Introducing change. Two factors which appeared to affect individual adaptability were; individuals’ lack of control over change which was introduced by the institution, and individual perceptions of having institutional change imposed upon them. Organisational structural change appeared to influence the capacity for individuals to cope with change, especially when combined with factors such as job security.
So part of that [change] has been the potential introduction of cross-campus schools and that is a big, big change. It is very unsettling for staff and students as well because they are starting to feel or become aware of that impact, so being able to do the normal run of the mill expectations of an academic to teach and to research has been quite difficult, particularly over the last six months, as issues have clouded security of tenure. [IP13]

**Leadership approaches.** Leadership approaches appeared to affect individual ability to adapt to change. Commenting on the introduction of the new Subject Outline tool (MSI) one Head of School voiced the view that; “[MSI] was certainly no tragedy, we just found a workaround.” [2010 01 21 Head of School meeting. Observation and meeting notes]. The MSI process went relatively smoothly in that school.

**Reflection 24 March 2010**

In answer to the question of his approach to MSI [the head of school] said “I just took the - don’t make a fuss about it approach. We do subject outlines every year, this is just a slightly different process.” [I need to probe more deeply with [my ED] on a few aspects of school processes formerly - I think they probably had fairly robust school processes without a major ED & production related involvement before MSI.

…In School of [x] I got the feeling that there is a certain conservative culture in the school with long established ways of doing things. They appear to have some staff with a fear of technology, or perhaps wary of overuse of technology for equity issues, OH&S issues, not sure if it is that people are generally overcommitted so unwilling to take on new things, or if changes in HOS and management have affected things.

*Drawing on experts.** There was large group of discipline experts in the area of teacher education whose area of academic research and teaching involved educational technology. The expertise of these people was recognised by membership in a variety of User Reference Groups, which were formed at various
stages in the development of the online learning environment. There was a VLE Reference Group (2005), an OLE Reference group to inform the original OLE Programme (2007-2009) and this group later evolved into an Interact2 OLE Reference group (2010). To encompass the broader scope of educational technology at CSU this became the Educational Technology Reference Group (2011).

Sharing a common understanding amongst stakeholders. At the start of this study in 2007 there was limited acknowledgement of educational technology support needs as separate, although there were IT customer support specialists who would pick up educational technology related questions and could draw on a growing knowledge base of material relating to educational technology.

Sharing a common understanding in multi-stakeholder groups working on educational technology projects became important. There was a significant difference in the understanding of key concepts. One example of this was that of Web 2.0 technology. In receiving feedback from a colleague [IP9] from the IT Services area on a draft of a journal article I had written I realised that the view of Web 2.0 technology put forward in pedagogical (academic) circles could be quite different to that understood by someone in an IT technical area. This had implications for determining a common focus and understanding when working on a shared project.

Accessing help with technology. Interview questions 7 and 8 (Set 4) sought information about effective institutional strategies to help people with new technology. When asked; “What strategies do not work?” there was this comment from an experienced educational designer. “Leaving them [academics] alone doesn’t work.” [IP15].

Being able to access help with technology when it was needed was important when supporting people to adapt to new technology (Buchan & Swann, 2007). At the institutional level there was an IT Service Desk Help system for all IT-related inquiries from the over 35,000 students and staff at the university. This system was significantly upgraded during the time period of the research. The move to a
dedicated IT Services hotline for the support of immediate videoconferencing and IVT (interactive video teaching) needs was beneficial.

During the implementation of Interact the IT Service Desk staff were briefed. In addition, a number of licences for the IT Service Desk management system Touchpaper were given to educational design staff who then had responsibility for the Interact-related queue of customer queries. The formation of the new Division of Learning and Teaching Services saw the creation of an ongoing position dedicated to the support of educational technology IT Service Desk queries. A similar service was suggested for other large-scale implementations of administrative technology such as MSI.

The educational designer was available as the first point of call for educational technology queries, as well as being a conduit of information. Sharing information towards problem solving within the educational design community of practice was an effective way of dealing with issues commonly experienced during the implementation of new systems. There was consolidation of information about common issues and solutions by a central authority and circulation via faculty educational design and media team managers to their staff [Internal email Monday, 16 November 2009].

I reflected deeply on the 2009 implementation of the new subject outline tool (MSI) because it was the first major implementation of a new educational technology since Interact in 2007/2008 and was an opportunity to gauge what the institution had learned from the Interact experience. Some of this is captured in the short reflection below.

The rollout of the subject outline tool came during a year when the new Division DLTS was being established and the schools were getting used to the changing role of the ED, with the MDC and new LTS processes. The official position for EDs was for them to have a minimal role in subject outlines outside of the PD role – i.e. to model the way things are to progress in the future. However, not all schools had sufficiently robust processes in place to coordinate the subject outline process…The faculty/school processes around
development and QA of subject outlines needs to be addressed as a matter of urgency. Many lack the processes to coordinate the development of subject outlines without significant ED/MDC assistance. [Internal document. 2010 03 06 Feedback on the rollout of the Subject Outline tool (MSI) – A systems approach. J.Buchan]


Institutional leadership. Leadership emerged as an important component of communication during the change process. Individuals took the leadership role seriously.

If I am looking at managing change at work, then I guess that that selffulfilling prophecy idea comes into play. If you are given a position, and people believe that you can do the job, then clearly you have to rise to the occasion and in the workplace I have to play a key role in helping other people to adapt to change. [IP3]

Leadership also played a role in influencing school/unit/group culture.

It appears that attitude of the leadership has a lot to do with the general school culture. In turn the general school culture has a lot to do with how the implementation and acceptance of technology is carried out. [24 March 2010 Reflection]

Communication. Communication at an institutional level emerged as an important factor. At CSU the Roadshow approach was used as a way for senior management to communicate important messages about significant changes to all members of staff. Typically at CSU an actual travelling roadshow was necessary in order to physically reach the dispersed campuses. “Roadshow” also became a metaphor for consistent communications between hierarchical levels about change and new initiatives.
Narratives, or stories, are a recognised way of communicating difficult messages. A variety of narratives were used to support the implementation and sharing of educational technology. Early in the implementation phase of Interact, stories about the use of the new online learning environment were collected and shared in an Interact site called “ICT-Integration”, which was set up to help develop a community of practice around the use of educational technology. One faculty developed a Faculty Showcase of Learning Designs. The ICT Community of Practice regular forums provided a platform for further storytelling and resources were made available in the Interact ICT-Integration site. In 2007 during the preliminary introduction of Interact I wrote Out of the Cabbage Patch which was used to synthesise the current state of Web 2.0 technology and to introduce Interact to a less technical audience (Available from http://janetbuchan.wordpress.com/publications/).

The metaphor of the adaptive cycle and the visual pictures which accompanied this were used effectively to facilitate a number of sessions about change. One such session was a workshop presented at AuSakai 2009 on Strategies for the widespread uptake of Sakai in tertiary and higher education (Buchan & Uys, 2009). A poster of the Adaptive Cycle Framework was used to capture where individuals perceived their position in relation to a nominated major technological change (see Appendix A 9.2.

The institutional strategies which contributed to individual adaptability have been summarised in Table 5.7.
Table 5.7.  Summary: Institutional Strategies Contributing to Individual Adaptability.

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional strategies which assist individuals with managing change</td>
<td>Leadership determines school/unit/group culture; poor processes impact on success of change strategy; communication and cooperation at the right levels; use evidence based management/practice; team approach; self-organising systems; communities of practice; mentors within faculty; supporting staff formally; good strategic management; people need to feel respected in institutional change processes</td>
</tr>
<tr>
<td>Institutional strategies for managing technological change</td>
<td>Digital literacy and use of educational technology; professional learning - encouraged informally and formally; team based approaches - professional development and opportunity to share; use change agents of different types and levels; choose suitable change agents; leadership</td>
</tr>
<tr>
<td>Perceptions/personal assessment of institutional approaches to managing change</td>
<td>Some institutional approaches to technological change appeared to affect the adaptability of the individual to change; poorly managed change processes can destroy credibility of change agents; change in individuals’ capacity to adapt to new technology over time; humanness of the organisation - show us you care</td>
</tr>
</tbody>
</table>
5.5.3. Discussion

“Adaptability is the capacity of the social components in a system to manage resilience” (Gunderson et al., 2006, p. 62).

This discussion section is structured according to the questions which framed this part of the research (see Background, Section 5.5.1).

5.5.3.1. How can one understand and measure the adaptability of individuals and how they approach change in general and educational technology change more specifically?

A variety of methods were used to explore the adaptability of individuals to change in general and to educational technology change more specifically (see Section 5.2.3). These included self-assessment; the use of leaders and change agents’ commentary that drew on a wide cross-section of stakeholders involved in educational technology change.

The individual view was balanced by the institutional view of adaptability. This was the view or perspective provided by those in leadership positions and those acting as change agents. Change takes time and a longitudinal approach to gathering data was valuable in enabling the observation of change taking place. As a start to making an empirical measurement of adaptability, academic leaders and some change agents were asked to rate other staff’s ability to adapt to change. Perceptions of one’s own and of others’ adaptability was notably subjective.

5.5.3.2. What are individuals’ personal understanding of, attitudes towards, and role in change?

Personal understanding of change varied. Some participants demonstrated an in-depth understanding which drew on professional knowledge and experience to help the individual and to assist others to navigate change. Those with an in-depth understanding of change generally displayed a more positive attitude to change, although they could still be critical of change and did not necessarily agree with the change. However, the deeper understanding translated into solutions and developing
approaches and processes to cope with and manage change. Of those change agents and leaders who were observed and interviewed, none described themselves as not feeling in control of the change. Some actively sought out change.

Those in leadership positions or in the role of change agents displayed a mix of positive and negative attitudes to change. Some people displayed a more surface view of change, usually associated with a perception of the change being something over which they had little control and that change was problematic. This was generally associated with a negative attitude.

There were wide ranging attitudes to change. The attitude of any one individual did not necessarily remain the same but was observed to change over time and according to the circumstances. In particular, towards the end of the study there was an observable perception of “change overload” across the case university. This appeared to translate into negativity and caution towards acceptance of new technology and new university initiatives, in particular amongst leaders and change agents in different areas.

In spite of apparent negativity about technological change, a group of individuals, such as a school, was observed to remain receptive to new technology if there was sufficient leadership and/or assistance from someone in the role of a change agent.

Those in leadership positions acknowledged a high level of personal adaptability and willingness to take on new technology and to deal with change. While some leaders admitted to actively seeking out new challenges and the associated change those challenges would bring, others indicated a tendency towards caution in dealing with change but that they were willing and able to step up to lead their staff through a period of change as needed.

5.5.3.3. What is the ability of individuals to adapt to change?

Individuals’ self-perceptions contributed to an understanding of adaptability and approaches to change. The majority of interview participants viewed themselves as being adaptable to change in general and technological change more specifically,
although some were realistically cautious about their adaptability. The follow-up interviews revealed that personal response to change and self-perceptions of adaptability can change when faced with unexpected challenges – even amongst the most capable change agents.

The data showed that the capacity of individuals to adapt to institutional change did change over time and was directly influenced by a number of factors. These factors included the total amount of change within the institution (see panarchy and para-analysis, Section 5.3.2.3), personal issues and how the change was introduced and managed at the institutional level.

There was a wide variety of personal strategies demonstrated and described for coping with and managing change (see Table 5.6).

5.5.3.4. *What is the ability and capacity of individuals to adapt to technological change?*

People who were conservative in their approach to change and to new things in general were generally conservative in their approach to technology. Some insight into the capacity of individuals to adapt to technological change is summarised in the following reflection.

2010 01 18 Reflection – Diary notes 2010 01 13

Early this morning I was working on my ALT-C paper on transformational potential of learning technology and had a major breakthrough. How do we know that transformation has taken place?

…Once people became critical users of learning technology, then one can safely say transformation has taken place. i.e. a critical user is able to look at a new technology and ask “what’s in it for me”, will question the WHY do we have to use it, will it save time, will it help my students, my own work. Critical users can independently evaluate a technology to be able to assess whether it is worthwhile using. Can be Good, users source new tools to
bring into the university. OR Bad i.e. users are critical of organisation’s efforts around learning technology, which is bad for management.

What is clear is that users are not complacent about quality of technology any longer and want systems that work, it may become increasingly difficult to implement new systems on the back of each other, and if prior experiences were not positive then it becomes more challenging to get acceptance of new systems.

What we can say is that according to the evidence we have seen significant transformation at the individual level at CSU. How widespread this transformation is, is not yet clear, however, the transformation of individuals into becoming critical users of educational technology is an important part of becoming an organisation for the future.

One of the most important findings in this study was that personal capacity to adapt to change is a conscious choice. [IP11’s] assessment of their ability to adapt to change perhaps sums up the innate ability of individuals to adapt to change.

“Excellent if I have to but poor if I don’t. It depends whether it is in my area or not.” [IP11]

Some of the value in the findings lies in being able to synthesise and apply them in practice. In March 2012 I developed and ran a workshop for educational designers and DLTS management with the theme of “Coming face-to-face with change.” This workshop drew heavily on this research into adaptability and was an opportunity to synthesise and interrogate some of the ideas through presenting them to an authentic and imaginatively critical audience. One activity asked participants to identify what personal strategies/qualities for managing changing technology applied to themselves. The activity also asked participants to use a table (see Table 5.8) to: identify those strategies which they could observe in others with whom they worked; to consider those which were not evident in their own area and to add any other strategies which they or others might use.
Table 5.8. *Personal Strategies and Qualities for Managing Change in Technology.*

(Buchan, 2012. Preparing your kitbag for change: becoming an effective change agent. Workbook. p.20.)

<table>
<thead>
<tr>
<th>Strategy/Quality</th>
<th>You</th>
<th>Those you work with</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be aware of personal capacity &amp; limitations and strengths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceptance - don’t question the technology itself, just use it &amp; just do it</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ask others’ advice about technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observe what others are doing before adopting technology oneself</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actively seek out new technology (leaders, change agents)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>People become more accepting over time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technological change not always as bad as anticipated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use it yourself to be able to empathise with and help others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Become critical users of technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The emergency management</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Capturing the feedback from that workshop as data to inform the research fell outside the ethical scope of this research. However, informal feedback was positive.

5.5.3.5. How can the institution contribute to the adaptability of the individual?

There was a number of key areas of institutional contribution to individual adaptability: organisational roles, organisation and change, professional development and support, leadership and institutional processes, institutional technology implementation and change processes.

A person’s role in the organisation with respect to change and the acceptance of this role appeared to have some correlation with their attitude to change in general and technological change. Where a formal part of a person’s role was to initiate and/or help implement change in some way some people appeared to have embraced the role. The leaders generally accepted their (changing) role but admitted to having to work hard to be in a position to help others through times of change. Most participants acknowledged some degree of personal responsibility for accepting or
acknowledging change even if only between themselves and their students. Where an individual’s role had changed significantly from the original role for which they had been employed, and the role now included responsibility for assisting others through periods of change, there was a degree of resistance and confusion.

Change in one area of the organisation affected change in another. At the interface of one area of the organisation with another, such as a service division working with a faculty, the impact of change in one area was felt as a disruption in the other area. This in turn flowed on to affect the individual acceptance of technological change.

The data provided a rich source of evidence around appropriate approaches to professional development and support. The notion of a learner dependency issue was raised in relation to educational technology. Instead of telling people what they needed to know, it was suggested that they needed to be able to work out for themselves how to gain the skills. This has implications for managerial decisions around effective professional development, learning and teaching support services and for change agents’ choice of strategies.

The evidence from this research supports the experience from specialists in Resilience such as the Center for Resilience. “Resilient organizations create a capacity for their employees to learn and accumulate knowledge that helps them in their jobs. This enables workers to perform better, both individually and in groups” (The Center for Resilience, 2009, p. 41).

Leadership in the institution emerged as an important part of the change process and there was a certain degree of faith or expectation, from those depending on the leadership, that the leader could deliver. This put pressure on individuals to step up to the responsibility. Teamwork and team building was also an important institutional focus during the time period of the study (Bryant, 2008). Interestingly, the assumption that people work well in teams in an academic environment was challenged by the findings in the study. This is of particular significance in the implementation of educational technology initiatives where success may be
dependent on multiple stakeholders in project teams and where the initiatives draw on many groups such as academic reference groups.

At the institutional level it appeared that having robust processes for manually carrying out administrative functions (using minimal technology) appeared to translate into better adaptation to the same functions when carried out using new technology. The ability of individuals to adapt to change was affected by compounding changes in the immediate environment. This was seen in the case of the introduction of the new subject outline tool where policy, processes, people and technology were all changing simultaneously.

5.5.4. Conclusion

In the original environmental context adaptability focuses at the system level. However, the findings of this research suggest that for the purposes of applying the social-ecological system heuristics to the higher education learning environment, a narrower definition would be more applicable. The following definition or understanding of the heuristic of adaptability within the context of the technology-enhanced learning environment is proposed:

Definition - Adaptability is the capacity of the social components in a system to manage change, including technological change.

Although the narrower definition focuses on the capacity of the social components, implicit in the social-ecological systems approach are the interactions of those components with, and within, the entire system.

The primary aim of this part of the study was to understand the property of adaptability and how it could be applied to the understanding of the technology-enhanced learning environment in the case. This involved the examination of the capacity of the social components in a system to manage Resilience. The research probed individual capacity to adapt to change and it became clear that individual adaptability was dependent on a number of complex interactions between different parts of the system. These parts of the system could be classified broadly as individual and institutional. This is consistent with the original conceptual
framework of this study which proposed that Resilience in a technology-enhanced learning environment needed to be developed at both an individual and an institutional level (see Figure 3.2).

While there has been extensive research into the adoption of educational technology (Fichman, 1992; Rogers, 2003; C. Russell, 2009; Zhou & Xu, 2007); and about institutional change management and the implementation of new educational technology (Benson & Palaskas, 2006; Philip Uys, 2010), there is little which brings the two areas together. The findings on adaptability make a significant contribution to change management practices because they provide new insights into people’s adaptability to technological change and blend this within an institutional management perspective using systems approaches. The Autoethnography explores change management approaches to educational technology in more depth (see Chapter 6).

The findings had a very practical application in the case by contributing to the developing role of change agents (Buchan & Uys, 2010; Philip Uys, 2010), staff and stakeholders involved in educational technology implementation and the support of users. This lays the foundation for a more widespread and generic application.

Adaptability is an important part of transformation and transformability since the formation and development of a new system is dependent on the adaptability of its components. The following section explores the heuristic of transformability in depth.
5.6. Heuristic 4 – Transformability

5.6.1. Background

Transformability is the capacity to create a fundamentally new system when the existing system is untenable. Where a social-ecological system appears trapped in a resilient but undesirable regime, adaptation may not be an option and a significant transformation is required. Transformation can be in response to changes in policies, triggered by a resource crisis or driven by shifts in social values (Walker, Gunderson, et al., 2006). Folke et al. describe transformational change as involving:

A change in the nature of the stability landscape, introducing new defining state variables and losing others, as when a household adopts a new direction in making a living or when a region moves from an agrarian to a resource extraction economy. It can be a deliberate process, initiated by the people involved, or it can be forced on them by changing environmental or socioeconomic conditions (Folke et al., 2010, online).

The stability landscape is defined as: “The extent of the possible states of system space, defined by the set of control variables in which stability domains are embedded” (Folke et al., 2010 online). More simply, the stability landscape is the extent of the different possible states of the system. The representation of the stability landscape used in this research is the ball-in-basin model (see Section 2.4: Resilience Thinking: Theoretical Background).

A focus in this research has been the factors that support transformability of a system at both whole-of-system and at the individual levels. Resilience, novelty and innovation are factors which affect transformability.

Transformational change at smaller scales enables resilience at larger scales, while the capacity to transform at smaller scales draws on resilience at other scales. Thus, deliberate transformation involves breaking down the resilience of the old and building the resilience of the new. Transformations do not take place in a vacuum, but draw on resilience from
multiple scales, making use of crises as windows of opportunity, and recombining sources of experience and knowledge to navigate social– ecological transitions from a regime in one stability landscape to another. Transformation involves novelty and innovation (Folke et al., 2010 online).

Transformation at the institutional level in higher education appears possible and there are lessons to be learned from those who have reflected on the process. The University of Memphis undertook a major transformation when, in 1991, it appointed its first CIO (Chief Information Officer) to lead its newly created IT organisation (Goldstein, 2004, p. 13). The transformation took eight years and leaders acknowledged that empowering staff, improving productivity and refining leadership strategies were long term goals. It was with this view of institutional transformation in mind that the investigation of transformation and transformability was approached.

The following insight into the organisational structures, processes and roles supporting educational technology is a summary of the CSU system in 2007. The rationale for the formation of the Strategic Learning and Teaching Innovation section in the new division of Learning and Teaching Services (2009) foreshadowed the changes to the system which would be required in order to meet the University needs and aspirations in educational technology related areas.

Currently responsibility for the maintenance and enhancement of learning and teaching systems and technologies is split across several divisions/centres. CELT provides leadership around educational technology in learning resource development and online systems and works closely with academics around user needs and learning and teaching practices. The LMC management team researches and evaluates production technologies, systems and software from an enterprise perspective ensuring they are scalable, efficient and enterprise compliant. DIT maintains CSU learning and teaching IT systems and also undertakes some educational technology initiatives. CELT, LMC and DIT, along with the Project Service Centre and Student Services, have played a major role in the selection and implementation of the Sakai community source approach to CSU’s online learning environment, CSU Interact. When support for the online
learning environment moves from a project management methodology to a continuous improvement model, new collaborative processes are needed. A system as complex as CSU Interact, with its multiplicity of stakeholders, requires development processes that are agile and iterative in order to provide ongoing innovation, improvement and system upgrades. Close collaboration between staff with different expertise is needed to ensure that overall system design is appropriate and robust and can evolve in response to feedback. Moreover, the community source approach poses challenges to CSU very different from relations with a commercial vendor…Building an integrated approach is central to effective engagement with the Sakai community. A new approach to divisional responsibilities for CSU Interact has been agreed through discussions between DVC (Academic), DVC (Administration) and senior staff in CELT, LMC and DIT and will involve ongoing consultations about detailed roles and processes. (Internal document. November 2007. Proposed restructure of CELT & the LMC into the Division of Learning and Teaching Services. Reproduced with permission)

The characteristic of system transformation has been examined through the heuristic of the adaptive cycle. This part of the study will focus on the application of the property of transformability to the case. The heuristics of transformability and resilience are closely linked and have been considered holistically within the social-ecological system. However, for the purposes of analysis and discussion in this study, these heuristics have been dealt with separately and cross-referenced where necessary.

The following questions were posed to guide this part of the research:

- Can transformability as a property of the social-ecological systems approach be applied to the case study?
- Can the system under study be shown to have transformed?
- What are the defining variables in the system (before and after)?
- How can the system under study be shown to have transformed?
- What is the stability landscape (before and after)?
• What features contribute to the transformability of the system?

In keeping with the investigation into the properties of the social-ecological system approach, the property of transformability will be applied to the Snapshot 4 which describes the learning and teaching support services system for the use of educational technology related to the provision of digital media learning resources to students. The primary function (or purpose) of the system was supporting academic staff in the use of educational technology related to the provision of online learning resources to students.

This support system is equivalent to a stability landscape (see Glossary, page xxvii) and is bounded by functions (purpose), feedbacks (connectedness), structure and identity. These determinants of the system have been used to analyse the system and to report the Findings, with the questions guiding the investigation. The “before and after” timeframe refers to the time period of the study, 2007 to 2011. The methodology used is described in Section 5.2.4: Transformability: Method Highlights.

5.6.2. **Findings**

A key finding was identifying the defining variables of the system and these underpin the further development and reporting on the heuristics of transformability and resilience.

5.6.2.1. **The defining variables.**

The patterns emerging from the data analysis fell broadly into six areas. These areas resulted in the development of the following six Institutional System Variables. Development of the variables was an iterative process, involving simultaneous data analysis of the heuristics of transformability and resilience.
Institutional System Variables

1. Strategy, policy and planning
2. Organisational structures
3. Operations, processes and procedures
4. People/roles
5. Connectedness
6. Educational technology

These six Institutional System Variables were used to guide the analysis of the system and the description of the findings related to transformability and resilience.

Variable 1 - Strategy/policy/planning. The new University Strategy 2007-2011 initiated a number of new policies which guided planning, strategy development and operational activities at all levels of the University. There was the development of a new Course Plan; Institutional Development Plan; Learning and Teaching Plan, Research Plan and the CSU Implementation Strategy for OLE programme (internal documents). These plans were then actioned at a variety of levels. During this period the time frame for faculty and divisional operational plans was changed from three years to one year. 2010 represented the defined end of the implementation of the 2007-2011 University Strategy and 2011 saw the start of the implementation of the new University Strategy 2011-2015 with associated development of new supporting plans.

At the beginning of a major period of change it was common to have a large number of meetings. In the early phases of the implementation of the new University Strategy there were a number of operational planning meetings. There were frequent meetings in 2008 during planning for the CELT/LMC merger, and again during the early stages of the formation of the new Division of Learning and Teaching Services in 2009.
Policy changes took place at a variety of levels; university, faculty, division and unit. There was no clear synchronisation of the timing of policy changes to support the defined learning and teaching support services. The upper level policy and strategy changes had an initiating effect. This involved stimulating the development of operational or action plans in faculties and divisions to guide actions which could contribute to carrying out the university strategic directions.

There was an observation that CSU subscribed to an “organic” approach to policy development with respect to (some) policy relating to the growing area of technology-enhanced learning environments [P1]. Evidence confirmed that a number of existing policies (at that time) did not adequately support the increasing move to digital media and online provision of resources. For example, the mandated nominal one hour per week access to the internet for students from 2004 (Internal document. 2004 Activities around online teaching and learning at CSU. Background paper) was no longer sufficient in 2007/2008 to support the use of Interact. In addition, there were contested changes to the student internet access charges in 2008 after the introduction of Interact (Internal documents).

An Internet account is provided automatically to each student when they enrol. At the start of each year the University gives all students a one off non-refundable quota of 1 Gigabyte to use during the on-peak traffic period. (Internal web page. 2011 Internet Access Charges).

There was an observed disconnect between policy and process decisions made by one area of the University which could affect operations in another. In 2007 it became clear that there were inconsistencies in how different areas of the University were publishing material online [2007 09 17 Questions for the Online Publishing Group. Internal email]. For example with the introduction of Interact, the policy decision was made in 2008 to limit the use of hosting subject sites on school servers. This had an adverse effect on some subjects, such as software programming, which needed the full functionality of an open website.

Variable 2 - Organisational structures. Changes were observed at a variety of levels in the stability landscape with respect to organisational structures. Some of
these changes in organisational structures are described below. Organisational structures included human resources and position descriptions which defined roles and thus operational functions. A number of new functional communities of practice were established to support educational technology projects and there was a change in organisational structure and associated roles to support the provision of digital media and online resources to students.

A change involving positions and roles in the organisational structure (the human resources-related structure) did not necessarily translate to an immediate change in practice and a settling period was observed whilst operational aspects of different roles were redefined. This was evidenced by the number and variety of meetings and draft documents associated with determining the roles of staff (see Appendix 5, Table A 5.9).

2009 was the first year of operation of the new Division of Learning and Teaching Services. Merging the Learning Materials Centre and the Centre for Enhancing Learning and Teaching brought together people, processes and functions as well as physical infrastructure. The changing structure of the divisions and units which supported learning and teaching, with a focus on those divisions and units relating to support for educational technology projects, are illustrated in Figure 5.12. The changing structure of divisions and units that supported learning resource provision as at 2011 is illustrated in Figure 5.13.
Figure 5.12. The changing structure of CSU’s divisions and units that supported learning and teaching in 2010.

(Buchan, 2010b, p. 58).

Figure 5.13. The changing structure of divisions and units supporting learning resource provision in 2011.
The system which supported and fostered learning and teaching as at the end of 2011 was described for the Flexible Learning Institute in an inter-institutional project relating to learning leadership (Buchan, In press). The system is depicted in Figure 5.14.

Figure 5.14. The changing system which supported and fostered learning and teaching at CSU.

(Buchan, In press).

When the Division of Learning and Teaching Services was formed in 2009, the Strategic Learning, Teaching and Innovation (SLTI) section was brought together under the leadership of the new Director of SLTI. SLTI brought together staff with a role in supporting educational technology at a variety of levels. This included staff from the former LMC, educational technologists from CELT and IT developers and solutions coordinators seconded from DIT. Prior to the first meeting of the diverse group the director SLTI met individually with each new staff member. As part of defining the new roles and establishing the section staff were asked to reflect on what bound the group together. There was an acknowledgement of the new people (components) and relationships (connectedness) in the new section and that these were diverse. In order to facilitate collaboration within the new section the individuals needed to understand their role and that of others in the system and the
common goals and values of the group (2009 02 11 SLTI first meeting. Observation and meeting notes).

In my new role as Manager Educational Design and Media (EDM) for the Division’s Faculty of Education team there was a strong operational focus to those initial meetings and a priority was the establishment of clear processes, lines of responsibility and functions (2009 02 17 EDM Faculty Managers meeting. Observation and meeting notes).

Variable 3 – People, social and roles. A major change in the stability landscape for academics (with respect to the system under investigation here) came as a result of the introduction of Interact. This was associated with the responsibility for a subject site and the associated communication and provision of online resources to students. Academics became writers, developers and publishers of online and digital resources.

Associated with the availability of new technology were changes in the day to day operations, processes and procedures around the development and publishing of learning resources. In 2007 and in 2010 some aspects of the educational designers’ duty statement (developed in 2004) had a similar focus to; “Advise academic staff and other content specialists on the most appropriate design and choice of media for learning resources in all modes of delivery” [Internal document. 2004 Educational Designer Duty Statement].

The increased focus on professional development, as observed in the new duty statements for DLTS educational designers, reflected the change in the stability landscape of the learning environment for the academic and their changing support needs: “Support the professional development of academic staff in learning and teaching including assisting them to embed their subjects in the e-environment”. [Internal document. 2008 09 08 Educational Designer Duty Statement].

The changes to the system reflected the new stability landscape. The DLTS team approach to faculty support involved a more strategic role for DLTS through educational designers and Faculty Educational Design and Media (EDM) teams. The
teams’ brief was to; “Provide planning support to Schools with respect to learning materials development and more broadly in the enhancement of learning and teaching”. [Internal document. 2008 09 08 Educational Designer Duty Statement]

Changes to a number of variables in the system; technology, operations and processes and policy meant that additional professional skills were required within the current role, in particular that of the educational designer. Some longer serving staff members had been employed under a different position description, reflective of the needs at that time. Despite offering significant professional development, some staff indicated a feeling of inadequacy for the changing role.

It appeared that there could be a critical point at which a support role, such as that of the educational designer, “morphed” into something new. An example of this was the role of the Media Development Coordinator (MDC). This was a new professional role established in each of the Faculty EDM teams. During 2010 and 2011 there was a regular re-visiting of the MDC role. The challenges associated with establishing a completely new role and institutional processes was illustrated in team discussions in mid-2009 when one of my team referred to the MDCs as “the invisible glue”. [2009 07 08 EDM role in LTS Professional services model. Observation and meeting notes]

The MDC role took on administrative work formerly done by CELT educational designers and also the LMC Learning Materials Processing Officers and LMC Production staff. Initially the basic tasks remained much the same since the outcomes needed to be the same, developing and producing learning resources. However, the people responsible for doing some tasks changed, some operational processes changed and relationships and interactions changed.

It became clear during 2009 that there were different understandings and perceptions of what responsibility individuals should have in certain roles or processes and what was actually taking place in the Division and the schools. This affected the new roles of educational technologists, media technologists, MDCs and educational designers.
Variable 4 - Operations, processes and procedures. Between 2007 and 2010 there was a move from a project-based approach to the management of educational technology and the development of the OLE under the responsibility of DIT, to a continuous improvement model under DLTS. The multi-stakeholder approach to educational technology projects (as seen in the OLE Programme and Interact and Interact2 implementation) relied on an Academic Reference Group for academic representation into the project. The following projects: DOMS (Digital Object Management System), Online Meeting (Wimba) and CSU Replay (Echo 360) saw a cementing of connections and feedbacks.

Incremental changes in processes and procedures were observed at school, unit and divisional levels in a number of areas. These included ongoing changes to procedures for the development and production of digital media within CELT/LMC and later DLTS. Changes in the stability landscape of the digital media support services showed a cause and effect relationship where changes in the stability landscape of schools and faculties impacted on the stability landscape around the support for the provision of digital media resource to students, and vice versa.

There were also changes in the processes and accountability for quality assurance in subject outlines and assessment with an increase in educational designer and MDC involvement. A senior faculty member [G10] acknowledged:

To put all the responsibility of quality assurance [QA] of assessment on EDs is inappropriate. We need the mechanisms in the schools e.g. assessment consultants, discipline perspective, where good practices are happening we need to share these & to develop good guidelines for MSI. [2009 02 20 Fac. of [x] Learning and Teaching Committee. Observation and meeting notes]

The transformation from boutique desktop development of CDROM format digital media in 2001 (after the establishment of the Learning Media Laboratories in CELT) to mainstream production of digital media in DLTS was an evolutionary process. The term “mainstream” is used to describe those institutional processes which build capacity. Transformation takes time and by early 2010 it was noted that: “We are now at a point for all CDROM production to be fully mainstreamed and for
CDROMs to be treated as print, no difference in media”. (2010 02 02 Reflection. Digital Media processes. Observation and meeting notes)

**Variable 5 – Connectedness and feedbacks** - Changes in connectedness within the system are illustrated through the changes in organisational structure (see Figure 5.12, Figure 5.13 and Figure 5.14. In 2007, shortly after the major faculty restructure, on-campus (internal) subjects and courses were being offered to primarily campus-based cohorts. The introduction of new educational technology in 2008 (*Interact*) facilitated a change in the stability landscape with respect to the connectedness in cross-campus schools. It was reported that in some newly created cross-campus schools this caused a number of practical problems in relationships and communication [IP3].

The connectedness of the system went beyond the internal connections and an important aspect of the systems approach was the connectedness to other systems. The acceptance and carrying out of new roles and processes was a perceived limitation to transformability.

Reflection – DIT is still pursuing L&T related initiatives independently. Not only an issue with resources, but also there is no clear way that the information from outside trials will come back into LTS & inform ongoing developments (projects between DIT & some academics). [2009 02 10 EDM Managers meeting. Observation and meeting notes]

There was an acknowledgement that the existing social system could play a role in effecting changes in processes. In the context of discussion around cross-campus courses, a senior member of the Faculty [G9] acknowledged that it was a “challenge to work within an existing social system to try and do things differently” [2010 02 18 Reflections on Teacher Education Symposium]. This suggests that it could be possible to have a change in processes without a concurrent fundamental change to the system itself. Without a change to the fundamental structures, operations and processes, people and connectedness the findings showed that individuals appeared to just be “doing things differently” and the system itself did not change to become a more self-sustaining (self-organising) system. This was

“A process of change initiated with an eye to effectiveness under existing norms turns out to yield a conflict in the norms themselves.” (Argyris & Schon, 1978, p. 21). Managers cannot use single loop learning to solve some conflicts i.e. they must be aware that they cannot correct certain problems by getting the division, for example to operate more effectively under existing norms BUT the norms themselves must change. [2007 03 15 Notes on Argyris & Schon, 1978]

Feedbacks in the system were a key factor in determining changes to the stability landscape. Feedbacks were determined by the connectedness between components in the system. The variable of connectedness encompassed interactions, relationships, dependencies and interdependencies between people and structures in the system. This is consistent with the findings in the investigation into understanding the learning environment.

Variable 6 – Educational technology. Findings from the investigation into the dynamics of panarchy and the adaptive cycle illustrate some of the changes in educational technology over the time period of this study. Panarchy and para-analysis (see Figure 5.4, Figure 5.5 and Figure 5.6) were used to create visual summaries of changes in educational technology, together with a measure of the impact of technology within the systems.

The change in technology has played a major part in the change in the system for the provision of digital media to students. Educational technology emerged as a cause of, or stimulus for, change in the format of learning resources when moving from print based resources into digital media formats. Technology also facilitated a change in the mode of creation and distribution of learning resources.
5.6.2.2. **Function of the system.**

Aspects of the findings relating to the function of the system are described in detail in the investigation into the heuristic of resilience (see Section 5.7.2.2).

5.6.2.3. **Structure of the system.**

One of the variables which emerged in the system was organisational structures, and this has been described in detail above (see Variable 2). Further aspects of the findings relating to changes in the structure of the system are described and discussed in detail in the section on resilience (see Section 5.7.2.3).

5.6.2.4. **Identity of the system.**

The final determinant of the system (stability landscape) is *identity*. The exploration of identity was left until late in the data analysis because it required a clear understanding of what identity meant in the original environmental context, and how identity might be applied to the case.

The snapshot of a system which has been analysed here is *the learning and teaching support system for the use of educational technology related to the provision of digital media learning resources for students*. It was found that for a human system, a system’s *identity* may be best described as the *purpose* of the system.

Some context and drivers for change in the way educational technology was being supported in the case study institution were given in the initial proposal for the merger of CELT and the LMC (Internal document. November 2007. *Proposed restructure of CELT and the LMC into the Division of Learning and Teaching Services*). The existing system was no longer adequate to support the changing needs of the University and the purpose of the system needed to change - there was a need to engineer a new system.

Using the focus of the snapshot system with its particular purpose, data was coded against the six Institutional System Variables for the time period 2007 to 2010.
(see A 9.3.). The time period represents a snapshot of a system which had a much longer temporal span (see panarchy). The combined changes in each of the variables over that time period illustrates the changing stability landscape of the system.

In order to interrogate the findings further I returned to some of the original (environmental) research into transformability to examine how effectively the concept of transformability has been applied to the case study system. “Social adaptability and transformability are complex self-organising processes that involve interactions among the key actors in the system, knowledge and understanding of the system, and the provision of conditions or opportunities for change” (Gunderson et al., 2006, p. 62). Four requirements necessary for adaptability and transformational change are:

- the development and maintenance of open and flexible epistemic networks;
- the roles of the different types of learning – scientific activities, other forms of social learning;
- an arena for discourse – network participants need a place to meet and foster learning, and
- the fostering of trust through leadership (Gunderson et al., 2006).

These general requirements have been interrogated against evidence in the case study and this data is presented in Table 5.9. The case study system demonstrated the presence of the general requirements for adaptability and transformational change. While the presence of these requirements is not necessarily evidence that transformational change has occurred, from an operational perspective these become criteria which can contribute to the examination of transformability.
<table>
<thead>
<tr>
<th>Requirement</th>
<th>Evidence in case study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development and maintenance of open and flexible epistemic networks</td>
<td>Illustrated through the identification of a variety of systems - where system is defined by its purpose; networks were observed at a variety of levels and with interactions across a range of different stakeholder groups</td>
</tr>
<tr>
<td>Roles of the different types of learning – scientific activities, other forms of social learning</td>
<td>Social learning took place at a variety of levels and was focused on learning within the institutional framework (not student learning); individual learning took place in formal situations (institutionally driven - workshops, training courses, professional development opportunities etc.) and informal situations; organisational learning was observed through improvements to processes; new change management frameworks and development of strategic plans</td>
</tr>
<tr>
<td>Arena for discourse – network participants need a place to meet and foster learning</td>
<td>Physical spaces/right groups; during the transformation process participants met in a variety of spaces to work on common issues, which in turn helped to foster learning; these spaces were face-to-face, by real-time electronic communication methods (videoconference, audio conference, online conferencing), by asynchronous communication via emails, collaborating on an online wiki, social-networking; formation of combinations of work teams and leadership groups took place, there was formal and informal discourse</td>
</tr>
</tbody>
</table>
5.6.3. **Discussion**

This discussion is loosely structured according to the questions which guided the investigation of this part of the study. Some of the original questions have been combined for continuity in representing the findings of the study.

5.6.3.1. *Can transformability as a property of the social-ecological systems approach be applied to the case study?*

Yes. The findings from this research have demonstrated that the property of transformability in social-ecological systems can be applied to the case. Institutional system variables and criteria have been identified which can be used to analyse a system in order to understand its transformability.

The successful application of the property of transformability does not, however, mean that the actual system itself is transformable. It appears possible to have a change in processes and other aspects of the system without a concurrent fundamental transformation of the system itself. This is an incremental change. However, without a change to the fundamental structures, operations and processes, people and connectedness it was shown that in some cases people ended up just “doing things differently”. It is important to understand the factors which give a system resilience to remain in the same state and to retain its identity, and those factors which force a change which can bring about transformation. This transformation or move into another state can either be engineered and controlled, or responsive and uncontrolled.

A lack of observable transformation may not necessarily be indicative of a lack of transformability. Where there was a demonstrated high degree of resilience there
was a correspondingly high tipping point (see resilience heuristic discussion, Chapter 5, Section 5.7.3 and Resilience discussion in the Autoethnography, Chapter 6). Changes in the variables in the system may not necessarily lead to transformation of the whole system, but could lead to a significant change in the stability landscape and functions.

From the organisational perspective of planning, the perceived amount that an area might need to transform its processes can differ significantly from the existing reality. For example the introduction of the new Subject Outline Tool coincided with major changes in processes, policy and operational relationships in the new Division. The disruptive impact of the new technology was greater than expected because of the combined effects of the changes in a number of system variables.

Transformability was able to be demonstrated in ways other than at a system level. For example, by selecting particular components of the system and taking learning technology as a focal point (or lens) the transformational impact of learning technology was demonstrated in three ways: (1) at the individual level; (2) in its contribution to transforming learning and teaching and (3) its impact at an institutional level (Buchan, 2011).

More work needs to be done to clarify the application of terminology from its environmental context to the institutional learning environment. The notion of the identity of a system as its purpose needs to be thought of more broadly. For operational management outcomes, using the purpose of the system to define the system boundaries provides a way to target the variables and what needs to be done.

5.6.3.2. Can the system under study be shown to have transformed?

The system used to illustrate the application of transformability within the case was the learning and teaching support services system for the use of educational technology related to the provision of digital media learning resources to students.

Over the time period of 2007 – 2010 there was no significant transformation in the system which resulted in what could be identified as a fundamentally new system, which is a system with a new purpose. There was, however, an incremental
change in some of the system variables, which is consistent with a change in the stability landscape (or system). The degree of this change could be important in determining the difference between an *incremental change* and a *full transformation*. However, when the longer time scale of 2001 to 2011 was applied to selected variables in the system, the data revealed that a significant change in purpose, and thus transformation, had taken place in the system.

The application of the heuristic of the adaptive cycle to the case provides a framework and distinct criteria for mapping and measuring transformation in a system (see Chapter 5, Section 5.4). The application of the Adaptive Cycle Framework to a changing institutional system provides a further illustration that a university system can transform. The following areas of transformation were illustrated through the use of the Adaptive Cycle Framework to contextualise some of the evidence (Buchan, 2011).

1. Transformational impacts of learning technology at an *individual level*
2. Contribution of learning technology to transforming *learning and teaching*
3. Transformation at an *institutional level*.

Different areas of the system in the case demonstrated different capacities to transform. Dissemination of a specific strategic direction for an area such as a division, unit or faculty did not necessarily permeate at the same speed throughout the area and change took time. This appeared to be related to adaptability at the individual level.

It was difficult to demonstrate and/or measure a clear distinction between a transformation and a series of incremental changes. This distinction may lie in the temporal aspect of the system. Incremental changes over a period of time were shown to lead to a transformation in the system and its stability state. At an institutional level, a period of four to five years was not necessarily sufficient for a transformation to take place.
5.6.3.3. *How can the system under study be shown to have transformed?*

The stability landscape of the snapshot system under investigation was shown to be bounded by functions, feedbacks (connectedness), structure and identity (purpose) and was successfully described by examining each those factors.

A set of defining variables has been able to be extracted from the data. These variables have been developed into the *Institutional System Variables*. These were used to describe the state of the system under investigation and have been successfully applied across the case to demonstrate transformation in the system. Changes in the stability landscape have been collated against the six Institutional System Variables system, as listed in Appendix 8, Table A 8.2.

The small number of system variables which emerged in this study is consistent with the environmental literature and the use of variables in the origins of properties of social-ecological systems (Holling, Gunderson, & Peterson, 2002). Consistent with the broader systems approach, changes to one or more variables were observed to have a cause and effect relationship whereby a change in one variable was shown to have an effect on other parts of the system. This is the essence of feedbacks in the system (Meadows, 2009).

5.6.3.4. *What features contribute to the transformability of the system?*

A summary of the Institutional System Variables (see Section 5.6.3.6) serves as a comprehensive list of the features which contributed to transformability and also resilience. The latter is explored in the final heuristic, resilience (Section 5.7). The features either helped to keep the system within the same stability landscape, contributing to the resilience of the system, or helped towards a full transformation into a new state and a new stability landscape. The findings did not show a clear predictive consistency as to whether a particular feature would help a system to retain its current identity, thereby remaining in its stability landscape, or to transform. Consistent with a systems approach the impact of individual features appeared to be related to the interactions at a whole-of-system level and features should not be considered in isolation. This would be an area for further investigation.
Because the institutional system is a social construction, the social variable emerged as a key variable. The property of *adaptability*, of the people and the system, contributed to transformability (see Adaptability heuristic, Section 5.5). A further set of features which can be used to understand transformability of a system are the four general requirements necessary for adaptability and transformational change (see Table 5.9).

5.6.3.5. *What was the stability landscape before and after?*

It was possible to demonstrate changes in the system, or stability landscape. The changes in the system are illustrated in Appendix 8, Table A 8.2. Changes in organisational structures which formed part of the system are illustrated in *Figure 5.12 and Figure 5.13 and Figure 5.14*.

5.6.3.6. *Summary of the Institutional System Variables.*

The six variables have been re-badged in a more meaningful and memorable way as *SCOOPE – a Guide to Institutional System Variables*, as illustrated in *Figure 5.15*. A concise summary of each variable contributes to their potential application in different cases (see below).

![SCOOPE - a guide to Institutional System Variables.](image)

*Figure 5.15. SCOOPE - a guide to Institutional System Variables.*
Variable 1 Strategy, policy and planning – Appeared to have an initiating function to drive and guide processes and operations. There was an almost cyclical trend in the development of strategy and policy with associated regular planning events in a variety of areas. There was some overlap in classifying the data according to certain variables, in particular in separating out planning from operations, processes and procedures.

Variable 2 Connectedness – Feedbacks in the system were a key factor in determining changes to the stability landscape. Feedbacks were determined by the connectedness between components in the system. The data revealed that connectedness as a variable encompassed interactions, relationships, dependencies and interdependencies between people and structures in the system. This is consistent with the findings in the investigation into understanding the learning environment.

Variable 3 Organisational structures – Encompass formal and informal structures. Formal structures included those institutional groupings of staff who have a common purpose. The purpose was determined by “human resources” boundaries. These boundaries included position descriptions which defined roles and thus operational functions. Groupings were also functional communities of practice which emerged from working together towards a common purpose. These included formal project teams working across human resources boundaries, committees and working parties. Formal structures included physical resources and infrastructure such as buildings, technology, campuses and associated physical structures.

Variable 4 Operations, processes and procedures – Included the formal institutional procedures. In the large and dispersed case study institution it was challenging to develop consistency in operations and processes. Formally describing and disseminating processes and procedures at the various levels within the institutional level was a way in which innovation and changing processes appeared to effectively be mainstreamed. Where there had been a significant change in the structure of the system, including changes in roles and relationships, it was noted that a collaborative development of processes and procedures was effective.

Variable 5 People/roles – The factors influencing this variable were the people themselves. This included who, how many, what formal roles and activities they
undertook, what informal activities they undertook, their individual capabilities. Adaptability of people/individuals is a property of the social-ecological system. The variable of connectedness was closely associated with, and difficult to separate out from, the variable of people/roles.

*Variable 6 Educational technology* – Educational technology has a distinct cause and effect role in the system and appeared to play a role in a number of variables. It facilitated connectedness (interactions, relationships, dependencies); it was a stimulus for change in operations and processes, and it also enabled and stimulated change in people.

5.6.4. **Conclusion**

Transformability as a property of the social-ecological systems approach has been successfully applied to the case through the use of a defined system. That is to say, an institutional system can be shown to transform and thus possesses the property of transformability.

Variables and criteria have been identified which can be used to analyse an institutional system in order to understand its transformability. The Institutional System Variables serve as a comprehensive list of the features which contribute to transformability and also resilience. The Institutional System Variables which have been extracted and developed potentially have broader application to other institutional systems, although though this remains an area for future research.

The features that were identified contributed to identifying changes in each variable and subsequently, to identifying incremental change or transformation in the stability landscape (system). It was beyond the scope of this study to attempt to elucidate quantitative measures of the variables. However, an area for future research would be to look for quantitative measures of these variables as indicators of change or transformation.
5.7. Heuristic 5 - Resilience

5.7.1. Background

The fundamentals of Resilience Thinking have been covered in the theoretical foundations to this study (see Review of the literature, Chapter 2). It is acknowledged that there are numerous definitions of Resilience in the literature and that “both conceptual clarity and practical relevance are critically in danger” (Brand & Jax, 2007). Brand and Jax’s paper provides detailed background for the different typologies of Resilience and goes beyond definitions to address conceptual concerns which appear to be impacting on research into this area in the scientific field. While on the one hand they call for conceptual clarity and practical relevance, on the other hand, they suggest that; “the increased vagueness and malleability of resilience is highly valuable because it is for this reason that the concept is able to foster communication across disciplines and between science and practice” (Brand & Jax, 2007. Online). *Shocks and disturbances* are a foundational aspect of understanding Resilience in a system.

The definition of Resilience pertinent to this study is that:

*Resilience is the capacity of a system to experience shocks that is, to absorb disturbance, while retaining essentially the same function, structure, feedbacks, and therefore identity.*

The terminology from this definition of Resilience will now be confirmed as it has been applied to the case. Resilience (capital R) is used for the overarching concept and resilience (small r) refers to the heuristic. The more general application of resilience outside of the environmental management field (in this study) is denoted by resilience (small r). The reader is referred to the Glossary (page xxvii) for descriptions of key terms which underpin this investigation.

The questions which guided the investigation into transformability were:

- Can the heuristic of resilience be applied to the case?
• How can resilience be applied to the case?

• What are the normal functions, structure, feedbacks and identity of the system under study?

• What were the observable changes in the functions, structure, feedbacks and identity of the system under study?

• What shocks and disturbances were observed in the system?

• What features of the system could be shown to contribute to its Resilience?

5.7.2. Findings

The Institutional System Variables which can be used to define the system and stability landscape of the technology-enhanced learning environment are important to the understanding of Resilience. The variables which were identified in the investigation into the heuristic of transformability have been summarised in Section 5.6.3.6. These variables were used to analyse the data to identify features and to determine changes in the system according to the functions, structure, feedbacks and identity of the system which could contribute to an understanding of the heuristic of resilience.

5.7.2.1. What are the shocks and disturbances?

Identifying the sphere of influence and locus of control was introduced as a way to understand the many levels of influence within and on the learning environment. The level at which the shocks and disturbances can influence the system under study has been defined by classifying the shock/disturbance according to this model. A classification system was developed from the data to identify the level at which the shock or disturbance influenced the system being observed (see Table 5.10). The shock or disturbance was identified as being either external or internal to the system, according to the locus of control of the system. The level/s at which a shock or disturbance influenced the system was the sphere of influence and this could cross multiple levels.
Table 5.10. *Locus of Control/Sphere of Influence Classification of Shocks and Disturbances in a System.*

<table>
<thead>
<tr>
<th>Locus of control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>External to university</td>
<td>Locus of control is external to institution</td>
</tr>
<tr>
<td>University</td>
<td>Locus of control is at whole-of-university level</td>
</tr>
<tr>
<td>Faculty/division</td>
<td>Locus of control is at faculty or division level</td>
</tr>
<tr>
<td>School/unit</td>
<td>Locus of control or influence is at the school or unit level</td>
</tr>
<tr>
<td>Learning environment</td>
<td>Locus of control is within the student-teacher learning space</td>
</tr>
</tbody>
</table>

The shocks and disturbances which influenced the learning and teaching support system for educational technology related to the provision of online learning resources to students over the time period of the study are summarised in Table 5.11. This is not an exhaustive listing but is representative of the variety of shocks and disturbances which were observed to affect the system during the time period of the study. This includes the academic world view as well as that of the support services which had a major role in supporting the provision of digital media learning resources to students, in particular in the online environment.
Table 5.11. *Summary of shocks/disturbances which influenced the system.*

<table>
<thead>
<tr>
<th>Locus of control</th>
<th>Shock/disturbance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>University</strong></td>
<td>2010 - Introduction of a new unified session model (USM) of teaching sessions; 2009 - new Mandatory Subject Information (MSI) policy and Online Subject Outline system; 2009 - Change in staffing profiles and salary ceilings; 2007-2008 introduction of new educational technology <em>CSU Interact</em></td>
</tr>
<tr>
<td><strong>Faculty/Division</strong></td>
<td>2006 faculty and school restructure; 2007 strategic voluntary separation; 2008 Fac. of Education cross-campus EC course; 2009 formation of new Div. of Learning &amp; and Teaching Services; changing student profile; course reviews and changes; move from print to online learning resources (ongoing); lack of adequate timetabling system to support flexible delivery modes; implementation of a new OLE <em>CSU Interact</em>; introduction of new educational technology, DOMS, Subject Outline Tool</td>
</tr>
<tr>
<td><strong>School/Unit</strong></td>
<td>Academic staff shortages; changing student profile; workloads; changing client needs; course reviews and changes; research directions; casualisation of academic staff</td>
</tr>
</tbody>
</table>
An examination of the temporal dimension of the data showed that in 2009 there was a simultaneous change in a number of the variables in the case system. These included changes to subject outline policy and technology, a change in subject outline development processes and a change to the major support roles of EDs and MDCs. Changes in multiple variables represents a major disturbance to the system.

5.7.2.2. **What are the normal functions, structure, feedbacks and identity of the system under study?**

The benchmark for normal has been defined as those functions, structure, feedbacks and identity of the system which facilitate the system being able to carry out its defined purpose. For the snapshot system, these were identified at the beginning of the study in 2007 and are described and discussed in conjunction with changes to the normal functions over the time period 2007 to 2010 (see Section 5.7.2.3).

5.7.2.3. **What changes were observed in the functions, structure, feedbacks and identity of the system under study?**

*Functions* – The changes in the normal system functions that were identified from the data are summarised in the following tables in Appendix 9:

Table A 9.1. *Changes in Normal Functions of the System.*

Table A 9.2. *Changes observed in the Functions (roles) of People.*

Table A 9.3. *Impact of the Availability of Interact on the Functions and Activities of Different Areas of the System.*

The data also illustrates some of the changes in activities and processes associated with changes in function of the system over the period of the study.

Table A 9.3 summarises the Impact of the Availability of Interact on the Functions and Activities of Different Areas of the System. There was an upskilling of both academics and educational designers in their use of technology and design of
online learning experiences. The availability of Interact (the LMS) provided new ways of delivering cross-campus courses. There were changes in operational processes. However, the data also highlighted changes in workloads. Educational designers noted an increase in support required for the use of technology and academics took on more responsibility for the provision of learning resources to students in the online environment. There were changes in staff support for educational technology and the management/leadership of educational technology.

With rapidly changing technology and curriculum renewal and course re-design there were significant changes in the production and distribution/delivery of digital media learning resources. There were evolutionary changes in project management and involvement in digital media projects. Providing professional development for staff in the use of educational technology became a core role of EDs and there was an expansion of specialist educational technology expertise in a distributed model.

Between 2002 and 2008 in CELT and the LMC there were specialist roles (Learning Media Laboratory Coordinators and Media Technologists) to support the innovation and use of technology, with a minority of educational designers having the relevant skills. By 2010 it was expected that all educational designers should have similar skills to those required of the specialist Learning Media Laboratory Coordinators between 2002 to 2008.

There were changes observed in the people (roles) who were identified as being responsible for key functions in the system. While there was observable change in some functions, in many cases the core functions remained the same with only a change in who carried it out and how.

Change management for educational technology was a growth area for leadership in the implementation of new educational technology. Communication was a vital component of the system and there were many changes in the pathways, connections and interactions required to keep the system functioning in the face of institutional changes, changes in technology and changes to personnel.

At the institutional structural level there was a significant change in the function of the system relating to educational technology implementation, where the
responsibility for educational technology implementation moved from DIT to DLTS. This also meant that the locus of control now sat with DLTS.

Digital resources provision to students continued to be a basic function but from 2008 onwards academics became more hands-on with the actual processes of developing and publishing online. Academics were then able to author and self-publish digital learning resources in *Interact* which freed up LMC/DLTS media processing officers to focus on other growth areas in digital media production. There were also changes in the scope within some functions. For example the type of professional development provided by EDs changed with the increased focus on educational technology in their roles. There were quantitative changes such as an increase in digital media production by support services (LMC and then DLTS).

An increased focus on educational technology was reflected in many of the role changes supporting the various functions. All educational designers were expected to take on professional development and change agent roles in relation to core CSU educational technology. There was a significant move towards course (program) design and development. Other areas of the university, such as the new Flexible Learning Institute, began to contribute to the outcomes of certain functions such as professional development. An example of this was through offering symposia for course design for blended and flexible learning (Flexible Learning Institute, 2013).

The impact of the introduction of *Interact* on the functions and activities of different areas of the learning and teaching support system for educational technology has been summarised in Table A 9.3. Schools were considered to be within the boundaries of the support system because academic staff were directly responsible for providing learning resources to students. The advent of *Interact* resulted in academics having a more direct involvement in providing online resources to both internal and distance students.

*Structure –* There are two levels at which the term “structure” could be applied in this study. Firstly there is the structure of the defined (Snapshot) system which consists of its components and the interactions in the system. This was the focus of this part of the study.
Secondly there is the organisational structure; the divisions, units, faculty and schools whose members carry out the functions of the system to produce the output. Changes in organisational structure have been comprehensively covered in the discussion about the adaptive cycle (see Section 5.4). There was an increase in the range and number of people involved in carrying out the functions of the system with a corresponding increase in the units/divisions involved in the support of the technology-enhanced learning environment (see Appendix 9, Table A 9.2). The affiliation of these people was primarily related to their particular role.

*Feedbacks* – A few examples of feedbacks in the system are now described. Changes in one component or variable in the system were observed to affect other areas. Organisational structural changes, such as the formation of the new Division, affected the social components of the system where there were role changes for individuals. Role changes in turn affected processes, or how particular functions would take place. Changes in the University Strategy and policy impacted across all the variables with consequent changes to organisational structure, technology and policy, amongst others. Introduction of new technology affected the social components of the system, both positively (new ways to engage with students and colleagues) as well as negatively (increased workloads, lack of competency in using technology). Technology changes also impacted on processes and were seen to initiate policy change. Connectedness (communication, interactions) between the social components, in relation to educational technology, was seen to increase over the duration of the study (see Table A 8.2. *Change in the Stability Landscape against the six Institutional System Variables*.). There was increased connectedness with the development of communities of practice around educational technology (ICT Integration Forum) which led to an increased uptake in technology and membership of key educational technology reference groups.

*Identity* – The investigation into the transformability of the system has presented the findings concerning the observed changes associated with the feature of identity (see Section 5.6.2.4) and these will not be repeated here. Those findings will, however, be drawn on to inform the discussion and conclusions about the heuristic of resilience.
5.7.2.4. *What features of the system promote its resilience?*

The features of the system which contributed towards developing resilience in the system as a whole are referred to here as *Resilience features*. A number of Resilience features were identified and mapped against the functions of the snapshot system (see Table 5.12).

Table 5.12. *Summary of Resilience Features Mapped against the Functions of the System.*

<table>
<thead>
<tr>
<th>Function</th>
<th>Resilience Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course and subject design &amp; development</td>
<td>Designing subjects with reusable resources; designing for blended learning approaches; avoid too much personalising of subjects where subject coordinators change; map digital media and technology through a course design approach</td>
</tr>
<tr>
<td>Consult around designing learning experiences and environments</td>
<td>Have the right staff and develop necessary skills, remain flexible in roles; allow people to respond to needs; well defined &amp; recognised professional roles can weather changes in needs; design subjects for delivery by any staff; provide people with the opportunity to make professional judgements; leave it up to academics to make their own choices around their use of technology &amp; don't lock down freedom to access new tools with policy/technical constraints; sufficient resources/budget; have a single person with common knowledge or way to store a picture of a course whole; make sure you have the right staff and develop necessary skills; well defined &amp; recognised professional roles can weather changes in needs, design subjects for delivery by any staff</td>
</tr>
<tr>
<td>Function</td>
<td>Resilience Features</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Communication</td>
<td>When there is lots of change in support divisions close communication with the faculty around new processes &amp; people builds relationships; ensure clear understanding of roles to avoid overload of work; people are more accepting when they feel they have been consulted and genuinely listened to about the educational technology; communication is key - sell the technology and make users feel they have ownership of the new technology or the change going on; have regular meetings and sharing opportunities across stakeholder groups; widespread communication around why, how and when new educational technology is being implemented</td>
</tr>
<tr>
<td>Staff support (educational technology)</td>
<td>Mainstream PD activities through central publicity and access; flexibility, agility, adaptability important attributes (support staff); developing others into new technology roles - mentor and hand over with resources available; drop-in help sessions to show people the basics of new technology help get people off the ground so they don’t need any more help; one-to-one help sessions with people; people need proactive support - leaving people alone does not work; know the boundaries and sphere of influence when working as a service unit; clarity around changes in processes and technology when it means academics/other staff will be taking on different tasks; sufficient resources/budget</td>
</tr>
<tr>
<td>Management/leadership educational</td>
<td>Courageous leadership and good management; follow up personally on issues heard in professional meetings; use incentives for completing work (carrot not stick</td>
</tr>
<tr>
<td>Function</td>
<td>Resilience Features</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------</td>
</tr>
<tr>
<td>technology</td>
<td>approach); efficiencies; imposing technology top-down is not well received; pilots are more than testing technology but are also about testing processes and procedures and policy; cutting a budget and asking people to do more with less is detrimental to engaging people; new technology can facilitate new modes of course delivery cross-campus - with adequate planning and investment from number of parties; benchmarking at a variety of levels; institutional level strategy and planning for educational technology; efficiency and purpose; be able to plan for uncertainty; multi-pronged attack to ensure communication reaches everyone; manage expectations; clarity around technology and tasks when there is a change in process brought about by technology; believe in people that they can do the task and will then rise to the occasion</td>
</tr>
<tr>
<td>Make connections</td>
<td>Know the holistic system and be able to identify the effects/consequences of particular changes to technology, process and policy</td>
</tr>
<tr>
<td>Production and distribution/delivery of digital media learning resources</td>
<td>Provide mainstream centralised facilities for development and production of digital media; build capacity for use of digital media through a central production unit; build independence and capacity of users through skills development; make software and hardware accessible to users; continually update skills and technology in line with changing needs of users; have online database systems for subject outlines which allows staff autonomy/minimises dependence on other parts of system</td>
</tr>
<tr>
<td>Function</td>
<td>Resilience Features</td>
</tr>
<tr>
<td>----------------------------------</td>
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</tr>
<tr>
<td>Professional development</td>
<td>Access to ongoing PD in use of educational technology (general and specific) and design of learning experiences for online and blended learning builds capacity</td>
</tr>
<tr>
<td>Project management and involvement</td>
<td>Systems support project management; culture and professional practice support a project approach to digital media and online resource development</td>
</tr>
<tr>
<td>Specialist ed. Tech. expertise – design</td>
<td>Use of specialist expertise in key areas; work with multi-stakeholder groups in educational technology projects; support for PD and professional experience opportunities for specialists</td>
</tr>
<tr>
<td>Specialist ed. Tech. expertise - software development</td>
<td>Use of specialist expertise in key areas; exposure to multi-stakeholder groups in educational technology projects; support for PD and professional experience opportunities for specialists</td>
</tr>
<tr>
<td>Educational technology change management</td>
<td>People can't always engage with new ideas until the need arises; institutional level support through leading change workshops; efficiency; be forward looking, not just best current practice; need multiple ways of doing things; make it happen in a softer inclusive way, collaborate on the change to take people on the journey with them; set expectations; multi-pronged attack to ensure communication reaches everyone; manage expectations; clarity around technology and tasks when there is a change in process brought about by technology; believe in people that they can do the task and will then rise to the occasion</td>
</tr>
<tr>
<td>Function</td>
<td>Resilience Features</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Organisational learning</td>
<td>Sharing practice; understanding how to build people’s stake in an issue as an active process; social learning; understanding learning and how one learns; use evidence based practice/management; innovation needs a free space with minimal constraints; develop appropriate feedback mechanisms and channels</td>
</tr>
<tr>
<td>Research</td>
<td>Academic research feeds into evidence based management &amp; evidence based practice; provides links and synergies with academic processes</td>
</tr>
<tr>
<td>Feedbacks</td>
<td>Observe/review/monitor/reflect to understand the pathologies behind acceptance of new technology; debrief with stakeholders after disasters and debrief after successes; know the holistic system and be able to identify the effects/consequences of particular changes to technology, process and policy</td>
</tr>
<tr>
<td>Educational technology implementation</td>
<td>Have reliable, robust, usable and intuitive systems; where the technology is immature/work in progress sufficient PD support and Help documentation can alleviate problems; technology change needs to keep pace with changing needs of the system (delivery modes etc.); engage stakeholders early; form Reference groups with academic presence; ED must have access to authentic trial systems on which to learn &amp; teach others the new systems; systems do not need to be complex to be effective; increased autonomy &amp; less dependence on inter-unit collaboration; work for flexibility in projects where there are inter-dependencies; specialists LMLCs and educational technologists; robust processes and</td>
</tr>
</tbody>
</table>
5.7.3. **Discussion**

This discussion is based on the questions which guided the investigation into the property of resilience.

5.7.3.1. *How can resilience be applied to the case?*

The heuristic of resilience was applied to the case by using a single snapshot system. That system was the **learning and teaching support services system for the use of educational technology related to the provision of digital media learning resources to students**. The system was demonstrated to be bounded by functions, feedbacks (connectedness), structure and identity (purpose). The identity, or purpose, was demonstrated by the outputs of the system. The purpose of the system was to: support learning and teaching and the use of educational technology related to the provision of digital media learning resources to students.

I have been able to extract from the data a set of six Institutional System Variables which have been developed and used to describe the state of the system under investigation. These variables have been applied across the case, as a framework to explain observations in the data from the heuristics of transformability and resilience.

5.7.3.2. *What are the normal functions, structure, feedbacks and identity of the system under study?*

The findings have shown that it was possible to identify functions, structure and feedbacks in the system. Determining a measure of “normal” was more difficult.
since normal is a relative term. While the core (normal) functions of the system did not appear to change significantly over the period of the study (see Table A 9.1), they did change over longer time frames. There was, however, ongoing modification and variability in core functions over time. There were also frequent organisational structural changes. “Normal” is perhaps best understood in a temporal dimension as the current situation in a system at a particular moment in time.

5.7.3.3. **What were the observable changes in the functions, structure, feedbacks and identity of the system under study?**

**Functions** - The findings highlighted a distinction between function and purpose. The data revealed many different activities or functions which contributed to the purpose and output of the system (see Table A 9.1). The basic functions did not appear to change over the time period of the study 2007 – 2011. There were no basic functions which ceased and no new functions were identified. However, the data showed that when the system was observed over a longer time period (1998 – 2011) there were significant changes to the basic functions within the system. This highlights the value of the panarchy approach which encourages a longer temporal view of the learning environment. Resilience appears to be a time-dependent attribute of the system and should therefore include temporal boundaries in the definition of the system to which resilience has been applied.

In a system where the basic functions associated with educational technology and the provision of digital resources to students remained predominantly the same in the short or longer term, what did change in terms of functions was how those functions were carried out (the processes) and by whom.

It was beyond the scope of this study to attempt to quantify the changes in involvement of individuals in the functions of the system. However, the following comment from one of the interview participants about the introduction of the new Subject Outline Tool (MSI) illustrates the need to be able to quantify aspects of an institutional system in order to fully understand the implications of changes in the variables of that system.
I recall one of the first information sessions that was held on this campus [the project manager] presented the outline because it was pre-populated and said it would take four programmers four months to pre-populate and [the program team] barely could get it done so [they were] doing it this way. As one academic pointed out, so instead of having five programmers doing it for four months and getting it done we hand it over to every academic to get it done so you can hide the cost. [IP16]

The corollary to this incident was that operationally, the manual population of the first outlines was so time-consuming that each faculty was given extra funding to spend on assisting academics with the process and DLTS provided extra support to schools in the initial transition to online subject outlines.

Structure - The changes in organisational structure which affected the system appeared to fall into two categories - active and passive.

Active changes describe those changes which were actively engineered to enhance the capacity of the system to support the provision of digital media learning resources to students. These included changes whereby the basic building blocks of the organisational structure (the people) were reclassified, sorted or repurposed through organisational restructuring into a new faculty, school, division or operational unit. The institutional vision for regrouping people appeared to be to change, or at least better service, the required output of the system. In some cases this extended to contributing to a change in purpose of parts of a system. Active changes were the formal, institutionally driven changes.

Passive changes were those changes in organisational structure which included the reorganisation of groups of people in response to the changed needs or purpose. This was mostly observed at the unit or school level. Groups of people could be re-formed as communities of practice to address an emerging need and to carry out a particular function or task without the formal, institutional changes/boundaries. Passive changes were organic, evolving from the bottom up. This has synergies with self-organising systems (Bain, 2007). In the latter stages of the research there was a growth in the use of social networking for communication and developing
communities of practice. The use of Yammer (a corporate social-networking application) and an Interact work group site called ICT-Integration was a way to bridge the boundaries between institutional sections at a variety of levels across the university. The use of social-networking towards restructuring and building structures of signification in an educational institution will be an interesting area to watch in the future.

With the changing focus of educational technology and the changing functions of the (Snapshot) system different outputs were required. In some cases the established role (formal duty description) of a person was observed to determine their function or output, including limiting what that person might engage with. Detailed duty descriptions not only established what output the individuals should have but were also observed to set the boundaries on that output. Roles were regularly revisited over the course of the study as client needs for support services changed. The actual people employed, however, remained largely the same with few changes to appointments.

In some cases an individual’s skills were a factor in determining their contribution to the functions in the system. This was seen, for example, in the variation in actual activities which educational designers undertook in their particular area. These were generally, but not always, aligned with individual professional strengths.

Sometimes there were a number of people responsible for, or involved with, a particular function, such as digital media projects. This appeared to cause some confusion, especially where the function was shared across two different organisational units. Autonomy of function and roles within a confined organisational unit seemed to be a factor in assisting a smooth operational outcome.

*Feedbacks* - There was evidence that changes in one variable in the system affected other variables. Being able to identify the presence of direct cause and effect relationships and feedback loops was an essential part of being able to determine whether a collection of elements (components) was a true system, or just a group of elements without a particular function/purpose or interconnections. Direct cause and
effect relationships are examples of feedback in the system. Feedback in the system was provided by interactions between the variables, and in a social system this requires human interaction. Interaction within the context of the case was described by the dimension of connectedness which became an important link in understanding the variables.

*Identity* - Applying the concept of system identity to the institutional context has potential value in the field of educational management. One can identify an institutional system by drawing its boundaries according to a particular purpose. The system can then be analysed according to the Institutional System Variables and its basic structure and functions which can provide operational insights. The significance of this for an institution is for planning purposes. Conceptually and strategically one can plan at a comprehensive systems level which cuts across the boundaries and thus addresses the limitations of the “silo” phenomenon characteristic of organisational structures. Operationally the logistics of working across the boundaries of divisions, faculties and institutes still remained.

Distributed institutional processes can be redefined as a system with functions, structure, feedbacks and identity. Processes, components, relationships, interactions, inputs and outputs can be translated into a system and Institutional System Variables can be identified. The reflexive, cause and effect relationships in the system can be understood and predicted.

5.7.3.4. *What shocks and disturbances were observed in the system?*

A classification system applicable to the case study institution was developed to assist in the description of the shocks and disturbances (see Table 5.10, Section 5.7.2.1). The shock or disturbance was identified as being either external or internal to the system under investigation according to the locus of control of the system. The level/s at which a shock or disturbance influenced the system was the sphere of influence which in turn was dependent on how the boundaries of the system were defined.
Separate to the classification of the shock or disturbance is how individuals dealt with these. This appeared to depend on the peoples’ locus of control. The senior executive staff working at a whole-of-university level, for example, had more control and influence over some decisions and operational aspects of the university than a staff member working at the school or unit level.

It took some time for the tangible effects of external events (shocks) to filter down to the operational levels of the institution. Action at a strategic level began at the senior executive level and filtered down through the university levels over time. One example of this was the recommendations from the Bradley Review (2008) which initiated external changes such as the formation of TEQSA and the uncapping of university enrolments. This initiated a premature review of the 2007-2011 strategy and associated action plans to accommodate the necessary changes in University directions. This review resulted in the new CSU Strategy 2011-2015 (Charles Sturt University, 2011).

The “MSI experience” refers to the implementation of new university policy (the MSI policy) and new technology (the online Subject Outline Tool) together with changes in processes (production of print subject outlines). The MSI experience can be categorised as both a shock and a disturbance and was an important learning experience for many sectors of the university. It is not the place of this study to comment on the efficacy of the organisational decisions which were made, or to suggest improvements for the future. However, what a focus on the MSI experience contributed is a well-documented snapshot of how different areas of the university dealt with an event which could be perceived as both a shock and a disturbance. The way in which individuals, schools and divisions approached the implementation of the MSI policy and the associated Subject Outline Tool gave an insight into the factors which affect a system’s Resilience and the overall functioning of the system.

The evidence showed that shocks and disturbances do dissipate and the system adjusts to the effects. The disruptive effect of the introduction of the new online Subject Outline Tool in 2009 appears to have had a positive long term outcome. By 2012 it was contributing to Resilience in the system by providing ease of access to
previous years’ outlines, a facility to clone outlines and to draw in data from other university systems such as subject coordinator database, staff contact details and Course and Subject Information Management System (CASIMS). It provided a way of dealing with the logistics of complex cross-campus course offerings, and facilitated the timely production of subject outlines when new staff and sessional staff appointments were made close to start of session. Importantly, as Australia begins a new phase in higher education with an increased focus on standards and reporting through TEQSA, CSU’s Subject Outline Tool will be an important component in the system for maintaining consistency and satisfying the reporting standards.

5.7.3.5. What features of the system could be shown to contribute to its Resilience?

A summary of the Resilience features was reported in the Findings (see Section 5.7.2.4, Table 5.12).

The features of the system which contributed towards developing resilience in the system as a whole are referred to here as Resilience features. A number of Resilience features were identified and mapped against the functions of the snapshot system (see ).

Key features which contributed to the resilience of the system included designing courses and subjects with reusable resources; and also mapping digital media and technology through a course design approach to support course and subject design and development.

Flexibility, agility and adaptability were important attributes of support staff and change agents. Other attributes included courageous leadership in educational technology and good management practices and skills. It was important to believe in people that they could do the task and would then rise to the occasion and provide institutional level support for major change initiatives, including professional development for change agents and leaders. Providing people with the opportunity to make professional judgements helped minimise the dependence of individuals on
other specialists. This was assisted by having well-defined and recognised professional roles which were able to weather the changing needs.

Communication was an essential Resilience feature and holding regular meetings and sharing opportunities across stakeholder groups made people more accepting of change when they felt they had been consulted and genuinely listened to about the educational technology.

At a practical level, sufficient budget and resources in all areas of support for the use of educational technology contributed to the Resilience of the system. Good centralised systems in production and distribution or delivery of digital media learning resources built capacity for resource-based approaches in the extensive distance education environment. However, building the independence and capacity of individual users to develop and maintain their own resources developed to resilience.

Features which contributed to successful educational technology implementation were to engage stakeholders early and to have reliable, robust and usable and intuitive systems. Where there were problems with reliability or usability of technology then robust processes and good communication helped weather the introduction of technology. Using a multi-pronged attack to educational technology change management helped to ensure good communication between everyone.

In addition to the formal, institutional hierarchical structures which have a role in the implementation of technology, another feature which emerged as important in resilience during the implementation of educational technology at an organisational level was that of self-organising systems. These self-organising systems were effectively the functional groups. The functional group could be a faculty, a school, a group of educational designers on a particular campus, a group of Study Skills staff from Student Services, or a research group coming together for a common purpose or need.

Organisational learning contributed to system Resilience and needed a free space with minimal constraints, but also needed to be supported by appropriate
feedback mechanisms and channels. Academic research fed into evidence-based management and evidence-based practice which contributed to system improvement. Benchmarking at a variety of levels helped planning for uncertainty.

The Resilience features which have been identified are perhaps some of the more valuable, practical outcomes of this research, because they support a new paradigm of thinking in educational management – that of Resilience.

The individual features which were identified are not necessarily “new” to management or to higher education. These features include attributes such as agility, flexibility, adaptability, communication skills, capacity building, robust processes, change management, organisational change and planning. However, what is new is identifying these attributes/skills/concepts as Resilience features and consciously aligning them with developing Resilience in a university system – that of the technology-enhanced learning environment.

The six Institutional System Variables serve as a valuable framework for identifying Resilience features and aligning them with core system functions and structures.

5.7.4. Conclusion

Resilience as a heuristic and property of the social-ecological systems approach has been successfully applied to the case through the use of a defined system. When applying the properties of the social-ecological systems Study 1 focused on resilience the heuristic. Resilience is loosely used as a metaphor in the literature and its potential application is broad. The broader and more important notion of Resilience is in its application applied at the whole-of-case (systems) level. This is discussed further in the Autoethnography in Chapter 6.

The normal functions, structure and feedbacks in the system were able to be described. Shocks and disturbances were identified and a classification system applicable to the case study institution was developed (see Table 5.10). The Sphere of influence/Locus of control model (see Figure 2.2) can be used to illustrate the effects of shocks and disturbances with the learning environment as the central focus.
This is also explored further in the Autoethnography (see Chapter 6, Figure 6.2. The relationship between the learning environment, the organisation and the external environment.)

Changes in structural variables in the system were observed to be active (formal, institutionally driven) or passive (people reorganising themselves in response to an emerging need).

A practical outcome from the investigation into resilience has been the identification of Resilience features (see Appendix 9) which contribute to the Resilience of a system. Although many of the features are specific to the functions in the case, they could have generic application to other systems with similar purpose and functions in other higher education institutions.

The higher level conceptual outcomes, however, are those of; introducing Resilience, identifying Resilience features and consciously aligning those features towards developing Resilience in a university system – that of the technology-enhanced learning environment.

The heuristic of resilience should not be considered on its own, but in combination with the four other heuristics of the social-ecological system. The findings from the investigation are brought together in the following Summary of Study 1, Part 2.
5.8. Summary Study 1, Part 2

This section draws together and summarises the key findings from Study 1, Part 2: The application of the social-ecological systems approach to the case.

The reader is directed to the Glossary of terminology (see page xxvii) which has been developed for this work. The Glossary includes key existing operational definitions taken from the literature, as well as new, case specific terminology which has been developed during the research. The decision to place the Glossary at the beginning of the thesis was made to provide the reader with some prior knowledge of relevant terms within the case study context in order to understand and navigate the narrative more easily.

The current understanding of the application of the five heuristics of the social-ecological systems approach to the technology-enhanced learning environment in the case is summarised below.

The systems which have been identified as important for our understanding and management of the technology-enhanced learning environment fall broadly into two areas: the learning environment and the institutional environment.

- The technology-enhanced learning environment in a higher education institution can be described as a system with its components, structures, functions and feedbacks.
- The system is an artificial construct and as such the boundaries need to be defined.
- The technology-enhanced learning environment has five dimensions which can be described through the Dimensions Model of the Learning Environment (see Figure 4.1).
- The Institutional support system for the technology-enhanced learning environment can be defined by six Institutional System Variables: 1. Strategy, policy and planning; 2. Connectedness; 3. Organisational structures; 4. Operations, processes and procedures; 5. People/roles; and 6. Educational technology (see SCOOPE, Figure 5.15).
• An *institutional support system* can be *created* or *defined* by determining the output (functional needs) of the institution or defined area of an institution – for example the provision of digital media learning resources to students.

• The *output* is the *purpose* of the system where purpose precipitates the choice and grouping of the *components*.

• The institution/organisation defines a system to support or service that output with components comprising *structures* (unit/school/division), *functions* (activities), *interconnectedness* and *feedbacks*. This system is part of the *stability state* of the particular functional system in the institution.

• A change in one or more variables may cause a change in other variables and parts of the system and thus affect its functions and output.

• Sometimes a need for a change in the *purpose* of an existing organisational system is identified. The existing system is then tasked with meeting the new or modified purpose.

• To meet the new purpose there need to be changes to the variables and ongoing changes in the components of the system.

• Changes to the variables may be *proactive* or *purposeful*, such as re-training staff, process improvement or through policy changes; while other changes may be *responsive* or *reactive* (unplanned).

• Changes in the variables reflect the change in the stability landscape of the system.

• *Resilience* in the system is measured by how far the existing variables and components in the system can buffer shocks and disturbances before there is an observed change in purpose and hence identity.

• In a robust (self-organising) system, connectedness and feedback leads to incremental changes/evolution in functions in response to feedback. If the required output of the system changes significantly from the original purpose of the system servicing that purpose, this could trigger the requirement for major changes in the system leading to a transformation of the system.

• The ability of a system to undergo transformation is aligned to the heuristics (properties) of *transformability* and *adaptability* and their attendant features.
• *Adaptability* is the capacity of the social components in a system to manage change, including technological change.

• *Transformability* is a property which contributes to the transformation of the system.

• A system can take on a new purpose when there has been sufficient, transformational change in its inherent functions.

• Changes in the system variables support changes in functions and when these functions are sufficiently different to the original system, it can then take on a new purpose. This change can be *evolutionary* and take place gradually in response to the needs of the organisation/environment, or it can be *revolutionary* where a new need is identified in the organisation which requires the development of a new system with a particular purpose.

• *Engineering* the development of a new system to achieve a particular purpose can be achieved in a number of ways:
  
  o re-purposing of an existing system with targeted changes to the components addressing the key variables in the process;
  
  o creating a new system dedicated to meeting the required purpose; or changes to the components can take place through activities such as up-skilling staff, policy changes or improved resourcing.

• If the *purpose* (identity) of the existing system changes to be significantly different to the original need for which it was formed/developed, then it can be said that the system has moved into a new *stability state*.

• The change in stability state is demonstrated by using the *ball-in-basin metaphor*. Each basin represents a functioning system.

• A change in stability state sees a shift from one basin (system) into another and the consequent formation of a new system.

• The heuristic of the *adaptive cycle* has been developed into the *Adaptive Cycle Framework* which provides a way of structuring the gathering of data (evidence) when monitoring the changes in a system during periods of change and transformation. This can be done by using the *features* of each of the four phases in the Adaptive Cycle Framework as the criteria for gathering data.
Creative destruction. Loss of normal connections, changes in interactions amongst stakeholders, inefficiencies in operations, loss of dependencies, changes in roles, freeing up of resources/people from old ways of doing things.

Reorganisation. Innovation – trying new ways of doing things, trial and experimentation in day to day operations, sharing of ideas, questioning of status quo, pilots and trials of new technology, teams/communities of practice set up, inefficiencies, leadership emerges.

Rapid growth. New processes and procedures developed, sharing of practice, acceptance of technology, improved efficiency, leadership cemented, creating and taking opportunities to make the most use of new technology and available support opportunities, new connections, interactions and dependencies forming, collaboration.

Institutionalisation. Improved efficiencies in operations, long lasting relationships develop, ongoing development of processes, ongoing small-scale renewal and review and improvement of processes, building up of resources, centralised services have well developed processes and procedures (adapted from Buchan, 2011, p. 167).

Revolt and Remember – systems within a larger institutional system move through the adaptive cycle at different speeds and the smaller, faster moving cycles are the revolt phase which stimulates change. The structures and processes within the slower moving institutional system “remember”, and integrate the innovation into the system. A time period of less than five years appears to be too short for a complete transformation in an institutional system to be effected but may be possible to demonstrate transformation in the system over a longer time period.

Changes in institutional systems are incremental. Incremental change may be sufficient to address a change in purpose. A lack of observed transformation in a defined system may not necessarily be indicative of a lack of transformability.
• The changes in the stability state, functions, structures and feedbacks need to be sufficient to change the purpose or identity of the institutional system to reflect a transformation.

• The heuristic of panarchy can be used to ground the understanding and use of the institutional system variables across a variety of dimensions and temporal, spatial and impact scales.

• The application of panarchy introduces a temporal and holistic focus to the learning environment and the understanding of change and transformation with a particular focus on temporal and spatial aspects of the environment.

• Panarchy can be used to ground the Dimensions of the Learning Environment in order to show the links and relationships which provide valuable connections between the institutional and learning environment.

Building on the finding that the technology-enhanced learning environment is a complex system, it has been possible to define functioning systems within the institution. These systems are defined by their purpose. The single system which was defined and investigated in the case study was the learning and teaching support services system for the use of educational technology related to the provision of digital media learning resources to students.

Transformability and Resilience can be seen as different points along a spectrum within the ball-in-basin metaphor. Transformability is the ability of the system to move into a new stability state. Resilience is the ability of the system to retain its current state. The measurement and management of transformability and resilience can be done by applying the six Institutional System Variables to the institutional system. The consideration of the concepts of tipping points, thresholds and the associated concept of resistance may help determine the point at which resilience is no longer sufficient to either prevent a transformation in the system, or the point at which a transformation can take place. Where there is a high degree of resilience there is a correspondingly high tipping point and the system is resistant to transformation. Changes in the variables in the system are therefore not likely to lead to a transformation of the whole system.
The application of panarchy introduces a holistic focus to an analysis of the institutional system, the learning environment and the understanding of change and transformation in these – with a particular focus on temporal and spatial aspects of the environment.
CHAPTER 6: STUDY 2 - AUTOETHNOGRAPHY

6.1. Asking for Enlightenment

‘I heard Anna’s voice…Please, please, Mister God, teach me how to ask real questions…” Tich,” I said, “what were you asking God about real questions for?”

“Oh, it’s just sad, that’s all.”

“What’s sad?”

“People is.”

“I see. What’s sad about people?”

“People ought to get more wise when they grow older…but people don’t.”

“Don’t you think so?” I asked

“No. People’s boxes get littler and littler.”

“Boxes?...”

“Questions are in boxes,” she explained, “and the answers they get only fit the size of the box….If you ask a question in two dimensions, then the answer is in two dimensions too. It’s like a box. You can’t get out… the questions get to the edge and then stop. It’s like a prison.”

“I expect we’re all in some sort of prison.”

“She shook her head. “No, Mister God wouldn’t do that…” (Fynn, 2005, p. 236).

I was 16 when I was given a copy of a little yellow book that caught my imagination. At different phases of my life Mister God this is Anna resurfaces to inspire - by helping me see the world through others’ eyes (that was my first lesson from Anna). Anna’s young, uncluttered view of life encourages a fresh way of
thinking, ungrounded and unbounded by academic theory and existing ways of thinking and doing (that was Lesson #2).

Researchers are advised to refine their research questions early because the question frames what one will do and how to approach the research. It is also what will set the research apart from others in the field. The preliminary aims in the initial proposal were different to those in this final thesis (see Appendix 2, Buchan November 2006 Proposal for Admission to the Ph.D. Programme). Not vastly different, but definitely two–dimensional. They were aims more so than questions, which in itself was confining. The final questions were at least two and a half dimensional – but sufficient to lead me into the three-dimensional space of Resilience Thinking and social-ecological systems – and to provide a glimpse of the promise of a fourth dimension.

There are different types of questions in academic research. There are answers which pose as questions and make one rethink and follow new trails, until the answer is no longer a question. The research process is filled with those. Then there are three-dimensional questions which give us a glimpse of that fourth dimension. These are the sorts of questions and problems to which the social-ecological systems approach has been successfully applied in environmental management and which gave me a glimpse of the promise of the social-ecological systems for the management of the technology-enhanced learning environment. Some of these were shared in the review of the literature (see Chapter 2, Section 2.6.4).

The fine detail of the application of the heuristics of the social-ecological systems approach to the technology-enhanced learning environment has been covered in the ethnographic explication of the case in Study 1. The overarching, key conceptual areas which underpinned the conceptual framework of this research were Resilience Thinking and systems thinking.

This autoethnography draws on moments of illumination which informed the research journey and focuses on the findings from the key conceptual areas. The themes of identity, space and time underpin the narrative. My growth as a reflexive researcher and as practitioner, through multiple changing roles, will be explored
through the notion of identity. Identity was associated with physical and virtual spaces in the campus locations. The temporal aspect of the research process is important because it was a continuous learning experience. The nature of the data and the rich data collection permitted, and encouraged, the luxury of re-visiting moments in time through different lenses, thus gaining new insights.

6.2. Professional Context

The following account describes the professional context, the broad scope of the nature of my work at CSU and the multiple levels and areas of interactions within my work environment. The account describes the context for the case study and illuminates the reflexive researcher-practitioner role research in practice.

CSU makes the distinction between an academic and a professional (general) staff classification. My early research was done within the professional role of educational (instructional) designer (circa 2003 and 2004). Over time, my role as educational designer changed in focus to include that of educational (learning) technologist with a focus on professional development and the implementation of educational technology, including project management and change management. This was followed by a move in 2006 into middle management. These role changes are significant and represent more than simply a change in name. Each new role brought with it new responsibilities, new challenges, new opportunities for learning and importantly, the right of entry into new territories with their new sets of conversations and circles of influence. These roles were the passport to crossing borders (Britt & Sumsion, 2001; Jasman 2010; Jasman; Giroux, 1999).

These border crossings took me into different areas of professional knowledge and professional practice. Crossing the border into different fields of knowledge enabled me to source theory, research, ideas and fields of knowledge from a variety of disciplines. Crossing the border into different areas of professional practice enabled me to observe and experience practice which falls broadly into three areas: teaching practice, research practice and professional practice. My focus was not on professional practice within particular academic disciplines (such as pre-service
teaching or allied health), but encompassed the different areas of professional expertise from within the university’s administrative units and divisions.

I crossed more than just metaphorical borders. The multi-campus nature of CSU means that staff within a particular division or faculty were usually dispersed across many campuses and my daily work saw me collaborating with colleagues across multiple campuses in either virtual or physical spaces. I was based at CSU’s most southern campus, Albury-Wodonga. From 2002 onwards my different physical locations on the Albury-Wodonga campus provided me with the opportunity to mix informally with staff from a wide range of discipline and interest areas. This inter-disciplinarily was influential in exposing me to a variety of concepts which contributed to my understanding of the processes of higher education management and explored different ways to manage the learning environment. The many tearoom conversations with colleagues in all areas were an important source of inspiration - some of which is captured as data in my reflective journal - in helping me to understand the issues facing staff and students in their learning environment.

My research and professional practice led me across boundaries into academic research and gave me the opportunity to attend and present at local, national and international conferences (see Appendix 5, Table A 5.5). Professional visits to other higher education institutions; Australian National University, University of Southern Queensland, Canberra Institute of Technology, University of Canberra, University of New South Wales (ADFA) and the University of Cambridge (UK) provided me with the opportunity to compare the learning and teaching environment in my own university with that of others. During this study that professional contact became an especially important and concentrated source of data and information for this study.

6.3. The Research Process

In the role of researcher-practitioner an important data collection method was note taking. With the approval of study participants I had the licence to take notes, observe activity and to reflect on proceedings from a variety of meetings and forums. Those notebooks which were used to record observations, along with a wide selection of university and other documents, became data. The analysis of that data
contributed to the findings which have been reported in Study 1. The array of learning opportunities is recorded in Appendix 5, Table A 5.3.

That data became a record of my lived experience throughout the research period. The experience included the people I met, the conversations and discussions which were had, the places travelled, illuminating moments, knowledge gained, the questions asked and the answers found. It was an experience lived at least three times over. Once in real time, once when transcribing the diaries and collating documents and data, and once when synthesising the key aspects of the data during writing-up. Living through something that many times leaves few excuses for not learning from the experience. The strength of the methodology of this research was the use of ethnography and autoethnography which enabled rich learning through the description of the case study.

6.4. The Mission

I came from the secondary and TAFE education systems into the university higher education system to take up a position as an educational designer in the (former) Centre for Enhancing Learning and Teaching (CELT) at CSU in 2002, based initially in the School of Business. From early in my time in the higher education environment I have been intrigued by how we can use educational technology to improve the student learning experience and how the broader learning environment for both staff and students can be managed better.

The theme of a 2003 Open and Distance Learning Association (ODLAA) conference; “Sustaining quality learning environments” was the impetus for formal reflection where I first drew on my early discipline background (Science/Biology) to note similarities between the issues being faced in managing the university environment and in managing the natural environment.

Education is the way knowledge, ideas and skills are passed on from generation to generation. It is a fundamental part of our survival. The learning environment, from the home to institutions, is the habitat that supports education. Today, education is often seen as a commodity to be bought and
sold, not the fundamental component of society it really is…Administrators can be forced to make decisions based on financial concerns, without being able to consider the long term effects on the people concerned. This has an alarming similarity to our natural environment…Natural resource managers have developed a range of techniques and tools to respond to ecological disasters and environmental changes…Can we take some lessons from nature and natural resource management? [emphasis added] Learning environments, from school to universities and the workplace, need to be managed carefully if they are to survive and support the need for quality education for future generations (Buchan & Buchan, 2003, p. 1).

That early research was conceptual, idealistic and full of unsubstantiated metaphor. It has value, however, if one looks at the questions which were being asked. This two-dimensional question; “Can we take some lessons from nature and natural resource management?” became three-dimensional when reframed as; “What aspects of environmental management have value when applied to the learning environment?”

During the period when I served as educational designer for the School of Environmental Sciences my research was informed by experts in environmental management discipline. The early research was into the application of adaptive management to our management of the learning environment (Buchan, 2004; Buchan & Buchan, 2003). A structured study in 2005-2009 moved adaptive management from the theoretical and conceptual to the practical (Buchan et al., 2009).

I began this Ph.D. study with an initial aim of using adaptive management towards the implementation of CSU’s new online learning environment. This was done from within my role as a project manager for the OLE Program. The results of preliminary research in 2007 (see Appendix 2) indicated that adaptive management was not a suitable approach for educational technology project management. The focus then moved away from adaptive management and towards the more broad-scoping social-ecological systems approach.
However, I could not abandon the promise of adaptive management altogether. The body of work on adaptive management was synthesised into a paper to address the ascilite 2012 Conference theme of “Future challenges. Sustainable futures.” What began as a paper to bring together bits of research which did not fit into the final thesis helped to distil my thoughts and to confirm the main focus of the thesis. Drawing on comprehensive research and sound evidence I was emboldened to put forward the need for a paradigm shift in educational management in higher education. This is expressed in the conclusion to that paper.

This paper only touches the surface of what is needed in order to effect a paradigm shift. \textit{That shift is to acknowledge a changing goal: that in our higher education environment there can be no single, stable state and change will be a constant} [emphasis added] (Buchan, 2012. P.8).

The paper also introduces the more aspirational potential of adaptive management (see Buchan 2012, p.8)

The positive peer review of the paper and acknowledgement of the presentation during the conference confirmed the potential value of adaptive management and the main argument of this thesis. However, grounded as they are in sound research, “feel-good” presentations at conferences only allow brief respite from the more pressing and practical issues at hand in the world of the reflexive practitioner.

6.5. Developing Resilience: How do you Know it is Not Working?

Spending time living through and reflecting on change and recording those reflections has allowed me the chance to re-live (three times over) and learn from experiences and comments which normally would have been ephemeral. In a review meeting at the end of the first year of the new Division in 2009, colleagues’ comments ranged from resignation and confusion; “So much of our lives have changed that we don’t know what is happening”, “The world changes everywhere”, to resolve; “You can’t jump off but you have to get on top of this”. The latter comment was questioned by others: “If things don’t work out you just change it?
That’s CSU attitude”. Then this; “How do you know it is not working?” [2009 12
Reflection EDM Manager’s review meeting]

During 2008/2009 I had crossed the border into the domain of Management
and Change Management. From that first big operational year in the new Division
the take-home question which drove my next few years of research and practice
towards improving our learning environment was: “How do you know it is not
working?” This was evidence-informed practice and management in action.

A total immersion in the big scale perspectives of ecological systems thinking
and access to the vast amount of data generated from within the scope of daily
practice reveals a personal “failing”. That is a tendency to reflect frequently and to
scope things broadly in the operational environment. In 2009 I worked with our
Evaluation Services Manager on an early evaluation of Interact. At that time I was
attached to my Bridge Support Framework (Buchan & Swann, 2008) as an
operational solution, putting this forward towards developing an evaluation tool for
Interact (see copy at , Appendix 10). The discussions and evolution of thought
processes towards turning a possible failing into a positive outcome were captured in
the following reflection.

**Reflection 2009 06 21**

Looking at [P4’s] initial proposal… and reflecting on the Bridge Support
Framework I finally realised that the problem was that we were actually
evaluating the wrong thing – the brief was incorrect.

“*This document presents a draft design of a strategy for the evaluation
of CSU Interact and its suite of tools in the extent to and manner in which
these enhance learning and teaching*” (Interact Evaluation Strategy. First
draft. Internal document).

What was important is that we evaluate the Online Learning Environment
(which just happens to be called Interact). The big difference is that by using
the term OLE we focus on the nature of the whole environment and the many
factors that influence it and are influenced by it. It takes me closer to putting
that whole learning environment in perspective. It takes us away from Interact
as simply a set of tools but places it in the broader perspective of the whole university environment. This is shown in the Integrated Evaluation Framework we developed (see Figure 6.1). The value of the work into the evaluation of Interact contributed to the understanding of the value of the adaptive management approach where monitoring is part of the process. Educators favour evaluation while scientists (environmentalists) favour monitoring.
Figure 6.1. An Integrated Evaluation Framework for CSU Interact.

Adopting a monitoring approach enables one to take a snapshot of the state of the current OLE at a number of levels; a single subject, a school or faculty. Monitoring can take place at any time of the year (not just a formal end-of-session survey) and can be done within different divisions encompassing a number of stakeholders. The data can then be fed into the overall framework so that a comprehensive picture is built up of the state of the environment which forms the basis of evidence-informed management.

The notion of pathologies gave valuable insight into how to approach the use of data and evidence. A pathologies metaphor means that the data collection identifies issues which are seen as symptoms. These are indicators. People interpreting the data can then decide on the pathology of the problem, what it means and who should be addressing it and how. The model put forward suggested lines of action and responsibility for various indicators (see Figure 6.1).

The solutions to the symptoms and causes may be many and varied. For example, a lack of budget for supporting students in using online tools might not be able to be dealt with by giving the additional funding needed. Alternative solutions might include replacing personal help with accessible self-help documentation and video or audio tutorials.

When working on the evaluation of Interact, I was not aware of the bigger drivers behind the evaluation – that the University needed to be able to demonstrate value for money and the focus on improved learning and teaching outcomes. When I thought that we were evaluating the wrong thing, the reality was that we were not ready to evaluate the right thing. We had not yet uncovered the three dimensional questions. By 2010, however, we were ready and evaluation was enacted through an all-encompassing university-wide Online Learning Environment Survey (Tinkler, Uys, Dalgarno, Carlson, & Crampton, 2012). By that time the university OLE consisted of many more educational technology systems than just Interact (see Appendix 6: Dashboards for ICT-Enabled Learning and Teaching; and para-analysis, Section 5.3, Chapter 5). The new Educational Technology Survey was both forward-looking as well as retrospective.

I have learned that Evaluation and university politics can limit the freedom of imagination one can apply to operational situations. However, imagination is valued
in other areas, in the academic world. The draft Integrated Framework for the Evaluation of *Interact* (see Figure 6.1) informed my choice of Snapshot systems to analyse the systems approach.

“Rethinking the digital divide” was the theme of a 2008 Association in Learning Technology (ALT) Conference. The integrated framework was applied through the lens of the theme and was an opportunity to publish preliminary findings for peer review in the form of “Rethinking management strategies for the online learning environment” (Buchan, 2008a).

![Figure 6.2](image_url)  
*Figure 6.2.* The relationship between the learning environment, the organisation and the external environment.  
(Buchan, 2008a, p. 4).

For the reflexive practitioner and those responsible for Evaluation and standards-based reporting on our university processes and outcomes I pose this hypothetical question:

*If you know it is not working then what are you going to do about it?*

The question can be two or three-dimensional, depending on the lens through which this question is answered and the practitioner’s sphere of influence and locus
of control. It can be a two-dimensional question if looking for answers about what operational issues to address and how to do that. Taking the question to three dimensions begins to probe the notion of social-justice and responsibility – which is where I found myself as researcher-practitioner: “If I know it’s not working then what am I going to do about it?”

**Systems and Stability States**

As an educational designer in the School of Business I made an early foray into the world of organisational management and systems. This was the beginning of understanding Resilience in organisational systems. In 2004 I attended a conference on Educating for Sustainability (eFs) where I introduced adaptive management into the field of *sustainability education* by drawing on Stafford Beer’s work on cybernetics and on his organisational metaphor (Beer, 1974).

An insight into the realities of current educational management is vital for those planning sustainability education programs. [Figure 6.3] demonstrates an organisation in action. Each of the members of the organisation is represented sitting atop a pole, holding on to pieces of elastic attached to a single tennis ball that represents the output, or performance, of the system (Beer, 1974). The members contribute to the work of the organisation by pulling on the elastic to stabilise the ball. Stabilisation reflects the optimum output of this system.

![Figure 6.3](image-url)  
(a, The organisation in action.  
(b, Stabilising the system  
*Figure 6.3*. The organisation in action and stabilising the system.

(Beer, 1974; Buchan, 2004, p. 15)
There are all sorts of tensions implicit in the relationships of the individuals in this dynamic system. In reality, the players in an organisation will have different lengths and widths of elastic, and have to contend with external factors such as wind blowing the ball (representing politics or economic factors), or the odd stray cat giving the ball a good knock. An unstable system may result from individuals having too much freedom to pull in their own directions or from other influences on the stability of the system. In an organisation where there is good communication and efficiency the players pull correctly on the strings to still the ball and thus maximise the output.

Returning to Beer’s *wicked problem* - his organisational system and that stray cat. One of his stated solutions to minimising the effect of the stray cat on the stability of the organisation was to “kill the cat” - or at least take it out of the equation. Admittedly, systems-based organisational management has come a long way since 1974 and my own understanding has changed in the years since the *Educating for Sustainability* papers were published. However, there are still some fundamental problems.

Getting rid of the cat is to get rid of a symptom. The real problem is not the cat. We need the cat. The cat is actually a canary in disguise. Take the canary in a cage down the mines of our higher education organisations and it will be able to show us where some of the more fundamental problems lie. If the organisation wobbles a bit because of a stray cat, then getting rid of the cat is not a long term solution – there are many more, much bigger cats out there - the underlying cause of instability in the system needs to be addressed.

Beer’s analogy shows the connections and captures some of the idiosyncrasies of an organisation, albeit simplistically, whereby it illustrates the focus on a stable state, fixed end points and controlling the situation. In 2013 with hindsight, new understandings and solid evidence I can confidently say that there is an even bigger problem in Beer’s organisation: its *stable state*. The real *paradigm shift* required is that the goal is a changing state and this is where the application of Resilience Thinking and the *ball-in-basin model* and *tipping points* have value.
Resilience Thinking is systems thinking. The framework for Resilience Thinking is based on two ways of seeing and understanding social-ecological systems. The first is based on the metaphor of adaptive cycles (see Chapter 5, Section 5.4). The second is based on the likelihood of the system crossing a \textit{threshold} and moving into a different \textit{regime} or \textit{state} through a transformation (Walker, Gunderson, et al., 2006).

6.5.2. \textbf{The Ball-in-the-Basin}

Walker and Salt’s System as the \textit{ball in-the basin} metaphor (or \textit{model}) illustrates the concept of multiple stable states and systems crossing \textit{thresholds} during periods of \textit{transformation} (see Figure 2.4). As described in the preceding chapters, in 2007 the University embarked on a major transformation, triggered by a new University Strategy.

The first attempt to develop some measurable criteria was through the research interviews. Follow-up interviews with two leaders in 2008 aimed to elicit information to help understand and in some way quantify transformation within the schools (see Interview Sets 3a and 3b, Appendix 3). One question (with several sub-questions) asked of the interview participants was; “CSU has been challenged to transform its learning and teaching in response to the Strategic Plan 2007-2011. How far are we along that transformation?”

Only two interview participants participated in the follow-up round of interviews. The third leader interviewed in the first round, ironically, changed roles following a faculty restructure. The depth of the responses from the interview participants was, however, sufficient to build on and to help focus the collection of data from other sources. It also stimulated reflection on practice and posed challenges for the researcher-practitioner.

I think that for every staff member here I could say that, if the buildings were razed [to the ground] tomorrow that, after some regrouping we could actually find a way to do what we still need to do. And that comes from recruitment
and all those processes that actually mean we have people on board who have flexibility and adaptability and expertise. [IP6]

We certainly have had transformation and particularly I think in relation to *Interact*. I said it would be a lifesaver, [the original interview was in 2008 June] my role has changed & I am…back teaching. When you are running the subjects across five campuses…having *Interact* I think is so much better. Before I would have had 100’s and 100’s of emails [but] having *Interact* and using the forums, resources, announcements…has helped run the subject more smoothly than ever before. [IP3]

The following two reflections show the development of the key concepts in Resilience Thinking. The reflection stimulated answers in the form of more questions, which was productive in itself because it gave direction to the next stages of the research.

**2010 09 08 Reflection**

Ball-in-basin metaphor is useful because it highlights the dynamic, & changing nature of the system, illustrates how one aspect can affect another, how there needs to be autonomy & balance in each area, needs to be communication between basins, there is a complexity of balance. Faster movement can be good to create forces to hold balls in the basin, but one mistake & there can be more severe consequences, similarly, too slow & not enough centrifugal force to hold you in the basin.

There is a long way to go before the ball in basin metaphor can be used to deal with complex systems, and before I could have an image that would do the complexity justice.

Thresholds and tipping points. Has some limitations as a metaphor in education. Cannot easily see how one can have a functioning system represented in a single basin, and then components of that are simultaneously a part of another functioning system. May need to change the image to be able to share the components – perhaps one is getting closer to the virtual
system, represented by a DOMS-style repository. A single server-like space for storage and you then virtually link to the various components from any basin.

**2010 09 29 Reflection**

_Tipping points & thresholds_ – need to explore further.

Causes – external & internal. Institutional and individual factors. Individual – transformative learning, how do we measure whether a person has undergone a transformative change with respect to educational technology? (ALT-J definition). Look at literature to see if there is a way to measure when individuals have reached a certain threshold of ability in technology.

- Ball & basin analogy – tipping point or is it an escape point? Maybe depends on whether the change is pre-determined & planned or not.
- How can we measure stability & responsiveness of the ball & basin?
- How many different balls can be supported, what speeds, when will they start spinning out of control, spinning in sync, different paces upset the momentum, disruption can be good - sometimes.

This early ball-in-basin work contributed data and questions towards understanding _transformation_ and _transformability_ in Study 1. System transformation has been addressed in depth in the findings for the dynamic of the adaptive cycle while the research into the heuristic of transformability identified the critical institutional variables.

6.5.3. _Erosion of Resilience_

By 2011 the roles of researcher and practitioner had merged. I had moved beyond the operational issues and problems in the case and was well into the phase of reflexive data analysis.
2011 01 21 Reflection

I am continuing to re-read Westley’s et al’s chapter in *Panarchy, Systems of people and nature*. I am even more blown away by the concepts and what the understanding of the mechanism of resilience brings to our management of educational environments. One of the most telling comments is in their discussion of the ramifications of a *loss of resilience in a system* (emphasis added).

Where they say “This erosion of resilience manifests itself in a number of ways with policy crisis and reformation being one manifestation of the erosion of resilience”. We see this very clearly in our ed. technology environment at the level of actual software & systems development. Take MSI. By introducing a software that was not fully functional and with a low usability factor users were forced into time consuming actions to get around the low usability. This included employing more people to specifically input subject outlines because of the lack of editing capabilities. In changing the overall system by which outlines are done i.e. towards independent input by academics initially there was a loss of resilience because certain people (EDs) were taken out of the system and complex arrangements and rules had to be made to deal with the new situation.

Returning now to the question; “How do you know it’s not working?” An important insight gained from my work with our Evaluation Services Manager was that of *pathologies* in feedback. Every response received to an evaluation question has the potential to tell us something about the condition of our system. The erosion of Resilience in a system is a *pathology* and how it manifests itself can be seen as a *symptom*. The findings from Study 1 have demonstrated that the case system demonstrated features of Resilience. The more sinister and systemic implications of policy limitations are that they are a *symptom* of, and contribute to, an erosion of Resilience (Buchan & Swann, 2007; Buchan, Swann, & Wilkinson, 2008)

I had been involved with operational and strategic aspects of online assessment tools since 2003. With maturity of insight from hindsight I moved from responsive
risk management strategies to more systemic tactics. This entailed working with key senior DLTS staff to make policy recommendations and to submit *Considerations for Online assessment at CSU: A discussion paper* (Buchan, 2011. Internal document) to the relevant committees.

The three-dimensional question that might guide institutional leaders’ and managers’ decision making in managing the technology-enhanced learning environment for an uncertain (four dimensional) future is:

*How do we identify, address and prevent an erosion of resilience?*

An early lesson in educational technology management was that there are many things that are out of one’s control. As educational technologist and Faculty Team Manager I had to deal with the ramifications of the implementation of extremely disruptive technology such as MSI (the new online subject outline tool) timelines and rolling out immature software. We were counselled; “The project team had no control over that, there were decisions not of their making.” [P1]

The researcher-practitioner role went beyond empathy. I lived through years of change alongside my colleagues, saw and felt the pressure that the implementation of new technology and ongoing institutional change places on people, and the growing weight of responsibility of becoming a change agent. People were visibly hurting because of the ongoing, overwhelming change at so many levels. “The University is doing too much. LTS is doing a bit too much. Change takes more time than we are giving it.” [G1]

It was a challenge to make meaningful use of the extensive data collection and tables and flowcharts of data which had been gathered and synthesised as a reflexive researcher-practitioner. It needed a three-dimensional question.

*How can the data be used to capture the human side of the impact of changes on individuals?*

There are many facets to this question. All could be answered by evidence-based management and the notion of pathologies. The data which underpinned the
development of the six Institutional System Variables (see Chapter 5, Section 5.6.2) was gathered within a particular, defined system. The variables are the components of the system and any changes in these reflects some of the pathologies in the system. The variables are effectively a framework (term loosely used) which can be used to gather data, the pathologies of which can be interpreted to identify the symptoms of an erosion of resilience. Prevention is better than cure, so my hope for the future application of this work would be to see the variables being applied both predictively as well as retrospectively.

I was able to leverage off the joint roles researcher-practitioner in a practical way. I worked closely with our Director Strategic Learning, Teaching and Innovation, Assoc. Prof. Philip Uys, to develop two conference workshops relating to the uptake and implementation of educational technology at an institutional level. The focus of the workshops was simple, to provide participants with a range of tools or instruments which they could apply to authentic situations (Buchan & Uys, 2009, 2010). There was positive feedback on the workshops from the participants.

Immersed in the operational details of management it took some time to understand the implications of a systems approach for this research - that is System (capital S).

6.6. What is the Systemic Effect of our Actions?

From a strategic planning perspective as a manager and change agent the questions I was being asked, and asking, were at best two-dimensional: vis-à-vis What do we need to do? Where do we need to be? How do we get there? In the world of the reflexive researcher-practitioner the three-dimensional question that might prepare us for an uncertain future could be:

What is the systemic effect of our actions?

Although the stated aim of this research was the application of the social-ecological systems approach to the case it took input from other disciplinary sources to make new connections.
In 2008 Professor Ray Ison (Chair of Systems for Sustainability and Professor of Systems Open University, UK) presented to the School of Environmental Sciences on “Systemic inquiry and river basin management”. One of Ison’s criticisms of NRM management was that it is increasingly “projectified” and he consistently asked; “How is the learning going to be taken forward?” (2008 12 Reflective journal).

“Projectified” management in NRM resonated with my experience of the way in which educational technology is commonly implemented – through discrete projects. Wearing my project manager’s hat I took this experience forward in writing; *A sustainable approach to project management for elearning* (Buchan, 2010b). The sustainable approach included; “Good practice guidelines for strategic project management for e-learning”. Reflecting on the role of projects and the position of project management saw the development of *para-analysis* out of *Panarchy* (Chapter 5). Para-analysis can be used to predict/understand the potential impact the outcome of the project and implementation of technology, might have on individuals.

“Taking the learning forward” resonates with system feedback loops and with the learning organisation in organisational management.

Some of Ison’s more recent thinking provides insight for the argument of this thesis; managing for uncertainty and change. “If our climate-changing world is unknowable in advance there is a need to take more responsibility for systemic effects of our actions” (Blackmore & Ison, 2012). The key being the “systemic effects of our actions” - reflexivity, cause and effect. I put forward here that this could be modified and applied as a *principle* to the technology-enhanced learning environment thus:

*The future of educational technology and our learning environment is unknowable in advance and those of us with some responsibility for managing the learning environment need to take more responsibility for the systemic effects of our actions.*
At the more operational level, traditional project management approaches to the introduction of educational technology have their limitations, focusing on what they needed to achieve without perhaps considering some of the long-term systemic effects of the actions. Systemic thinking opens the portal to that fourth dimension, of uncertainty and change.

It is relevant to the validity of this research that I came to understand the system and its true value late in the study. The discovery that the learning environment is a complex system (see Chapter 4) and the defining of six Institutional System Variables (see heuristic of Transformability, Section 5.6), which were the key outcomes/findings from Study 1, genuinely emerged out of the data. These outcomes were the result of a hybrid of *grounded theory* and applying existing theory about systems from the environmental discipline. As the relevance of *real* systems to the work became clear, I consciously avoided reading too much formal literature about systems, so that I could consolidate my own findings. I was then able to interrogate those findings against the relevant literature.

Late in the research I returned to systems basics and drew on Meadows’ (2009) *Thinking in Systems. A primer*, to interrogate the findings and to finalise the Summary (see Chapter 5, Section 5.8) and Glossary. Systems thinking is big concept and this research has only just touched the surface of what it has to offer the field of educational management. This work complements and builds on work by practitioners such as Ackoff (Ackoff, Addison, & Carey, 2010), Senge (Senge, 1990), Vaill (Vaill, 1996) and Bain (Bain, 2007). The place of *complexity theory* in this work was noted in the review of the literature as providing an “over-arching world view” with the social-ecological systems approach as a sub-set of complexity theory. The findings from the research confirm this notion whereby; “Complexity theory…concerns itself with environments, organisations, or systems that are complex in the sense that very large numbers of constituent elements or agents are connected to and interacting with each other in many different ways” (Mason p.33). The scope of this research has fallen short of delving into *emergence*, which is a key attribute of complexity theory (Mason, 2008). However, there was clear evidence of the characteristics of emergence in the technology-enhanced learning environment.
when examining the transformability of the system in the case. The heuristic of the adaptive cycle combined well with panarchy to provide practical frameworks for understanding emergence and this would be an area for future research.

6.7. Learning from History?

From the time of the implementation of CSU’s new LMS, Interact, in 2007-2008 significant work was done in the case study institution around the pedagogical application of Interact and other technology. There was the development of resources for CSU practitioners and exemplars of effective teaching with technology (Hardham et al., 2011). CSU was represented in the International Teaching with Sakai Innovation Awards in 2009 and 2010. The programmes for the internal CSUed Conferences in 2008, 2009 and 2010 serve as rich evidence for the active use and value of educational technology for learning and teaching at the University.

In the broader educational environment technology became increasingly cloud-based and there was rapid growth in mobile learning and changing paradigms of learning and teaching towards online learning, hybrid and collaborative models (New Media Consortium, 2012). New Educational Technology Strategy and Plans had been introduced in 2010 and 2011 to guide the expansion of CSU’s Online Learning Environment - and thus the wave of new educational technology continued. By 2011 a major project was underway to oversee the choice and implementation of a new LMS to replace Interact, this would be Interact2. There was something of a déjà vu in the scope of the project and the challenges the University would be facing.

I was tasked with leading the Interact2 Change Management Team in developing the Interact2 Change Management Plan. This was one of four plans developed collaboratively to guide the implementation of the new LMS. The other plans were the Communications Plan, Professional Development Plan and Student Support Plan. The Change Management team had all been a part of the original implementation team of Interact and brought a combined wealth of knowledge, grounded in experience and sound review and reflection.
Wearing the hat of change manager did not sit comfortably at first. The years of reflection, in-depth research and analysis and access to personal insights from colleagues had made me critically aware of the responsibility of a change agent and the changing learning environment at CSU. I had been made aware that change agents are often the “cause of the change” [IP9]. Change management was a term still perceived by some as heralding major and often unwelcome, *top-down* change. Change management was perceived as “something that is done to you” [IP2]. “Who decides what new university initiatives need change management and what don’t?” [IP3]

Being offered the role of change manager, however, was welcome. As a practitioner I felt comfortable and prepared for the role and was confident that I could draw on the collective experience and support of our Division and the Project Team. I was also in a locus of control/sphere of influence to be able to apply some of the findings of my research and our collective experience in the Project Team, to the new project.

The culmination of applying this research in practice was reflected in the Interact2 Change Management Strategy (Buchan, 2012a). It was more than simply applying findings, frameworks and tools. I felt a significant social responsibility as a practitioner that the lessons learned from many years of intense reflection should be used to make a difference. The following extract from the *Interact2 Change Management Plan* reflects something of that motivation.

*Delivering on the Interact2 Project*

…The speed and amount of change i.e. “Change fatigue” at CSU has been noted as a significant factor affecting both staff and students through the CSU Climate Surveys in 2006 and 2010. An awareness of this is particularly important in how we approach managing change in the area of educational technology, especially since we are only at the beginning of the cycle of the new CSU Strategic Plan 2011-2015 with the potential changes, however positive, which that will bring.
The Interact2 Change Management Plan draws on the CSU experience and current research to develop an innovative approach to change management. Similarly, the supporting plans – Professional Development, Communication and Student Support Plans draw on our now extensive experience from the CSU context (Buchan, 2012a, Internal document reproduced with permission).

The Project Team attempted to incorporate features into the Change Management Plan which would promote Resilience in the system. Three key concepts which were put forward were: a distributed approach to change management; the use of Interact2 Guiding teams and principles for educational technology change management.

The Principles were developed out of a grounded theory approach and drew on existing good practice. They addressed some of the short-comings in current change management practice as observed in the research (Scott, 2003). These principles have been modified to be offered as generic principles for educational technology change management (Adapted from Buchan, 2012a).

6.7.1. **Eight Principles for Educational Technology Change Management**

1. Use evidence based management/practice.
   - What does the research show? What worked/what didn’t work in the past?

2. Balance the top-down, bottom-up approaches to change management.
   - Avoid situations where people feel the technology is being imposed upon them
   - Use good communication at all levels
   - Use Guiding Teams to develop bottom-up approaches
   - Ensure senior and middle management support.
3. Develop good communication at all levels.
   o Listen to people
   o Develop clear and consistent messages
   o Develop and disseminate clear lines of communication
   o Develop clear lines for feedback, act on the feedback.

4. Use collaborative partnership approaches.
   o Develop Communities of Practice to support one another.
   o Use mentoring or coaching to support change within developing communities of practice.

5. Respect and trust our colleagues.

6. Encourage professional judgement.
   o Encourage staff to use professional judgement to work out the best strategies to provide necessary professional development /change management within work areas. Minimise the top-down approaches.

7. Assume a base level knowledge of/competency in the use of educational technology prior to implementation.
   o Address technical competency in educational technology and pedagogical competency in aspects of online teaching and learning.

8. Ground professional development in principles of good learning and teaching.
   o Situated learning, flexible delivery, variety of modes of delivery, learner centred, authentic learning (among others).
   o Promotion of deep learning by taking place over time and including opportunities for follow-up learning and feedback;
• Authenticity, situation and relevance placed within a context that is meaningful to the participant to assist learning and engagement.

It was a significant professional milestone to have the mandate to be a part of introducing a particular set of values to be shared at an institutional level. These values, manifested as the “Principles for educational technology change management”, were effectively the culmination of this research, synthesising and bringing together some of the most important findings and actively applying them to the operational environment.
CHAPTER 7: CONCLUSIONS AND FUTURE DIRECTIONS

This research began over six years ago with two research questions. The primary research question was:

How can the technology-enhanced learning environment be understood and managed in the face of constant change in the broader educational environment?

with the sub-question:

How can the contemporary technology-enhanced learning environment be described?

These questions addressed the research problem which was the observation that:

Current educational and organisational management processes/strategies do not adequately address the urgent issues in higher education; of how to understand and manage the learning environment in the face of constant change in the broader educational environment.

Hence, the focus of this research became the rigorous examination of new heuristics for understanding and managing changing technology-enhanced learning environments. The source of inspiration for those new heuristics was the field of environmental management.

The research took the form of a single case study in a regional, mixed mode university. From a practical point of view, and because it was the area of perceived need, the case focus was confined to the technology-enhanced learning environment. This has implications for the generalisability of the results to other populations and other universities. The study was carried out by a single researcher and in the spirit of auto/ethnographic research this has implications for subjectivity in the findings. The scope of the research attempted was necessarily broad scale because of the extent of the conceptual foundations of the five heuristics of the social-ecological system. The value of the research can be increased through conducting future studies
that include the application of the models and frameworks to other institutional contexts.

### 7.1. Understanding the Technology-Enhanced Learning Environment

It was necessary to answer the second research question first so that the value of the technology-enhanced learning environment could be established in order to support the investigation into the application of environmental management concepts to management in higher education. The research drew on the premise, taken from environmental management, that there is intrinsic value in the environment. Using a case study approach the environment selected for scrutiny was the technology-enhanced learning environment at Charles Sturt University, a large regional mixed-mode university in NSW. This investigation formed the first part of the ethnographic case study (Study 1) and was reported in Chapter 4.

The key finding was that the complicated technology-enhanced learning environment in the case study institution can be simply represented as a complex system in the truest sense of the term. A complex system with components, variables, feedback loops, interactions, inputs and outputs. The system of the technology-enhanced learning environment has been distilled into the powerful Dimensions Model of the Learning Environment (see Figure 7.1 and Chapter 4, Figure 4.1).

![Figure 7.1. Representation of the five dimensions of the learning environment.](image-url)
The Dimensions Model identifies the following four dimensions: temporal, spatial, social, technological and connectedness. This model complements and builds on existing frameworks and theories. One such framework is Keppell’s “Perspectives for considering blended and flexible learning” in course (program) development and planning (Flexible Learning Institute, 2009). These five perspectives included: pedagogy, interactions, learning spaces, ICTs and the development of multiliteracies. Multiliteracies are similar to the Dimensions whereby pedagogy and multiliteracies would equate to the social dimension. However, the five perspectives make no reference to a temporal perspective, and this is what the Dimensions Model from this research can contribute.

The metaphor of a learning ecology has been used to examine the phenomenon of learning on the internet. The work done around a learning ecology supports the findings in this work whereby it encourages educators “to see things from a systemic perspective, and to understand the components of the system and how they interplay with each other to enable and to support the processes of learning” (Looi, 2000, p. 56). It is suggested that; “an ecological perspective is consistent with the perspective of distributed cognition” (Looi, 2000, p. 56). This is an area with potential for future research, in particular exploring the intersection of the learning environment with professional practice and distributed cognition and where connectedness and educational technology will be important features. This leads into connectivism.

Siemens’ Connectivism: a learning theory for the digital age (2005) provides a grounding for understanding the processes of learning in the complex system which is the technology-enhanced learning environment in this case study. “Connectivism is the integration of principles explored by chaos, network, and complexity and self-organization theories” (Siemens, 2005).

The temporal dimension is one of the missing links in existing frameworks and models of change management and the learning environment that emerged in this research. Lessons from the natural environment are that change can take time. The application of the heuristic of panarchy requires one to take a systemic, holistic, systematic and long-term view of the learning environment.
Another important conceptual finding was that of boundaries in the technology-enhanced learning environment. This is captured in the choice of the term *Dimensions* for the model. “Dimensions” promotes an awareness of a boundary-less space. However, this does not mean that the learning environment is an indeterminate or amorphous space. It is a system with clearly identifiable variables, components and connections. The technology-enhanced learning environment, that is the system, does not simply exist but needs to be designed and co-created and each of the dimensions clearly defined and managed. Implicit in the model is the movement between different physical, spatial, social and temporal spaces where learning takes place.

Boundaries can be both limiting and enabling. The notion of permeability of the boundary contributes to the metaphor. The more permeable a boundary is the less of a barrier it is. The difference between a boundary and a barrier could be dependent on the degree of control and insight that one is afforded. The notions of boundaries and dimensions provides scope for extending existing work on border crossings (Britt & Sumsion, 2002; Henning & Van der Westhuizen, 2004; Jasman, 2010).

The Dimensions Model of the Learning Environment has practical potential to ground institutional planning in a number of areas. These could be the development of new curriculum, courses or programs; planning the design, development and use of physical learning spaces, or the selection and implementation of new learning technologies. It is also a visionary tool. The Dimensions Model was used to create the following vision for how learning and teaching with technology could look at Charles Sturt University in 2020. The vision was shared internally in the 2012 CSU Educational Technology Futures Forum which engaged leaders in learning and teaching across the university (see Figure 7.2).

*Vision* - Educational technology will enable connectedness between communities of learners in the learning environment. The learning environment will be co-created by staff and students, it will be temporally and spatially permeable and our staff and students will be resilient and adaptable users of educational
Dimensions of the Learning Environment – CSU 2020

**Temporal**
Permeable - the degree environment no longer bounded by institutional timelines. Students accessing learning spaces, resources, professional portfolios & a personal learning environment beyond the lifespan of a single subject or degree.

**Spatial**
A permeable learning environment; seamless working between personal, institutional & professional spaces; formal and informal learning in a single space; movement of staff and students between physical & virtual spaces, across campuses, nationally & internationally.

**Social**
Students & staff - resilient & adaptable users of technology, flexible co-creators of learning environments; students, academics, professional staff a community of learners inside & outside CSU. Moving between higher education institutions & workplace environments.

**Technological**
Educational technology enabling CONNECTEDNESS: seamless, integrated, intuitive, flexible, adaptive and accessible.

*Figure 7.2.* Vision for learning and teaching with technology at CSU in 2020.

The findings from the learning environment investigation formed the foundation for the major part of the study.

### 7.2. Understanding the Application of the Social-Ecological Systems

#### Approach to the Case

**7.2.1. Outcomes of the Research**

The research was interdisciplinary in so far as the problem presented fell at the intersection of a number of areas/fields of knowledge that were thoroughly investigated in the Review of the Literature (see *Figure 2.1*). Each of these disciplines and fields contributed valuable insights to the research. These included successes, failures and the types of questions and problems that could be addressed...
in the research. The use of grounded theory and a constructivist approach led to the emergence of the findings within the case.

The depth of the study; the range of data collection methods and the systematic application of the five social-ecological heuristics to a variety of Snapshots within the case all contributed to the rigour of the research. A detailed summary of the key findings from the study are presented in Section 5.8. This summary is a world first in that it presents an evidence-based interpretation of the application of the social-ecological systems approach to a higher education environment.

The research has been shown to have application beyond the case study and the findings have been applied to wide-ranging issues in the higher education environment. Conventional project management approaches were challenged and sustainable approaches to project management for e-learning were explored through the application of panarchy. This resulted in the development of the tool called para-analysis (Buchan, 2010b).

Para-analysis is grounded in the temporal dimension and fills a gap in practice in educational management as a tool for understanding and demonstrating the institutional impact of the implementation of educational technology and institutional initiatives and projects. The Adaptive Cycle Framework was developed and introduced as a framework for understanding changes and transformations in the educational technology environment (Buchan, 2008b). The Adaptive Cycle Framework has been successfully applied in practice in the case study institution and more broadly (Buchan, 2011; Buchan & Uys, 2010).

The transformational impact of introducing new educational technology to the university was explored. This was grounded in the social–ecological systems approach and described using the Adaptive Cycle Framework. The heuristics of adaptability and transformability contributed towards understanding the adaptability of the organisation. Also understanding its capacity to predict, plan for and support ongoing changes in educational technology when realising the transformational potential and effectiveness of educational technology.
The pedagogical advantages for e-learning of implementing an open-source collaborative learning environment (CLE), Sakai, were explored through the application of the social-ecological systems approach at an institutional level (Buchan, 2010a). This research contributed to the description of the changing nature of the learning and teaching environment at CSU which provided a detailed context for six case studies that were developed for a larger inter-institutional study (Buchan, 2013).

The application of the properties of transformability and resilience to different Snapshot systems of the technology-enhanced learning environment in the case resulted in the identification of six Institutional System Variables that can be used to ground institutional planning and management processes in the tool called SCOOPE - a Guide to Institutional System Variables (see Section 5.6.3.6, Figure 5.15). Other outcomes of the research were original insights into institutional change management and managing change.

### 7.2.2. Managing Change

Two key concepts from environmental management which underpinned this research were *wicked problems* and *adaptive management*. These concepts formed the basis for discussion when advocating that:

In the face of constant change, in order for higher education institutions to achieve the goal of creating sustainable approaches to new models of learning and teaching with technology a fundamental paradigm shift in management approaches is required…That shift is to acknowledge a changing goal: that in our higher education environment there can be no single, stable state and change will be a constant (Buchan, 2012c, p. 8).

Which brings this discussion back to where the research problem began; in the meeting rooms and classrooms of the university where some of the limitations of current approaches to educational management, organisational change and change management were first observed.
If one steps into the meeting rooms of today’s universities one can be forgiven for thinking one has mistakenly entered a pre-football match briefing when one hears the discourse relating to such aspects as; “continuous improvement”, “goals”, “team work” and “coaching for performance”. In those same meeting rooms, in a climate of decreasing budgets and increasing accountability, there is a need to meet targets, standards and benchmarks (Australasian Council on Open Distance and e-Learning, 2007; Australian Government. Tertiary Education Quality Standards Agency, 2013; Bacsich & Chatterton, 2008). In order to keep pace with the competition there is pressure for organisational change at all levels, from major organisational structural change to introducing new curriculum or new and innovative educational technology. Where there are formal change management plans who decides what changes are important enough to require managing and which new initiatives can be implemented with limited support and planning (Bryant, 2008; Pasian & Woodill, 2006)?

This research has navigated through a broad range of disciplines and perspectives to maintain a focus on Resilience and change. There is a loose and inconsistent use of the words change and management in the literature and in practice (Bromage, 2006; Camillus, 1997; Hunt et al., 2006; Kotter & Cohen, 2002; Scott, 2004). Emerging from within the context of this research the distinction can now be made between Change Management (capital C, capital M), Managing Change (capital M, capital C) and managing change (small m, small c). Change Management is defined as those formal, institution-driven models, strategies and plans for effecting planned change towards a defined, institutional outcome or goal. Managing Change refers to the strategies and techniques used by an institution to respond to change and uncertainty. Particularly important to this research is managing change, which is now understood to be the strategies individuals and institutions might employ to cope with unscheduled or unexpected (at least to them) change in their immediate environment. If individuals are unable to manage change, then Change Management cannot occur and institutions and organisations cannot successfully Manage Change.
7.2.3. **Individual Perspectives on Change**

Looking objectively at the research process, I have never felt comfortable when people are classed as *data* – it seems so impersonal – but my data has taught me a lot. One of the most humbling personal revelations during the research came from one of the interview participants. When asked about his own ability to adapt to technological change and what strategies he used to manage that change he replied: “Excellent if I have to, but poor if I don’t…If I don’t agree with the change then I resist it actively” [IP11]. This is one of the single most important personal insights in this study: that *personal capacity to adapt to change is a conscious choice*. No matter what institutional change management strategies are adopted, how good the planning, or how valuable and necessary the new educational technology or latest institutional initiative might be – it is those human factors of individual attitudes, beliefs and adaptability which remain the limiting factors when it comes to the implementation and uptake of new technology.

7.2.4. **Value of the Research**

There is value in this research for those stakeholders who have responsibility for the support and/or use of educational technology for learning and teaching. These are practitioners in higher education; institutional leaders, managers, change managers, academics, academic developers, educational designers and change agents. The research is *timely* because the nature of change and uncertainty is overwhelming (Bacsich & Pepler, 2009; Conole, 2013). The findings supported the observation that people tend to solve problems one time scale at a time with the result that systems may be successful in one domain but this tends towards a rigidity that limits their resilience (Westley et al., 2002). Through the application of panarchy and Resilience Thinking the research outcomes present tangible solutions to this temporal limitation by offering new theory, tools and frameworks.

Although based on a single case study, the research should also prove *timeless* because its value lies in several different spheres and levels: systemic, generic and operational.
**Systemic application** – The application of systems thinking to the management of the technology-enhanced learning environment resulted in a number of systemic solutions. The introduction of the social-ecological systems approach into institutional management produced the *Dimensions Model of the Learning Environment* and the identification of six Institutional System Variables. Further value in applying a systemic approach to problems lies in being able to address issues associated with an erosion of Resilience when decisions need to be made in a climate of uncertainty and change.

**Generic application** – Principles have been developed which have generic application beyond the boundaries of the case; as in the Principles of Change Management for technology-enhanced learning environments (see Section 6.7.1).

**Operational application** – The findings informed operational solutions to the management of the technology-enhanced learning environment in the case study institution. These included the development of a number of frameworks and models which were applied in practice.

The Summary of Study 1(Section 5.8) serves as a rich synthesis of the concepts that have been developed and which can be applied to developing Resilience in other learning environments.

7.2.5. **Future Directions**

The interdisciplinary nature of this research means that potentially it has broad application to the fields of educational management, environmental management and organisational management. The social-ecological systems approach has been demonstrated to be generically applicable to the educational and organisational situations and has thus addressed the nexus and focal point of the gap in the literature and practice (see Review of the Literature, *Figure 2.1*).

For the environmental management field some of the value lies in this study being an in-depth application of the social-ecological systems heuristics to a single case in an organisational environment. The research interrogated the terminology associated with social-ecological systems and adapted this to a new field. The
Dimensions Model of the Learning Environment and the notion of connectedness provide very real possibilities as a systemic approach for linking the learning environment and technology to driving environmental causes towards addressing critical issues such as climate change, over-population and sustainability.

The original work around Resilience Thinking and social-ecological systems has taken many researchers several decades to get to its current state. That research is a powerful platform to work from and this study only scratches the theoretical surface of this area. Future research and application of the findings in practice could include:

- applying the refined heuristics back into the environmental management field with new insight;
- applying the suite of heuristics to a new case study, and the broader learning environment, not limited to the technology-enhanced learning environment;
- publish the findings in the environmental field and the organisational management field to get peer review from those fields towards ongoing improvements.

My real area of intrigue is to explore the Dimensions Model of the Learning Environment further and to apply that rigorously to other cases. I believe that the Dimensions have potential to inform course and program design. They could be applied to the design and development of blended learning environments in their broadest sense, including the use of physical as well as virtual learning spaces. Combined with insight into Resilience of institutional systems it also has potential application to the development of online (virtual) learning environments and software systems such as learning management systems and their variations.

In a late post-script to this work it is noted that just as writing up this study was being completed (April 2013) the concept of Resilience was introduced into management of higher education management in reference to digital resilience and MOOCs by Professor Martin Weller (Open University UK) and Professor Terry Anderson (Athabasca University) (Weller & Anderson, 2013). Introduction of Resilience Thinking to higher education and the management of educational technology at this
level of experience opens up a wealth of possibilities for the practical application of Resilience to the wicked problems in higher education.

It is said that the Conclusion should be an opportunity to make a “graceful exit” from one’s Ph.D. thesis. Making a graceful exit from something the magnitude of War and Peace, in the middle of a battle scene, has not been easy. As a practitioner there are feelings of inadequacy: have I stirred up more questions and uncertainty than I have answered? Towards the end of this six year research study, however, I have gained a lot of confidence in the value of the work through applying it within my professional practice and through peer reviewed publications and presentations. There is a sense of satisfaction in having been able to demonstrate the tangible evidence of transformation in learning and teaching through technology; to have observed the evolution in management of educational technology in the case study institution and to have shared that work widely to contribute to the development of new approaches to educational management practice (see Appendix 1, Annotated list of Publications Arising from the Research).

If one asks the right questions and listens carefully one can get valuable insights. The research problem posed in this thesis was addressed by using an interdisciplinary approach which drew on knowledge and practice from a number of different fields. For those researchers and practitioners who have responsibility for managing change in the learning environment, in particular the technology-enhanced learning environment, the findings from the research provide a solid foundation from which to work towards a future of uncertainty and change – a future where Resilience at the individual and at the institutional level will be an essential attribute.
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http://www2.bc.edu/~fichman/Fichman_1992_ICIS_IT_Diff_Review.pdf


APPENDICES

Appendix 1  Annotated list of Publications Arising from the Research.


This short paper formally introduced the concept of social-ecological systems into educational management. It showcased the preliminary findings of the case study to document the current state of the educational environment together with interviews and discourse analysis to provide evidence to support the proposed integrated management approach.

*Conference theme:* Rethinking the digital divide.


Refereed paper. This paper introduced a social-ecological systems analysis approach to understanding changes in organisations and the impact of outside factors on our learning environment. The *Adaptive Cycle Framework* was introduced as a predictive tool for understanding changes and transformations in the educational technology environment, and to thus determine a pathway to maximise opportunities afforded by change.

*Conference theme:* Where are you now in the landscape of educational technology?

Refereed paper. The metaphor of *panarchy* was introduced into the educational discipline as a means of describing and understanding the complex interrelationships of multi-scale institutional projects and the influences of a variety factors on e-learning initiatives. The original concept of *para-analysis* was introduced as a management strategy.

*Special issue theme*: Project management for e-learning.


Book chapter. This chapter addressed the challenges of the project management methodology and processes in the large-scale implementation of an open-source courseware management solution at the institutional level. Through the CSU case study aspects of transformation in the social-ecological systems approach were explored through an investigation into the potential impact of open source software on pedagogical transformation. The book chapter was selected for publication in a special issue of IJOSSP.

*Book theme*: Free and Open Source Software for e-learning: Issues, successes and challenges.


Refereed paper. This paper described the results of the transformational impact of the introduction of significant new learning technology applications. The description of this transformation is grounded in a social-ecological systems approach and the Adaptive Cycle Framework is used to illustrate transformation and to contextualise the findings of this study. This paper was a distillation of work on applying the adaptive cycle to the technology-enhanced learning environment over three years and provides a detailed description of features of the phases and highlights the potential of the cycle to depict transformation.

*Special issue theme:* The transformational impact of learning technology.


This essay used the lens of the academic to examine the changing nature of the changing learning and teaching environment at CSU as a context for six case studies that were developed for a larger DEHub study. The essay drew on the social-ecological systems approach to describe this environment. Written towards the end of the writing-up phase of the Ph.D. it provided an opportunity to further synthesise and interrogate the data to address the focus of the context essay.

Refereed paper. This publication used evidence-based practice to report on two key aspects of environmental management: Wicked Problems and adaptive management which contribute to understanding the learning environment and learning from the past and present towards management of higher education institutions for the future.

*Conference theme:* Future challenges. Sustainable futures.
Appendix 2  Preliminary Aims of the Research and Findings relating to Adaptive Management

This appendix describes the preliminary aims of the research as outlined in the November 2006 Proposal for Admission to the Ph.D. Programme. Key aspects of the exploration into Adaptive Management, which was part of the preliminary aims, are also presented.

Preliminary aims

1. To define a technology-enhanced (e-learning) environment;
2. To develop a framework/model for the practical management and support of sustainable technology-enhanced (e-learning) environments (online learning environments) in higher education;
3. To introduce, develop and use the principles of adaptive management (generally confined to use in environmental management), as a way of managing a sustainable e-learning environment;
4. To use CSU as a test bed to document and test the validity and robustness of the above frameworks/models within the CSU e-learning environment (known as the Online Learning Environment) as it implements a new learning management system (LMS) Sakai over the next few years from 2007 - 2010.

(Buchan November 2006 Proposal for Admission to the Ph.D. programme)

An Overarching Conceptual Framework (Figure 3.2) for the study was drawn up for the initial proposal for acceptance into the Ph.D. degree as a tool to organise the variables and their relationships (Buchan 2006 Proposal for Admission to the Ph.D. programme). The initial conceptual framework focused on Resilience Thinking and adaptive management. This later evolved to focus primarily on Resilience Thinking and the social-ecological systems approach (see Figure 3.3. Blueprint for the study.).
Findings related to adaptive management

Some of the findings from preliminary research into adaptive management were synthesised into a publication for the Ascilite 2012 Conference (Buchan, 2012c).

Future directions in the research into adaptive management highlighted the following key concepts which have informed the main focus of this research. These included:

- Consideration of the place of the basic principles of adaptive management in project management; learning from actions, intention to learn, multiple points of learning throughout the process and coming together for a common cause.

- **Benchmarking** which was explored within the social-ecological systems framework as a potential strategy to enhance our understanding of adaptive cycles and transformability.

- **Project management.** A more detailed understanding of the intricacies of institutional project management and the potential of projects as a means of implementing widespread (institutional) change and transformation led to new understandings around management of educational technology (Buchan 2010).

- **Stakeholders.** The exploratory study highlighted the importance of stakeholders in the adaptive management feedback loops within the technology-enhanced learning environment and identified some limitations in current models of using stakeholders. This informed the development of the social variable in the learning environment.

- **Organisational learning.** The principles of organisational learning which were explored in this study in relation to adaptive management; single and double loop learning, are the pre-cursors to complex systems thinking and were explored for their potential in developing resilience at a whole-of institution level.
• Understanding how to position the organisational processes of *continuous process improvement* (such as the PIRI cycle) in a social-ecological systems approach.

• Understanding the factors that affect, effect and/or cause change and transformation.
Appendix 3 Research Methods

A 3.1. Set 1 Interview Questions

1. What is your current role in the organization? What other roles have you had?
2. How long have you been at CSU and/or in the higher education sector?
3. What do you understand by the term ‘learning environment’?
4. Describe the features of a learning environment with which you are familiar.
5. What are some of the issues and problems facing you in your current role?
6. What are some of the current issues and problems facing students?
7. Identify the main technological changes that have influenced your learning environment in recent times.
8. Describe your ability to adapt to change. Give an example which illustrates your view.
9. How would you rate your ability to adapt to technological change? Excellent, average, poor, other.
10. What strategies do you personally use to manage change in general?
11. What strategies do you use to manage technological change in the learning environment?
12. How would you rate CSU’s management of technological change in relation to the learning environment?
13. What are some strategies institutions can use to better manage technological change?
### A 3.2. Set 2 Interview Questions

1. What is your current role in the organization? What other roles have you had?
   How long have you been at CSU and/or in the higher education sector?

2. What do you understand by the term ‘learning environment’?
   Describe the features of a learning environment with which you are familiar.

3. What are some of the issues and problems facing you in your current role?
   What are some of the current issues and problems facing students?
   Identify the main technological changes that have influenced your learning environment in recent times.

4. Describe your ability to adapt to change. Give an example which illustrates your view.

5. How would you rate your ability to adapt to technological change?
   Excellent, average, poor, other.

6. What strategies do you personally use to manage change in general?

7. What strategies do you use to manage technological change in the learning environment?

8. How would you rate CSU’s management of technological change in relation to the learning environment?

9. What are some strategies institutions can use to better manage technological change?

10. What are some of the strategies/techniques you use in your leadership position to help others adapt to change?

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### A 3.3. Set 3a Interview Questions

Leader follow-up Interview questions [IP6] - 16 June 2009

[Omitted - background on the ball-in-basin approach to transformation of systems provided to interview participants]
Part 1

CSU has been challenged to transform its learning & teaching in response to the Strategic plan 2007-2011. How far are we along that transformation?

Q.1. In your school over the last 5 years (2004 onwards) has there been a transformation in learning and teaching?

- Yes / no
- Give some examples of the type of transformation you have seen.

Q.2. You stated in your original interview that although useful, Interact was long overdue and you and your colleagues are continually pushing the boundaries on the latest technology fix.

- Do you think Interact and other technologies (IVT. Multimedia resources etc.) have transformed learning & teaching in your school in the last few years?
- [Rate this on a scale of 0 – 5 with 0 being no positive impact and 5 being a visible transformation.]
  0 1 2 3 4 5
- Is it the technology, or the ability to reconceptualise teaching & learning or a mix of both that brought about the transformation?
- Do you think access to educational technology such as Interact and other technologies (IVT. Multimedia resources etc.) have transformed learning & teaching in the Faculty in the last few years?
- Rate this on a scale of 0 – 5 with 0 being no positive impact and 5 being a visible transformation.
  0 1 2 3 4 5

Q3. You mentioned in your original interview that you try to create a culture of change. That you challenge your staff to try new things and had an ambitious first rollout of Interact together with cross-campus teaching in 2008 with participation in the pilots in 2007.
• Speaking for your staff in general – how receptive are they to using new technology? 0 = not receptive at all, 5 = extremely receptive.

0 1 2 3 4 5

• To change in general?

0 1 2 3 4 5

• On a scale of 1 – 5 (1 being least adaptable) how would you rate your school’s capacity to adapt to change in general? (are you in a position to rate the other schools?)

1 2 3 4 5

• On a scale of 1 – 5 (1 being least adaptable) how would you rate your school’s capacity to adapt to change in technological change? (are you in a position to rate the other schools?)

1 2 3 4 5

• Understanding change in systems

A school in itself can be seen as a system, within bigger system of the faculty, university etc.

Transformability, adaptability and resilience are three factors help determine how well a system can adapt to change and to transform.

**Resilience**

*Resilience is the capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks & reliability.* Resilience is determined through the characteristics of the actors which in turn which determines the adaptability, or capacity of the system as a whole to absorb change.

Q.4. Identify some of the key factors that have impacted on your staff in these years. Rate the resilience of the school in each of these years. Each year has its own challenges so in rating the resilience think of how the school would have
managed each year if they had to face the worst scenarios of budget cuts, new technology etc.

1= minimal resilience so the ability of staff to still teach and carry out other duties is severely affected. Teaching quality goes down. Affects student retention & course offerings. 5 = maximum resilience, staff still able to teach well and good student learning outcomes, retention of students and subjects etc.

a. In 2006 (milestones - faculty changes, etc)

1 2 3 4 5

b. In 2007 (Interact pilots late in year, ED secondment, strategic voluntary separation etc)

1 2 3 4 5

c. In 2008 (Interact introduced, cross-campus teaching, ERA etc.)

1 2 3 4 5

d. In 2009 (budget & staffing cuts etc.)

1 2 3 4 5

e. In 2010 (USM, MSI, Sakai 3.0 etc.) – predict capacity

1 2 3 4 5

Transformability

[Omitted – background to transformability provided to participants]

Q5a. Can you think of any transformative moments in recent years in your school?

(e.g. Use of digital media, Interact, Cross campus team teaching )

What transformative moments are on the horizon?
Q5b. Considering your approach to change, would you agree that Transformability in MSE appears to be incremental, no single transformative moment to date, but continually adopting new ways of doing things?

Q5c. On a scale of 1 – 5 rate the transformability of your school.

1 = minimal capacity to create a new system i.e. new ways of conducting their business of learning & teaching & research 5 = maximum capacity

Adaptability/Resilience

Adaptability is the capacity of the actors in a system to manage resilience. A threshold is where the system moves into a different state or where there will be significantly different interactions and ways of doing things to the old system. Three critical aspects of adaptability contribute to determining the adaptability of the system. Latitude, resistance and precariousness.

Q6. Rate the adaptability of your school in terms of these 3 aspects.

a. Latitude: the maximum amount a system can be changed before losing its ability to recover (before crossing a threshold which, if breached, makes return to the old status quo difficult or impossible – but crossing the threshold may be desirable).

0 = no latitude. 1 = slight change in external factors will cause a transformation in the system, 5 = system has a high degree of ability to absorb major changes without fundamentally changing the output i.e. good learning & teaching and research.

b. Resistance: the ease or difficulty of changing the system; how “resistant” it is to being changed & moving into a new state.
0 = no resistance at all, totally open to changes. 5 = extremely resistant to change.

0 1 2 3 4 5

c. Precariousness: how close the current state of the system is to a limit or threshold.

How close is your school to its threshold i.e that point at which it is forced into a changed state (willingly or unwillingly) and to be looking at new ways of doing things (e.g. cross-campus teaching potentially created a new state in the faculty in response to various factors this has impacted on how things are done.)

0 1 2 3 4 5

What characteristics, strategies & techniques do you think your staff demonstrate or need in order to continue to remain or become adaptable? (In your original interview you mentioned leading by example, having champions like [academic name], ED assistance, not overloading staff with too many things at once).

A 3.4. Set 3b Interview Questions

Set 3a interview questions were used to develop Set 3b of interview questions customized for Interview Participant 3, based on their initial interview. Only those questions which are different are included here.

4 a. Can you think of any transformative moments in recent years in your school?

It is that structural change of creating the new cross-campus school. We have gone through major transformation.

(e.g. Use of digital media, Interact, structural changes)

What transformative moments are on the horizon?
b. Or would you say that transformability in [Sch of X] now is incremental, no single transformative moment to date, but continually adopting new ways of doing things?

On a scale of 1 – 5 rate the transformability of your school.

1 = minimal capacity to create a new system i.e. new ways of conducting their business of learning & teaching & research 5 = maximum capacity

1 2 3 4 5

Part 2

[The questions and background to this section were explained to participants]

The adaptive cycle

The Adaptive cycle framework has been developed as a way to understand the phases a system moves through during a transformation of the system. Also to predict where a system (e.g. school, faculty, university) might be in the cycle. By understanding where the system is in the transformation phases one can make best use of current resources as there are certain characteristics that will adapt a person to work best in one particular phase. It also helps determine what management actions need to be taken to move the individuals and thus the system into a different phase when needed.

Questions

• Where on this cycle do you think your school is at the moment (can have multiple speeds in transition in a system)?
• Do you think this model has value in helping deal with constant change? Elaborate
• Any improvements you can see?

[Background to the adaptive cycle omitted]
A 3.5. Set 4 Interview Questions

1. What is your role in the organization now?
2. What other roles have you had at CSU or in previous employment?
3. How long have you been in the organization?
4. What was your involvement in the rollout of Interact in 2007-2008?
5. Briefly describe what MSI is and what Interact is.
6. What role are you playing in the rollout of MSI?
7. What strategies have you used effectively to assist people in the move to MSI?
8. What strategies do not work?
9. Compared to Interact, how receptive are people to MSI?
   Scale 1 (not very) – 6 (excited-very open). Explain your choice.
10. Have you found any resistance to the acceptance of MSI? Explain your answer further.
11. Do you think people are more open to changes in learning technology at CSU now than they were in 2006-2007 i.e. prior to Interact. Explain your answer.
12. In general what strategies has the university used that are effective in helping people accept/adapt to the introduction of new learning technology?
13. What are some of the issues or things that have impacted on the introduction and acceptance of new technology?
14. What suggestions do you have for how CSU should go about implementing Sakai 3.0?
## A 3.6. Research Activity and Data Collection Timeline

Table A 3.1.  *Timeline: Research Activity and Data Collection.*

<table>
<thead>
<tr>
<th>Date</th>
<th>Ethics</th>
<th>Data collection</th>
</tr>
</thead>
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<tr>
<td></td>
<td>Ethics related activity</td>
<td>Interviews</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observation &amp; Meeting notes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reflective journal</td>
</tr>
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<td></td>
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<td>1998</td>
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<td></td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>Primary Ethics clearance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>applications: USQ HREC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and CSU EHRC</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>Endorsement by OLE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Program Team for Modules</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pilot Team participation;</td>
<td></td>
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<tr>
<td></td>
<td>CSU Ethics in Human Research</td>
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<tr>
<td></td>
<td>Committee approval for the study</td>
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<tr>
<td>June</td>
<td>DVC (Academic)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>permission to use CSU as</td>
<td></td>
</tr>
<tr>
<td></td>
<td>case study</td>
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<tr>
<td>November</td>
<td>USQ Human Research Ethics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Committee approval for the study</td>
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</tr>
<tr>
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<td>CELT and <em>Interact</em> Project</td>
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<tr>
<td></td>
<td>staff consent for inclusion in</td>
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</tr>
<tr>
<td></td>
<td>study sought</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>Participant interviews begin</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Ethics</td>
<td>Data collection</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
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</tr>
<tr>
<td>July</td>
<td>CSU EHRC progress report</td>
<td>Set 1 &amp; Set 2 begin</td>
</tr>
<tr>
<td>October</td>
<td></td>
<td>Interview Set 1 complete</td>
</tr>
<tr>
<td><strong>2009</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>CSU EHRC application for variation to clearance for project</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>USQ HREC progress report; CSU Variation to Ethics application submitted; CSU EHRC approval of ethics clearance research variation</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>USQ HREC application for amendment of Ethics clearance for research project</td>
<td></td>
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<tr>
<td>June</td>
<td>USQ Amendment to Ethics application approved</td>
<td></td>
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<tr>
<td>July</td>
<td></td>
<td>Interviews Set 3 begin. Set 2 complete.</td>
</tr>
<tr>
<td>November</td>
<td></td>
<td>Interviews Set 3 complete. Set 4 begin</td>
</tr>
<tr>
<td><strong>2010</strong></td>
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<tr>
<td>Date</td>
<td>Ethics</td>
<td>Data collection</td>
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<tr>
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<td>--------------------------</td>
</tr>
<tr>
<td>January</td>
<td></td>
<td>Interviews Set 4 complete</td>
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<tr>
<td>June 2011</td>
<td>EHRC Progress report CSU</td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>USQ HREC Variation to research project application</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>USQ HREC Approval for amendment to Variation to research</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>CSU EHRC Progress report; CSU EHRC Variation to research project application</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>USQ HREC Variation to research project application</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>USQ HREC Approval for amendment to Variation to research; CSU Approval for amendment to Variation to research</td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>USQ HREC Progress report-Final; CSU EHRC Progress report</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>USQ HREC Acceptance of Final Progress report; consent sought from senior divisional/faculty staff. Approval from DLTS Executive Director</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Ethics</td>
<td>Data collection</td>
</tr>
<tr>
<td>----------</td>
<td>------------------------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>February</td>
<td>Met with DLTS Executive Director to seek approval to use internal Divisional documents</td>
<td></td>
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<tr>
<td>September</td>
<td>Approval from Dean Fac. of Education</td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>Meet with Exec director DIT to seek approval to use internal Divisional documents</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>CSU EHRC Progress report submitted</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>Final CSU EHRC Progress report submitted</td>
<td></td>
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</table>
Appendix 4  Coding for Participants

Participant coding including ID code, affiliation and contribution to the research.

Table A 4.1.  *Detailed List of Coding for Participants.*

<table>
<thead>
<tr>
<th>ID Code</th>
<th>Participant</th>
<th>Role/Position/Contribution</th>
<th>Affiliation</th>
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<tbody>
<tr>
<td>P1</td>
<td>Individual</td>
<td>Senior executive</td>
<td>Division Learning &amp; Teaching Services</td>
</tr>
<tr>
<td>G1</td>
<td>Generic group, professional staff</td>
<td>Middle management/educational design</td>
<td>Division Learning &amp; Teaching Services</td>
</tr>
<tr>
<td>G2</td>
<td>Generic group, professional staff</td>
<td>Educational technologist/educational design</td>
<td>Division Learning &amp; Teaching Services</td>
</tr>
<tr>
<td>G3</td>
<td>Generic group, professional staff</td>
<td>Educational designer</td>
<td>Division Learning &amp; Teaching Services</td>
</tr>
<tr>
<td>ID Code</td>
<td>Participant</td>
<td>Role/Position/Contribution</td>
<td>Affiliation</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>---------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>G4</td>
<td>Generic group, professional staff</td>
<td>Middle management/IT</td>
<td>Division Learning &amp; Teaching Services</td>
</tr>
<tr>
<td>G5</td>
<td>Generic group, professional staff</td>
<td>Middle management/printery</td>
<td>Division Learning &amp; Teaching Services</td>
</tr>
<tr>
<td>G6</td>
<td>Generic group, professional staff</td>
<td>Middle management/IT</td>
<td>Division Learning &amp; Teaching Services</td>
</tr>
<tr>
<td>G7</td>
<td>Generic group, professional staff</td>
<td>Middle management</td>
<td>Project service Centre</td>
</tr>
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<td>G8</td>
<td>Generic group, professional staff</td>
<td>Middle management</td>
<td>Unit - Organisational Development</td>
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<td>Senior executive</td>
<td>Division of Information Technology</td>
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<tr>
<td>G10</td>
<td>Generic group, professional staff</td>
<td>Senior executive</td>
<td>Division of Library Services</td>
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<tr>
<td>ID Code</td>
<td>Participant</td>
<td>Role/Position/Contribution</td>
<td>Affiliation</td>
</tr>
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<td>---------</td>
<td>-------------</td>
<td>----------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td></td>
<td>professional staff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G11</td>
<td>Generic group, professional staff</td>
<td>Senior staff</td>
<td>Division of Student Services</td>
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<td>AG1</td>
<td>academic group</td>
<td>Learning &amp; teaching with technology</td>
<td>Faculty/Flexible Learning Working Group</td>
</tr>
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<td>AG2</td>
<td>academic group</td>
<td>Learning &amp; teaching committee</td>
<td>Faculty/committee</td>
</tr>
<tr>
<td>A1</td>
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<td>Dean</td>
<td>Faculty Executive/Faculty</td>
</tr>
<tr>
<td>A2</td>
<td>Academic</td>
<td>Senior staff</td>
<td>Faculty Executive/Faculty</td>
</tr>
<tr>
<td>A3</td>
<td>Academic</td>
<td>Head of School</td>
<td>Executive/Faculty</td>
</tr>
<tr>
<td>A4</td>
<td>Academic</td>
<td>Academic</td>
<td>Faculty/academic</td>
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<td>PE1</td>
<td>external participant</td>
<td>Researcher</td>
<td>external/institute/</td>
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<tr>
<td>PE2</td>
<td>external participant</td>
<td>Executive</td>
<td>external</td>
</tr>
<tr>
<td>PE3</td>
<td>external participant</td>
<td>Senior academic</td>
<td>external</td>
</tr>
<tr>
<td>PE4</td>
<td>external participant</td>
<td>Academic</td>
<td>external</td>
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### Appendix 5  Data Collection and Analysis

Table A 5.1.  *Data Collection Matrix.*

<table>
<thead>
<tr>
<th>Data type</th>
<th>Interviews</th>
<th>Documents</th>
<th>Observation &amp; meeting notes</th>
<th>Reflective journal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research question focus</td>
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<td></td>
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<td></td>
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<tr>
<td>Learning environment</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Social-ecological system heuristics</td>
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<tr>
<td>Panarchy</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Adaptive Cycle</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Adaptability</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Transformability</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Resilience</td>
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Table A 5.2.  *Retention of Data.*

<table>
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<tr>
<th>Form of data</th>
<th>Type of data</th>
<th>Actual data stored</th>
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<tbody>
<tr>
<td>Raw material</td>
<td>Unprocessed data</td>
<td>Field notes in notebooks, audio files, documents (hard copy &amp; e-copy), readings and literature sources</td>
</tr>
<tr>
<td>Partially processed</td>
<td>e-copies of writings and</td>
<td>Write-ups, interview transcriptions, draft publications/papers, transcribed notebooks, readings and literature review notes, publications with preliminary findings</td>
</tr>
<tr>
<td>data</td>
<td>spreadsheets</td>
<td></td>
</tr>
<tr>
<td>Coded data</td>
<td>Write-ups with specific</td>
<td>Annotated notebooks, NVivo coded data, e-notes with comments</td>
</tr>
<tr>
<td></td>
<td>codes attached</td>
<td></td>
</tr>
<tr>
<td>Reflective journal</td>
<td>Researcher’s reflections</td>
<td>Notebooks and e-copy</td>
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<tr>
<td></td>
<td>on the conceptual meaning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>of the data</td>
<td></td>
</tr>
<tr>
<td>Memos and notes</td>
<td>e-copies of memos, and</td>
<td>Notebooks, official memos and communications</td>
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<tr>
<td></td>
<td>communications</td>
<td></td>
</tr>
<tr>
<td>Search &amp; retrieval</td>
<td>A system to document and</td>
<td>Excel spreadsheets linking data sources, hard copy storage of readings, EndNote reference storage</td>
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<tr>
<td>records</td>
<td>access current data</td>
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<tr>
<td>Data displays</td>
<td>Matrices or networks</td>
<td>Conceptual frameworks, Excel spreadsheets, NVivo</td>
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<td></td>
<td>used to display retrieved</td>
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<tr>
<td>Form of data</td>
<td>Type of data</td>
<td>Actual data stored</td>
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<td>----------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Analysis episodes</td>
<td>Documentation of what was done step by step to assemble the displays and write the analytic text</td>
<td>Includes journal/conference papers and preliminary findings, analysis of the different types of heuristics</td>
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<tr>
<td>Report text</td>
<td>Successive drafts of what was written on the design methods, &amp; findings of the study</td>
<td>Draft e-copies of chapters, papers, proposals &amp; individual sections of text</td>
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<tr>
<td>General chronological log/documentation of data collection and analysis work.</td>
<td>PhD progress reports with timelines, diaries</td>
<td>Spreadsheet timeline document</td>
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<td>Work groups, committees, project teams</td>
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<td>----------------------------------------</td>
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<tr>
<td>Intra-divisional/unit/ institutional</td>
<td>Faculty</td>
<td>Individuals</td>
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<td>ICT-Committee</td>
<td>Flexible Learning Group</td>
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<td>Fac. of</td>
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<td>Wagga/Albury-Thurgoona</td>
<td>FLI Team</td>
<td>Teaching</td>
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<td>School staff</td>
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<td>other 2007 meetings</td>
<td>Course</td>
</tr>
<tr>
<td>Albury team</td>
<td>Interact Project development teams</td>
<td>Deans</td>
</tr>
<tr>
<td>LTS Leadership Committee</td>
<td>Interact2 team</td>
<td>Teaching</td>
</tr>
<tr>
<td>EDM Faculty Team</td>
<td>Project Team Committees</td>
<td>Sub-deans</td>
</tr>
<tr>
<td>Managers</td>
<td>Educational technology project teams</td>
<td></td>
</tr>
<tr>
<td>Managers team</td>
<td>Liaison Group School L&amp;T</td>
<td></td>
</tr>
<tr>
<td>SLTI Team</td>
<td>committees</td>
<td></td>
</tr>
<tr>
<td>Educational technologist team</td>
<td>IT Futures Group</td>
<td>CSU Degree Initiative Advisory Group</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------</td>
<td>-------------------------------------</td>
</tr>
</tbody>
</table>

**Forums, conferences, seminars, presentations**

<table>
<thead>
<tr>
<th>Educational technologist team</th>
<th>Inter-divisional/unit/ institutional Faculty</th>
<th>Individual</th>
<th>External/other institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDM Team forums</td>
<td>Vice-Chancellor Deputy-Vice</td>
<td>Ray Ison</td>
<td>AuSakai</td>
</tr>
<tr>
<td>Divisional Forum</td>
<td>Chancellor (Acad)</td>
<td>Etienne</td>
<td>Ascilite</td>
</tr>
<tr>
<td>EDM Forum F2F with Change EDM Directors</td>
<td>Geoff Crisp</td>
<td>CSUED</td>
<td></td>
</tr>
<tr>
<td>Managers retreats</td>
<td>Deans</td>
<td>Grainne</td>
<td>ALT-C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conole</td>
<td>5th Annual Stream</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>John</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Management Conference</td>
</tr>
<tr>
<td>Intra-divisional/unit</td>
<td>Inter-divisional/unit/ institutional Faculty Individuals</td>
<td>External/other institutions</td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------------------------------------------------</td>
<td>----------------------------</td>
<td></td>
</tr>
<tr>
<td>Professional development, communities of practice, scholarly visits*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational technology use: Interact, IVT, Pebblepad, m-Learning</td>
<td>Regional Academic Developers' CoP (Canberra/Sydney) Australian National University*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership development training</td>
<td>Change management</td>
<td>University of Southern Queensland* Canberra* Institute of Technology*</td>
<td></td>
</tr>
<tr>
<td>Course design training</td>
<td>Educational designer regular PD sessions workshop</td>
<td>Understanding culture Performance management training</td>
<td></td>
</tr>
<tr>
<td>Curriculum design and development</td>
<td>ICT-Integration CoP</td>
<td>University of Cambridge*</td>
<td></td>
</tr>
</tbody>
</table>
### Table A 5.4. Matrix for Upper Level Sorting of Data.

<table>
<thead>
<tr>
<th>Date</th>
<th>Feature</th>
<th>Participant + ID code</th>
<th>Data type</th>
<th>Dimension</th>
<th>Heuristic</th>
<th>Quote/detail</th>
<th>Data location/file name</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007 11 13</td>
<td>Coordinated support plan for students</td>
<td>G11</td>
<td>diary notes</td>
<td>temporal</td>
<td>panarchy</td>
<td>Student Services report – G8 on Interact plans</td>
<td>2007 10 22 diary notes</td>
</tr>
<tr>
<td></td>
<td>ED monthly meeting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009 07 05</td>
<td>ED is key to personal relationships &amp; managing own workload &amp; communications</td>
<td>A3</td>
<td>reflection</td>
<td>technological, connectedness, spatial</td>
<td>resilience</td>
<td>Moving from paper based DE to online. Noted that the ED support has been exceptional</td>
<td>2009 06 26 Diary notes</td>
</tr>
<tr>
<td></td>
<td>School of X. HOS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table A 5.5.  *Panarchy: Mapping Matrix for Dates of Key Events.*

<table>
<thead>
<tr>
<th>Date</th>
<th>Organisational impacts</th>
<th>Technology</th>
<th>Key CSU working parties &amp; papers</th>
<th>Learning &amp; teaching</th>
<th>External impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>CSU first starts delivering online supported subjects through its own VLE etc.</td>
<td>Board of Governors tasks TTIC. Online supported subject etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Feature</td>
<td>Participant ID code</td>
<td>Data type</td>
<td>Dimension − learning environment</td>
<td>Detail</td>
</tr>
<tr>
<td>------------</td>
<td>------------------</td>
<td>--------------------</td>
<td>-----------</td>
<td>-----------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>20.08.08</td>
<td>Institution sells</td>
<td></td>
<td>diary</td>
<td>social</td>
<td>Reflection – CSU logo on banner – ‘The world is changing. Get ready. Preparing leaders for a changing world.”</td>
</tr>
<tr>
<td>Vice-Chancellor or address</td>
<td></td>
<td></td>
<td>notes</td>
<td></td>
<td>notes from diary</td>
</tr>
<tr>
<td>2009 09</td>
<td>planned change</td>
<td>G5</td>
<td>diary</td>
<td>temporal</td>
<td>Printery review − CSU Print now under LTS. Will be able to offered improved reproduction services. “part of a process of change that will roll out over the next 6-8 months.”</td>
</tr>
<tr>
<td>10 LTS Leadership Committee meeting</td>
<td></td>
<td></td>
<td>notes</td>
<td></td>
<td>Diary notes</td>
</tr>
</tbody>
</table>

etc.
Table A 5.7. *Adaptive Cycle: Mapping features of the Phases.*

<table>
<thead>
<tr>
<th>Phase</th>
<th>Institutionalisation</th>
<th>Creative destruction</th>
<th>Reorganisation</th>
<th>Rapid growth</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FEATURES</strong></td>
<td>Duration</td>
<td>stability</td>
<td>flexibility</td>
<td>to absorb</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>change</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>etc.</td>
</tr>
</tbody>
</table>

Table A 5.8. *Adaptive Cycle Institutionalisation Phase: Mapping matrix.*

<table>
<thead>
<tr>
<th>Date</th>
<th>Feature</th>
<th>Who + ID code</th>
<th>Evidence</th>
<th>Context &amp; type</th>
<th>File name</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007 10 19</td>
<td>close relationship</td>
<td>G9 G1</td>
<td>Need identified – a closer relationship</td>
<td>observation notes</td>
<td>2007 10 19</td>
</tr>
<tr>
<td></td>
<td>IT futures</td>
<td>P1 P2</td>
<td></td>
<td></td>
<td>IT futures meeting #2</td>
</tr>
<tr>
<td></td>
<td>meeting #2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>agreed areas of responsibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>staff &amp; supporting key learning systems, including DOMS &amp; Interact</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

etc.
The matrix in Table A 9 was used to capture data relating to each of the four phases of the adaptive cycle. A separate table was used for each phase and the data was then repurposed into a variety of single sets to address different aspects of the heuristics.

Table A 5.9.  Coding used to Classify and Describe Document Data.

<table>
<thead>
<tr>
<th>Document Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>agenda</td>
<td>meeting agendas in-university</td>
</tr>
<tr>
<td>conceptual diagram</td>
<td>brain storm ideas</td>
</tr>
<tr>
<td>duty statement</td>
<td>role description (unit/divisional)</td>
</tr>
<tr>
<td>email</td>
<td>internal/external; received via email general information, announcements, process information, discussions</td>
</tr>
<tr>
<td>email announcement</td>
<td>announcement via email distribution: in-house &amp; external</td>
</tr>
<tr>
<td>guidelines</td>
<td>internal/external; operational guidelines for processes associated with learning and teaching; policy support guidelines</td>
</tr>
<tr>
<td>meeting notes/minutes</td>
<td>minutes/notes from internal meetings</td>
</tr>
<tr>
<td>memo</td>
<td>unit/divisional level memo</td>
</tr>
<tr>
<td>news item</td>
<td>internal news/external news via email announcements and online subscriptions</td>
</tr>
<tr>
<td>newsletter</td>
<td>internal/external; university/divisional/project information</td>
</tr>
<tr>
<td>notes</td>
<td>professional notes to inform work practices</td>
</tr>
<tr>
<td>official communication</td>
<td>university &amp; divisional information communications</td>
</tr>
<tr>
<td>Document Classification</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>official memo</td>
<td>university &amp; divisional memos</td>
</tr>
<tr>
<td>online announcement</td>
<td>announcements through CSU's online “What's New” portal</td>
</tr>
<tr>
<td>policy</td>
<td>internal university policy</td>
</tr>
<tr>
<td>position paper</td>
<td>position and discussion papers, university level and divisional/unit level</td>
</tr>
<tr>
<td>presentation</td>
<td>internal and external presentations, by senior staff and myself</td>
</tr>
<tr>
<td>processes and guidelines</td>
<td>documentation to guide learning and teaching processes; included guidelines of unit/divisional/faculty and external origins</td>
</tr>
<tr>
<td>conference/symposium</td>
<td>programs from conferences and symposiums</td>
</tr>
<tr>
<td>project proposal</td>
<td>proposals for research projects, learning technology implementation projects</td>
</tr>
<tr>
<td>project report</td>
<td>project report</td>
</tr>
<tr>
<td>reflection</td>
<td>personal reflections</td>
</tr>
<tr>
<td>report</td>
<td>internal and external; university-level &amp; unit/divisional/faculty level, university initiatives, recommendations for improvements, working parties</td>
</tr>
<tr>
<td>statistics</td>
<td>internal reports and summary statistics</td>
</tr>
<tr>
<td>strategic plan</td>
<td>formal university level strategies and plans (usually</td>
</tr>
<tr>
<td>Document Classification</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>strategy</td>
<td>strategy and guidelines at unit/divisional/faculty level &amp; internal project level</td>
</tr>
<tr>
<td>survey results</td>
<td>results of surveys</td>
</tr>
<tr>
<td>terms of reference</td>
<td>terms of reference of committees and working groups</td>
</tr>
<tr>
<td>training materials</td>
<td>training and professional development materials; internal and external; learning technology &amp; broader university engagement</td>
</tr>
<tr>
<td>workflow</td>
<td>processes and operational workflows</td>
</tr>
</tbody>
</table>
Appendix 6 Institutional Supporting Documents


Figure A 6.1. Dashboard of Systems for ICT Enabled Learning and Teaching 2009.
**Figure A 6.2.** Dashboard of Systems for ICT Enabled Learning and Teaching 2010.
Figure A 6.3. Dashboard of Systems for ICT Enabled Learning and Teaching 2011.
Appendix 7  Narrative – A Week in the Life

An ethnographic account presenting a week in the life of staff and student teaching and learning experiences across the CSU technology-enhanced learning environment (circa July 2009). This narrative supports the investigation into the technology-enhanced learning environment in Study 1, Part 1 (see Section 4.5).

**Monday 8.55am Albury** – Lecturer Simon (not his real name) enters the new classroom for the first lecture of the final semester. It is his first class in the new building so he takes time to find the cabinet containing the controls for the computer and data projectors and the new lecture recording equipment (there have not yet been any training sessions on how to use the new technology in the new building). Unclear about how to run the two data projectors simultaneously he decides to only use one. He notes that now over one quarter of his students are carrying laptops, at the start of the year there were only two in the class. The students are excited about the new classroom and amazingly, they all connect first time to the new high speed wireless system.

It is almost lunchtime by the time Jake wakes up. Monday classes are unfair after the night shift of supermarket shelf-packing – but it pays the bills. He fires up his laptop and downloads the online lecture notes from his subject Interact site. With luck Simon might have recorded the lecture on his mp3 recorder again and will put that up. Sends off a few SMSs on his mobile phone to friends to organise his study group for the afternoon tutorial and then hops back on his laptop to sign up online in the subject site wiki for the group tutorial.

Simon’s class goes well, but he makes a note to talk to someone about getting help with the technology in the new classroom (who in IT? since they never replaced the assistant who used to come round and help troubleshoot in the lecture theatres). Luckily he is pretty good with these things - those casual staff members who come in for the occasional lecture really struggle. Often they cannot even log on to the CSU system for the first two weeks or so.
Back in his office Simon checks his emails quickly and calls his colleague up in Bathurst to finalise tomorrow afternoon’s videoconference class. He goes on to Interact and spends an hour online with his distance students. This year is much easier than last year, when the new online system came in. He tried every tool last year, blogs, wikis, forums, chat rooms but it seemed to confuse some students. So he has limited his subject sites to just a few tools this time. He reflects that every time they have one of those learning and teaching workshops it is all about technology and some people are doing amazing things with Twitter and podcasts and other new things he cannot even name- makes him feel guilty not using them. Are his students missing out?

**Tuesday 9.50am** - With the kids off to school, out on the farm near Swan Hill Sandra manages to dial up to start her study for the day. She has a big assignment to complete and has already had to get an extension because of lambing time. Although the new online Interact is good she finds the dialup connection too slow and it limits what she can download. It was okay when she only had to go online to check the odd Forum messages and she received a print package with all her readings and the study guide. That CD-Rom they sent her for one subject was excellent, it had video and audio interviews and lots of pictures. In her new subject everything is online, so she has to print the readings herself and that is costly. When the internet does work she has met lots of other students and her class used Interact to arrange shared accommodation at the upcoming residential school. She learned on the Forum that she was not the worst with this online stuff, other mums in her class seem to be really struggling. There is no help for DE students with technology except an online site, which is not much help with dialup. She has heard about lecturers using mobile phones and iPods for lectures in some subjects, she is glad she has not had to use those.

Back in Albury Simon gets to the classroom early to turn on the videoconference equipment. The early childhood classes on the three campuses are connecting up today for a guest lecture with a music expert. He is pleased that at least for this experiment they will have the help of their educational designer who has given them some training in using the videoconference technology and will be
there to help troubleshoot. The IT helpline is useful, but only if you have a telephone in the classroom and not all the new rooms have those yet.

**Wednesday 11.40am** - Dianne hurries out of her second and final tutorial of the day in Albury. Students kept her a bit late, assignment time…Back in her office she quickly checks her email and answers three student queries before getting into the CSU car at 12.30pm for the drive north to Orange. Lack of staffing in Orange means that Dianne is doing a weekly trip to Orange to provide on-site teaching for their newly established cross-campus school. The five and a half hour trip is tiring but she takes the opportunity to listen to some podcasts of material for her Graduate Certificate in University Learning and Teaching. With the current workload and travel it would not be possible without technology to keep up with the reading and work for this extra study. But if she wants promotion she needs to get the teaching qualification. Later that evening in the hotel Dianne puts on her ‘student’ hat and quickly visits the Interact Grad Cert online Forum to review and contribute to comments from fellow students about their upcoming assignment and virtual classroom trial.

**Wednesday 4pm** - On a visit into town to stock up on farm supplies and collect the children from school, Sandra collects the mail which includes a library book from CSU and her last assignment which has been marked. She will be glad when all her lecturers start returning assignments electronically so assignment return is quicker, although the slow internet on the farm will still be a problem.

**Thursday 9am** - Dianne begins her first laboratory practical session in Orange followed by a short break before the second laboratory session. As expected, some of the students have not done their reading, but there is positive comment about the new podcasts of the lectures and links to e-readings that she put up last week. After lunch she joins in a teleconference with the subject development team and media technologist about developing a new DVD for the DE offering of the subject. Just after 3pm she sets out on the return trip home to Albury.

**Thursday 11.00am** - In Albury Janet has been at work over three hours. The day began at 8am with a videoconference with a Faculty Learning and Teaching
Committee meeting. There were six different videoconference sites including CSU’s Burlington, Ontario campus. It is early evening meeting (still Wednesday in Canada) for Ontario CSU staff so another late finish.

Janet tries to set up a teleconference call on her new VOIP telephone. 11.01am, email from Tracy in Dubbo to indicate that she cannot get into the teleconference from home where she is working this week. Go to plan B. Janet emails Sarah in Wagga Wagga to set up the teleconference from her office. Tracy and Janet dial in and a short time later Paul joins in on his mobile phone. In-between passing cars and trucks Paul apologises for the quality of the reception because he has stopped on the side of the road mid-way between Goulburn and Bathurst campuses to take the teleconference. It is a productive meeting - coincidentally about the new mobile learning project. 12.01pm - Janet puts in an IT Service Desk request to get help with the VOIP phone.

**Thursday 12.30pm** – Janet joins in another lunchtime meeting, this time by videoconference to three rooms, one office dial-in and desk-top videoconference unit. The “virtual” meeting is about the governance of learning and teaching spaces and involves representatives from three divisions. She reflects that since the project to build the new campus learning and teaching spaces began there has been considerable change in how the multiple-stakeholders engage. Who owns learning and teaching spaces anyway? Indeed a wicked problem.

**Thursday 2pm** – The fun part of the day. Janet gets to go to the Faculty of Education’s roundtable showcase, organised by their Flexible Learning Working Group. This time the theme is on blended learning. About 35 people “attended” (again virtually by the means of different technology). A fresh approach to the presentations with not a PowerPoint™ slide in sight – good old fashioned listening, and good old fashioned descriptive presentations! This was not all about technology for a change, but a useful focus on designing learning experiences and developing approaches to blended learning. There is excellent work being done across the faculty which will be captured in the faculty’s *Interact* Showcase site by the educational designers.
**Friday 10am** - On the Wagga Wagga campus Amanda sits in a near-empty computer laboratory working alone on her subject. She downloads the podcasts the lecturer has put up from last week’s lectures and checks the subject announcements from the combined DE/internal subject to see if any are relevant to her. A third year full time student, this year she is doing half her subjects by distance through Bathurst and Albury because they are not offered on her campus; part of that subject rationalisation a couple of years ago. She is part of the same “class” as the on-campus students in Bathurst and the role play task they all have to do is interesting. They never meet face to face but are all in the same subject site. Her group will be meeting through online Chat, the online Forums and someone has set up a Facebook site. Not sure if it’s legal at CSU but it serves a purpose. She sends an SMS message to a friend to organise to meet in the canteen later to do some study and to make the most of the trip to the campus.

Simon is on a research day at home. Time to make inroads into the journal paper he has been trying to write (once he has finished his marking). Every time he connects straight through to the network via Thin Client he is grateful for the reliability of the network and administrative systems at CSU.

**Sunday 4pm** – Dianne is working on a research paper for a conference submission deadline. She spends some time answering students’ questions which have been posted on the forum and then starts to prepare her classes for the coming week.
Appendix 8  Data Supporting the Heuristics of the Adaptive Cycle and Panarchy

A 8.1. Application of Panarchy in Practice: Improvements to Para-analysis

The following critique of para-analysis supports the Discussion in Section 5.3.3 and suggests more areas for future development of the tool.

Temporal scale - The length of time an event exerts an influence was measured in years and plotted on the x-axis. The temporal influence was determined by collating the dates for when the technology was implemented and/or decommissioned. It proved difficult to establish clear start and end dates for many university initiatives. Where institutional initiatives were project-based or were centrally administered it was possible to establish the institutional timelines for the initiative according to funding and resourcing of projects/initiatives. In the case of events such as the reorganisation of faculties or introducing a unified session model of university semesters, the data reflected as closely as possible the start of the initiative and the end of its full implementation or mainstreaming and acceptance into institutional processes. Some insights into how to measure when mainstreaming has occurred comes from the exploration into the dynamic of the adaptive cycle where the properties or characteristics of each of the four phases of the adaptive cycle are outlined. According to the adaptive cycle the mainstreaming of a technology could equate to a return to the Institutionalisation phase.

The data showed that the impact of initiatives was not necessarily confined to the timelines associated with implementation. Planning for major initiatives was seen to take place well in advance of the actual event and at the individual level the anticipation of an event was seen to have a localised (but possibly unmeasurable) negative effect. The ripple effect of changes which lasted beyond the lifespan of a project, initiatives or event is an important consideration.

Institutional impact scale - Initially the institutional impact scale was envisaged as a way of measuring and mapping the scale of influence of different educational technology projects along with the simultaneous mapping of the impact
of individual events. In the institutional context this equated to how many people in the institution, or the part of the institutional population being measured, might feel (predictive) or did feel the impact (analysis) of the event. In the 2010 work this measure was largely subjective. The simplest impact factor used was how many people needed to be familiar with the use of the technology as part of their normal job. Where a tool or technology could be classified for optional use it was given a lower impact factor.

There were discrepancies in the 2010 projected or anticipated impacts of certain events and technologies compared to how some of these events or the implementation of technology actually panned out.

The following factors were subsequently identified as important considerations in any future work to be done towards developing a more accurate measure of an institutional impact scale (see Table A 8.1). As a start, some suggestions of possible measurements and the observations and considerations which could guide future development of these measurements are given.


<table>
<thead>
<tr>
<th>Measurement factor</th>
<th>Observation/consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of people using the technology</td>
<td>• Core technology – need to use it in their daily work</td>
</tr>
<tr>
<td></td>
<td>• Peripheral technology – optional use</td>
</tr>
<tr>
<td>Institutional project or initiative timelines</td>
<td>• Determined by institutional funding or support</td>
</tr>
<tr>
<td></td>
<td>• When the initiative has become mainstreamed – explore links to the adaptive cycle and the return to an institutionalisation phase</td>
</tr>
<tr>
<td>Impact can be positive or negative</td>
<td>• Impact continues beyond the lifespan of a project implementation</td>
</tr>
<tr>
<td></td>
<td>• can be positive/increase if the new technology/initiative can be fully mainstreamed</td>
</tr>
<tr>
<td>Measurement factor</td>
<td>Observation/consideration</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Impact can be dependent on the perceptions of people   | • contributes positively to ways of working, towards transforming ways of working  
• whether the impact was positive or negative can be dependent on the current state of that part of the system, whether stable or not and where in the adaptive cycle the system is  
• Is there an absolute measure?  
• Individual perceptions of the impact of technology may differ to the perceptions others have of the impact on different individuals and/or populations  
• Perceptions of impact can be individual and can be subjective not objective. Individual perceptions can change over time  
• Adaptability of the individual can affect the impact factor of a technology |
| Impact is dependent on the perceptions of the institution | • perceptions of themselves and perceptions of those who make judgement calls                                                                                                                                              |
| Impact of an event or technology can vary in different populations | • Define the population for which the impact is being measured  
• May be aligned with locus of control or sphere of influence  
• positive if one is in control  
• negative if not in control  
• may be aligned with the level of shock or disturbance |
A 8.2. **The Adaptive Cycle in Practice**

*Report from DLTS March 2012 Workshop for educational designers and senior DLTS staff – “Coming face-to-face with change”* (Reproduced with permission).

**Activity - Benchmarking**

The aim of this activity is to understand some of the important transitions (or transformations) which currently [in 2012] shape our work in LTS.

Identify a system e.g. school or faculty as a system. Use the Adaptive Cycle Framework to assess where the system is with respect to the following (Poster and workbook):

1. The move from print to online resources
2. The CSU Degree Initiative (CSU DI) – embedding the design principles in courses new/under review.

This is a summary of the benchmarking activity done with the ED group during the ED f2f. It provides a simple snapshot of where schools/faculties are at in changing/transforming systems, processes and practice with respect to the CSU DI and the Print to online transition.

Those in the Institutionalisation phase have effectively made the transformation with well-developed processes and systems. Those in the Creative Destruction phase are just beginning the journey of transformation. Some schools are at the end of the ‘old’ institutionalisation phase having reached the ‘tipping point’ where they are forced into a Creative destruction phase.

The snapshot can be used to target planning and management activities.

*CSU DI* – participants were asked to assess where their school/faculty currently is on the cycle according to the features (below) with the Institutionalisation phase being that their school has a well-developed processes and policies around the CSU DI and in particular the embedding of the CSU Degree Principles etc.

*Print to online* - participants were asked to assess where their school/faculty currently is on the cycle; Institutionalisation being that the school has well developed online processes and policies etc.
Figure A 9.1 and Figure A 9.2 summarise the EDs’ perception of the positions of their schools and faculties with respect to the CSU DI and the move from Print to Online resources, developed through the use of the Adaptive Cycle.

Figure A 8.1. EDs’ perceptions with respect to the CSU Degree Initiative.

Figure A 8.2. EDs’ perceptions of the move from Print to Online.
Figure A 9.3 and Figure A 9.4 illustrate AuSakai 2009 Workshop participants’ perceptions of their personal and institutional positions on the Adaptive Cycle Framework with respect to implementation of a new learning management system.

Figure A 8.3. Perceptions of personal positions.

Figure A 8.4. Perceptions of institutional positions.
Table A 8.2. *Change in the Stability Landscape against the six Institutional System Variables.*

<table>
<thead>
<tr>
<th>Organisational structures</th>
<th>Operations/procedures/ processes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2007</strong></td>
<td><strong>2010</strong></td>
</tr>
<tr>
<td>LMC and CELT separate centres</td>
<td>Div. of Learning &amp; Teaching Services established 2009 (CELT + LMC)</td>
</tr>
<tr>
<td>Working in multi-stakeholder teams on OLE program under Project Service Centre</td>
<td>SLTI (2009 LTS) has IT programmers/solutions coordinators dedicated to learning technology</td>
</tr>
<tr>
<td>IT support for educational technology on a project base (Project Service Centre)</td>
<td>LTS full custodians of the OLE. Service level agreements with DIT</td>
</tr>
<tr>
<td>Organisational structures</td>
<td>Operations/procedures/ processes</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2007 Flexible learning &amp; Interact</td>
<td>2007 ED administrative role in learning resource production</td>
</tr>
<tr>
<td>Team formed to oversee ED related aspects of Interact implementation</td>
<td>2010 MDC taken over administrative role</td>
</tr>
<tr>
<td>New DLTS Faculty EDM team structure (2009); ED Areas of Professional focus established</td>
<td></td>
</tr>
<tr>
<td>Staff seconded to OLE Program to implement Interact (CELT, LMC, DIT, Library, Student Services)</td>
<td>---</td>
</tr>
<tr>
<td>First round strategic voluntary separations in faculties (redundancies); new faculties and schools settling</td>
<td>---</td>
</tr>
<tr>
<td>Flexible Learning Institute &amp;</td>
<td>---</td>
</tr>
<tr>
<td>Cross-campus offering of</td>
<td></td>
</tr>
<tr>
<td>Organisational structures</td>
<td>Operations/procedures/ processes</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>EFPI established</td>
<td>blended learning courses;</td>
</tr>
<tr>
<td>LMLs (CELT) for innovation in digital media; LMC for innovation in enterprise production systems</td>
<td>PODs for innovation in digital media (ED - academic); LTS Media Development Unit (Production); Media Technologist specialist in digital media production</td>
</tr>
<tr>
<td>Interact pilots run in each school allow staff to try new ways of teaching;</td>
<td>LTS production of Interact based learning resources fully mainstreamed</td>
</tr>
<tr>
<td>---</td>
<td>Media technologist with specialist role in technology innovation</td>
</tr>
<tr>
<td>LMC learning materials processing officers begin acquiring specialist skills in digital media</td>
<td>---</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Organisational structures</th>
<th>Operations/procedures/ processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007 2010</td>
<td>2007 2010</td>
</tr>
<tr>
<td>--- ---</td>
<td>Multiple stakeholders in</td>
</tr>
<tr>
<td></td>
<td>educational technology initiatives</td>
</tr>
<tr>
<td></td>
<td>since 2001</td>
</tr>
<tr>
<td></td>
<td>Project Service Centre. Rapid</td>
</tr>
<tr>
<td></td>
<td>planning sessions with multiple</td>
</tr>
<tr>
<td></td>
<td>stakeholders</td>
</tr>
<tr>
<td>--- ---</td>
<td>Processes in developing digitally</td>
</tr>
<tr>
<td></td>
<td>enhanced learning environments:</td>
</tr>
<tr>
<td></td>
<td>flexible delivery in action</td>
</tr>
<tr>
<td>People/social/roles</td>
<td>2007</td>
</tr>
<tr>
<td>---------------------</td>
<td>------</td>
</tr>
<tr>
<td>EDs initiate pilots in schools; upskill in using new technology; support staff in preparing to use Interact in teaching</td>
<td>---</td>
</tr>
<tr>
<td>EDs provide widespread professional development and assistance with Interact and other educational technology</td>
<td>CELT, LMC and DIT, PSC and Student Services played a major role in the selection and implementation of the Sakai community source approach to CSU’s online learning environment, CSU Interact</td>
</tr>
<tr>
<td>People/social/roles</td>
<td>Connectedness</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------</td>
</tr>
<tr>
<td><strong>2007</strong></td>
<td><strong>2007</strong></td>
</tr>
<tr>
<td>EDs starting to provide at-your-desk help for Interact</td>
<td>EDs &amp; MDCs provide at-your-desk help for Interact</td>
</tr>
<tr>
<td>People/social/roles</td>
<td>Connectedness</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>2007</strong></td>
<td><strong>2007</strong></td>
</tr>
<tr>
<td>Some EDs developing specialist skills in digital media &amp; online learning</td>
<td>A new approach to divisional responsibilities for CSU</td>
</tr>
<tr>
<td></td>
<td>Interact agreed through discussions between DVC (Academic), DVC (Administration) and senior staff in CELT, LMC and DIT and involves ongoing consultations about detailed roles and processes</td>
</tr>
<tr>
<td>2009 Interact administration taken over by LTS. Service Level Agreement with DIT</td>
<td>2009 Interact administration taken over by LTS – gives autonomy. Service Level Agreement with DIT; OLE Reference Group became Educational Technology Reference Group; Sakai OAE Managed</td>
</tr>
<tr>
<td>LMLC (CELT) specialists in digital media development; Multimedia team leader</td>
<td>Diary note - when support for the online learning environment moves from a project management methodology to a continuous</td>
</tr>
<tr>
<td>(LMC) specialist in</td>
<td></td>
</tr>
<tr>
<td>Media technologist is the specialist in digital media production; all EDs need</td>
<td></td>
</tr>
<tr>
<td>base level skills in digital media development; online digital media the growth</td>
<td></td>
</tr>
<tr>
<td>area</td>
<td></td>
</tr>
<tr>
<td>People/social/roles</td>
<td>Connectedness</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>2007 2010 digital media production;</td>
<td>2007 2010 improvement model, new collaborative processes are needed</td>
</tr>
<tr>
<td>DIT Programmers/developers learning skills to work with Sakai and associated systems in Sakai community</td>
<td>Virtual team pioneering agile development processes for software; team has autonomy &amp; close working relationship with Sakai community; EDs and academics can nominate new Interact tools and educational technology for innovation</td>
</tr>
<tr>
<td>DIT Programmers/developers playing a lead role in work with Sakai and associated systems in Sakai community</td>
<td>Diary note - CSU Interact system with its multiplicity of stakeholders, requires development processes that are agile and iterative in order to provide ongoing innovation, improvement and system upgrades</td>
</tr>
<tr>
<td>Change of school processes for online resources, trying new</td>
<td>OLE Programme a multi-stakeholder project run by LTS full custodians of the OLE. Service level agreements with DIT</td>
</tr>
<tr>
<td>People/social/roles</td>
<td>Connectedness</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2007 resources, trying new processes in schools</td>
<td>2007 Project Service Centre</td>
</tr>
<tr>
<td>2010 processes in schools</td>
<td>2010 Interact - Service Desk responsibility moves to LTS specialist</td>
</tr>
<tr>
<td>EDs employed for specific projects - Interact, Faculty funded projects</td>
<td>IT Service Desk supports Interact Help questions; CELT ED specialists hold Touchpaper licences to support Help Desk in Interact implementation phase</td>
</tr>
<tr>
<td>Start of additional EDs employed by faculties for specific funded projects e.g. revising full courses for online delivery</td>
<td></td>
</tr>
<tr>
<td>Interact was the first introduction to an LMS (Web 2.0) technology for many staff, EDs &amp; academics</td>
<td>Social presence possible through online Forums &amp; Chat tool</td>
</tr>
<tr>
<td>Staff more critical of technology and better able to make decisions about using new tools</td>
<td>Interact enables students and staff to have a social presence in subjects through Chat, Forums, wiki, Blog, other tools &amp; dynamic sharing of content</td>
</tr>
<tr>
<td>People/social/roles</td>
<td>Connectedness</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------</td>
</tr>
<tr>
<td><strong>2007</strong></td>
<td><strong>2010</strong></td>
</tr>
<tr>
<td>IT skills limited to available software, no LMS</td>
<td>Overall increase in IT skills amongst academic, support and administrative staff, includes online administrative systems</td>
</tr>
<tr>
<td>Cautious with Interact, some resistance</td>
<td>More adaptable to new technology, prepared to try new things</td>
</tr>
<tr>
<td>Mainly print based, online supported subjects</td>
<td>New skills in designing blended &amp; flexible learning experiences</td>
</tr>
<tr>
<td>---</td>
<td>+ increased workloads</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### People/social/roles

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDs on OLE Programme introduced to CSU</td>
<td>EDs on OLE Programme introduced to CSU</td>
<td>EDs on OLE Programme introduced to CSU</td>
</tr>
<tr>
<td>Project Management methodology</td>
<td>Project Management methodology</td>
<td>Project Management methodology</td>
</tr>
<tr>
<td>Some schools held on to control of PD in learning &amp; teaching during introduction of Interact, ED as observer/support not driver</td>
<td>Some schools held on to control of PD in learning &amp; teaching during introduction of Interact, ED as observer/support not driver</td>
<td>Some schools held on to control of PD in learning &amp; teaching during introduction of Interact, ED as observer/support not driver</td>
</tr>
<tr>
<td>ED role focuses on PD, subject design &amp; development, production of learning resources</td>
<td>ED role focuses on PD, subject design &amp; development, production of learning resources</td>
<td>ED role focuses on PD, subject design &amp; development, production of learning resources</td>
</tr>
</tbody>
</table>

### Connectedness

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDs play role of coordinating development, production &amp; delivery of online &amp; digital resources</td>
<td>EDs play role of coordinating development, production &amp; delivery of online &amp; digital resources</td>
<td>EDs play role of coordinating development, production &amp; delivery of online &amp; digital resources</td>
</tr>
<tr>
<td>Academics must take more personal responsibility for provision of learning resources to students (fewer controls, but less reminders)</td>
<td>Academics must take more personal responsibility for provision of learning resources to students (fewer controls, but less reminders)</td>
<td>Academics must take more personal responsibility for provision of learning resources to students (fewer controls, but less reminders)</td>
</tr>
<tr>
<td>Self-help resources in Interact, updated L&amp;T websites, new staff induction resources lessens dependence of staff on EDs</td>
<td>Self-help resources in Interact, updated L&amp;T websites, new staff induction resources lessens dependence of staff on EDs</td>
<td>Self-help resources in Interact, updated L&amp;T websites, new staff induction resources lessens dependence of staff on EDs</td>
</tr>
<tr>
<td>CSUED Conferences - increased focus on staff from all divisions, Library, Student Services, Learning &amp; teaching services, Information Technology, academics from all faculties and</td>
<td>CSUED Conferences - increased focus on staff from all divisions, Library, Student Services, Learning &amp; teaching services, Information Technology, academics from all faculties and</td>
<td>CSUED Conferences - increased focus on staff from all divisions, Library, Student Services, Learning &amp; teaching services, Information Technology, academics from all faculties and</td>
</tr>
<tr>
<td>People/social/roles</td>
<td>Connectedness</td>
<td></td>
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<tr>
<td>--------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>2007 through LMC</td>
<td>different disciplines. Shared hosting with DLTS, Institutes – FLI &amp; EFPI</td>
<td></td>
</tr>
<tr>
<td>--- Cross-campus courses supported by Interact enables lecturers to cope with high and complex workloads; # enables courses to run with staff shortages and increased workloads</td>
<td>No online community of practice prior to Interact</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>The CSU Interact site “about ICT integration” has 498 (2011) members</td>
<td></td>
</tr>
<tr>
<td>--- No university-wide social networking (pre-Facebook!)</td>
<td>Yammer used as a professional networking site has 205 members (2010) &amp; 449 members (2011)</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>ICT-CoP (established 2009) is distributed across all campuses, faculties and divisions of the University.</td>
<td></td>
</tr>
<tr>
<td>People/social/roles</td>
<td>Connectedness</td>
<td></td>
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<tr>
<td>---------------------------------------------</td>
<td>----------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>2007</td>
<td></td>
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<td>---</td>
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<td></td>
</tr>
<tr>
<td>AuSakai 2007 CSU first presence networking  with other institutions</td>
<td>AuSakai conferences 2007/08/09/10. Lead player in 2010/11</td>
<td></td>
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<td>---</td>
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<td></td>
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<tr>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>CELT &amp; LMC work closely together,</td>
<td>New collaborations LTS EDM teams</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>CELT-LMC collaborate on developing digital media development processes, Digital Media Flowchart. LMLC and MMTL roles</td>
<td>Less involvement of EDs in digital media development (CDROM/DVD); Change in educational technologist support; EDs with specialist skills</td>
<td></td>
</tr>
<tr>
<td>Strategy/policy/planning</td>
<td>Technology</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>2007 CSU Strategy 2007-2011</td>
<td>Online subject outline (central processing by LMC through Subject Outline Management System SOMS); Flexible Publishing tool; OASIS; CSU online Chat; Forums; IVT; screen capture software available supported through LMLs</td>
<td></td>
</tr>
<tr>
<td>2010 CSU Strategy 2007-2011</td>
<td>OASIS; Forums; IVT; CSU Interact suite of tools**+ Test Centre (Tasks, tests &amp; quizzes); citations manager + signup tool; Subject Outline Tool (MSI) for academic use; + online conferencing (Wimba)</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>CSU Educational Technology Framework introduced</td>
<td>--- release of single tools e.g. Gradebook, online meeting tool (Wimba); DOMS (Equella); podcasting tool in Interact</td>
</tr>
<tr>
<td>3 year Operational plans (faculties/divisions)</td>
<td>CSU implements Sakai 2.4 as new OLE CSU Interact</td>
<td>CSU a leading contributor to Sakai OAE (formerly Sakai3) community project</td>
</tr>
<tr>
<td>1 year Operational plans (faculties/divisions)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Strategy/policy/planning</td>
<td>Technology</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>2007 Planning meetings, all levels</td>
<td>Planning meetings, all levels</td>
<td>Pilots of <em>CSU Interact</em></td>
</tr>
<tr>
<td></td>
<td>policy details (IT access etc) various plans</td>
<td>SOMS all subjects by autumn 2007</td>
</tr>
<tr>
<td>2006 Policy for the use of University computing and communication facilities</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
### A 8.3. Educational Technology: Administrative Teaching and Systems and Tools

Table A 8.3. Educational Technology: Administrative Teaching and Systems and Tools.

(Adapted from Buchan, 2010. p.61)

<table>
<thead>
<tr>
<th>System</th>
<th>System full name</th>
<th>Teaching or administrative use</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banner</td>
<td>administrative Database system</td>
<td>Database system for recording a variety of information about student enrolments and grades</td>
<td></td>
</tr>
<tr>
<td>BlogWow</td>
<td>teaching</td>
<td>Blog tool</td>
<td></td>
</tr>
<tr>
<td>CASIMS</td>
<td>Course and subject information system administrative</td>
<td>Recording course and subject information</td>
<td></td>
</tr>
<tr>
<td>CSU Replay</td>
<td>Echo 360</td>
<td>teaching</td>
<td>Podium and desk-top lecture capture and sharing</td>
</tr>
<tr>
<td>DOMS</td>
<td>Digital object management system (Collections tool) teaching/ administrative</td>
<td>Provides structured storage repository for learning resources and automation of specific processes</td>
<td></td>
</tr>
<tr>
<td>EASTS</td>
<td>Electronic assignment submission tracking system administrative</td>
<td>For students to submit assignments online &amp; university to track assignments and send to markers, online marking function available</td>
<td></td>
</tr>
<tr>
<td>System</td>
<td>System full name</td>
<td>Teaching or administrative use</td>
<td>Function</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------</td>
<td>--------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>eBox</td>
<td>(system predates official use)</td>
<td>administrative</td>
<td>Online delivery point for official communications between the University and its students, secure and authenticated online environment, messages sent and received are stored and tracked to provide students with a permanent, web based record of official communications</td>
</tr>
<tr>
<td>eReserve/Rapid print</td>
<td>Electronic reserve</td>
<td>teaching</td>
<td>For storing readings in electronic form</td>
</tr>
<tr>
<td>ePortfolio</td>
<td></td>
<td>teaching</td>
<td>For creating a portfolio of work</td>
</tr>
<tr>
<td>eReserve/Rapid print</td>
<td></td>
<td>teaching</td>
<td>System by which e-copies of readings can be selectively accessed and printed on demand</td>
</tr>
<tr>
<td>Flexible Publishing</td>
<td></td>
<td>teaching</td>
<td>A tool for uploading files to a unique subject site to be accessed by students via the online subject outline</td>
</tr>
<tr>
<td>Forums</td>
<td></td>
<td>teaching</td>
<td>In-house developed communication tool that enabled students and teaching staff to post, read and reply to messages from other members of the</td>
</tr>
<tr>
<td>System</td>
<td>System full name</td>
<td>Teaching or administrative use</td>
<td>Function</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------</td>
<td>--------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Gradebook</td>
<td></td>
<td>teaching/administrative</td>
<td>A Sakai tool for recording and administering grades</td>
</tr>
<tr>
<td>CSU Interact</td>
<td>A collaborative learning environment (CLE)</td>
<td>teaching</td>
<td>A collection of tools in an integrated framework, for communicating and sharing information within a subject or course. Installation of Sakai 2.4 (CLE)</td>
</tr>
<tr>
<td>Interact2</td>
<td>SakaiOAE. Open Academic Environment</td>
<td>teaching</td>
<td>A contemporary online academic environment with powerful capabilities for content authoring, sharing, and reuse</td>
</tr>
<tr>
<td>Institutional repository</td>
<td>Uniline</td>
<td>administrative</td>
<td>For official recording and storage of research papers, theses and publications</td>
</tr>
<tr>
<td>Mobile learning</td>
<td></td>
<td></td>
<td>A project based initiative exploring and introducing a variety of devices and aspects of delivering mobile learning experiences</td>
</tr>
<tr>
<td>MSI</td>
<td>Mandatory subject information</td>
<td>teaching/administrative</td>
<td>For developing online subject outlines with required subject/course</td>
</tr>
<tr>
<td>System</td>
<td>System full name</td>
<td>Teaching or administrative use</td>
<td>Function</td>
</tr>
<tr>
<td>-------------</td>
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<td>--------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>my.CSU</td>
<td>administrative</td>
<td></td>
<td>An integrated homepage for access to university services</td>
</tr>
<tr>
<td>OASIS</td>
<td>Online assessment submission</td>
<td>teaching</td>
<td>In-house developed multiple choice quiz tool</td>
</tr>
<tr>
<td></td>
<td>information system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OES</td>
<td>Online Evaluation system</td>
<td>teaching/administrative</td>
<td>In-house developed subject specific student evaluation survey tool</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online</td>
<td>Wimba. Online conferencing software</td>
<td>Teaching/</td>
<td></td>
</tr>
<tr>
<td>Meeting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OSAM</td>
<td>Online subject Assignment</td>
<td>Administrative</td>
<td>For administering and marking assignments online</td>
</tr>
<tr>
<td></td>
<td>Submission System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New SES</td>
<td>New Subject Evaluation Survey</td>
<td>Teaching/administrative</td>
<td>In-house developed tool for subject specific student evaluation surveys</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMPF</td>
<td>Subject Materials Preparation</td>
<td>Administrative</td>
<td>For capturing requirements to initiate the subject development production process</td>
</tr>
<tr>
<td>forms</td>
<td>Form</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOMS</td>
<td>Subject Outline Management System</td>
<td>Teaching/administrative</td>
<td>In-house developed tool for publishing subject outlines online</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Centre</td>
<td></td>
<td>Teaching</td>
<td>Online quiz tool (Sakai)</td>
</tr>
</tbody>
</table>
### Table A 8.4. Transformation at an Institutional Level: Creative Destruction Phase.

<table>
<thead>
<tr>
<th>Faculties/Schools</th>
<th>Learning &amp; Teaching Support</th>
<th>Information Technology Support*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006 University-wide faculties restructure</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2007 First round strategic voluntary separations in faculties</td>
<td>Staff seconded to OLE Program to implement Interact</td>
<td>Working in multi-stakeholder teams on OLE program</td>
</tr>
<tr>
<td>2008 All DE and internal subjects move to the new CSU Interact; Faculty of [X] embraces Interact to support whole of faculty team approach to cross-campus courses; further isolated faculty restructures</td>
<td>Staff seconded to OLE Program to implement Interact; EDs undergo intense professional development</td>
<td>Interact implementation creates high demand on IT Service Desk; responsibility shared with specialist EDs</td>
</tr>
<tr>
<td>Faculties/Schools</td>
<td>Learning &amp; Teaching Support</td>
<td>Information Technology Support*</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>2009</td>
<td>Introduction of new Subject Outline tool across university causes major change &amp; disruption to processes; new Faculty team model of ED support; increased casusalisation of academic staff in all faculties</td>
<td>New divisional structure gives EDs more responsibility for educational technology support; Introduction of new Subject Outline tool across university causes major change &amp; disruption to processes</td>
</tr>
<tr>
<td>2010</td>
<td>Increased casusalisation of staff</td>
<td>Change in educational technologist support; EDs with specialist skills</td>
</tr>
</tbody>
</table>

* The data presented for Information Technology support was limited to that available through the researcher’s involvement in inter-divisional initiatives.
Table A 8.5. *Transformation at an Institutional level: Reorganisation Phase - Innovation and Renewal.*

<table>
<thead>
<tr>
<th>Faculties</th>
<th>Learning &amp; Teaching Support</th>
<th>Information Technology Support*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>Interact pilots run in each school allow staff to try new ways of teaching; some schools use pilot extensively for teaching; others more conservative to start; new faculties and schools settling</td>
<td>EDs initiate pilots in schools; upskill in using new technology; support staff in preparing to use Interact in teaching; change of roles, change of school processes, trying new processes in schools; Flexible learning &amp; Interact Team formed to oversee ED related aspects of Interact implementation</td>
</tr>
<tr>
<td>2008</td>
<td>Flexible Learning Institute established; mid-year interim (qualitative) report by EDs on school usage of <em>Interact</em> indicates mixed use ranging from minimal &amp; basic use of standard <em>Interact</em> tools to innovative use of wide variety of tools (chat, wiki etc.);</td>
<td>EDs work with academics to look at alternative ways of teaching, resource provision in new online learning environment; Flexible Learning &amp; Interact Team active</td>
</tr>
</tbody>
</table>
Faculties

Learning & Teaching Support

Information Technology Support*

CSUED 2008
Conference presentations demonstrate a wealth of uses of *Interact* & other technology; presentations confirm the varied levels of technology adoption & use.

2009 Regular ICT-enabled CoP forums demonstrate & encourage sharing practice & examples of innovation & renewal in L&T; course mapping service trialled & makes use of new online subject outline tool; pilots of & release of single tools e.g.

Trialling mainstream production of *Interact* based learning resources; new faculty ED team structure; new collaborations

Interact - Service Desk responsibility moves to LTS specialist; IT programmers build new subject outline tool

2010 Regular ICT-enabled CoP forums demonstrate & encourage examples of innovation & renewal in L&T; course mapping service trialled & makes use of new online subject outline tool; pilots of & release of single tools e.g.

EDs continue to try new *Interact* tools and support academic staff; EDs take on new Areas of Professional focus in technology

Ongoing rollout of new *Interact* tools, Sakai 3 development; CSU leading contributor to Sakai 3 community project; LTS full custodians of the OLE. Service level agreements
<table>
<thead>
<tr>
<th>Faculties</th>
<th>Learning &amp; Teaching Support</th>
<th>Information Technology Support*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gradebook, online meeting tool (Wimba); DOMS (Equella); podcasting tool in Interact; Course mapping using technology</td>
<td>with DIT</td>
<td></td>
</tr>
</tbody>
</table>
Table A 8.6.  *Transformation at an Institutional Level: Rapid Growth Phase.*

<table>
<thead>
<tr>
<th>Year</th>
<th>Faculties/Schools</th>
<th>Learning &amp; Teaching support</th>
<th>Information technology support*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>Start of cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>Use of <em>Interact</em> in all DE subjects; rapid uptake of core <em>Interact</em> tools</td>
<td>EDs working with academics to look at alternative ways of teaching, resource provision in new online learning environment</td>
<td>IT Programmers mastering Sakai coding</td>
</tr>
<tr>
<td>2009</td>
<td>Fac. of Education seconds ED &amp; staff for developing online courses; increased use of <em>Interact</em> in internal subjects; Flexible Learning Institute growth; FLI fellow scheme established; - some faculties offer innovation project funding</td>
<td>EDs seconded for specific projects revising full courses for schools in Education; (Flexible Learning &amp; Interact Team disbanded) educational technologists and some with specialist expertise support Interact development; new ICT-Enabled learning committee</td>
<td>IT programmers contributing to Sakai community; dedicated Service desk help for Interact</td>
</tr>
<tr>
<td>2010</td>
<td>EDs employed for specific projects revising full courses for online Faculties of Education, Arts &amp; Science; more stability in processes in some</td>
<td>EDs employed for specific projects revising full courses for online delivery; Increased demand for mainstreaming production of Interact</td>
<td>IT programmers contributing to Sakai community</td>
</tr>
<tr>
<td>Faculties/Schools</td>
<td>Learning &amp; Teaching support</td>
<td>Information technology support*</td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------</td>
<td>--------------------------------</td>
<td></td>
</tr>
<tr>
<td>schools in using the</td>
<td>based learning resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>new subject outline tool</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table A 8.7. Transformation at an Institutional Level- Institutionalisation Phase.**

<table>
<thead>
<tr>
<th>Faculties/Schools</th>
<th>Learning &amp; Teaching support</th>
<th>Information technology support*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>Increased use of existing OLE tools</td>
<td>IT support for educational technology on a project base (Project Service Centre)</td>
</tr>
<tr>
<td></td>
<td>Learning &amp; teaching support unit; learning materials production support unit; centralised production of online learning resources on request, study guides, all subject outlines (LMC)</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>University-wide implementation programme around <em>Interact</em> with PD etc.</td>
<td>IT support for educational technology on a project base (Project Service Centre)</td>
</tr>
<tr>
<td></td>
<td>Centralised production of online learning resources on request - study guides, all subject outlines</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>All DE and internal subjects move to the new <em>Interact</em></td>
<td>IT Services maintain existing OLE</td>
</tr>
<tr>
<td></td>
<td>EDs provide widespread professional development and assistance with <em>Interact</em></td>
<td></td>
</tr>
<tr>
<td>Faculties/Schools</td>
<td>Learning &amp; Teaching support</td>
<td>Information technology support*</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td><strong>2009</strong> Increasing use of Interact, DE &amp; internal &amp; blended learning; timesaving and reuse of learning resources</td>
<td>Div. of Learning &amp; Teaching Services formed; minimal centralised Production of online resources, professional development programmes established, EDs provide at-your-desk help</td>
<td>OLE Program ends. Ongoing support of OLE, Well developed connections with Sakai community</td>
</tr>
<tr>
<td><strong>2010</strong> Flexible Learning Institute &amp; FLI Fellows scheme</td>
<td>Production Services offered to support online subject outline development on a needs basis</td>
<td>LTS become full custodians of the OLE; Service level agreements with DIT; new Educational technology framework; dedicated <em>Interact</em> Service desk</td>
</tr>
</tbody>
</table>
Appendix 9  Data Supporting the Heuristic of Resilience

Data supporting resilience, demonstrating changes in the function of the learning and teaching support system for educational technology system over time.

Table A 9.1. Changes in Normal Functions of the System.

<table>
<thead>
<tr>
<th>Function of the system</th>
<th>2007</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course and subject design and</td>
<td>Available educational technology integrated at subject level on an</td>
<td>Ad hoc integration of available technology into subjects; more planning</td>
</tr>
<tr>
<td>development</td>
<td>ad hoc basis; minority of EDS specialist in educational technology</td>
<td>evident in design of subjects; beginnings of establishment of mapping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>technology across a course; all EDs working at a base level advisory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>capacity on Interact &amp; new technology; Flexible Learning Inst. supports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>course approaches through Blended Learning Symposums, course directors getting established</td>
</tr>
<tr>
<td>Consult around designing</td>
<td>Subject (unit) focused; print focus; technology use limited to</td>
<td>Course focus developing; new OLE well embedded in learning design; design</td>
</tr>
<tr>
<td>learning experiences and</td>
<td>available tools</td>
<td>for blended learning environments emerging</td>
</tr>
<tr>
<td>environments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>School based EDs</td>
<td>Improved connections;</td>
</tr>
<tr>
<td>Function of the system</td>
<td>2007</td>
<td>2010</td>
</tr>
<tr>
<td>------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>primary conduits between faculty &amp; LMC/CELT; LML coordinators broker the connections with LMC digital media production</td>
<td>faculty team approach; MDC role bridges the gap to LTS Production; educational technologists (2009) broker the connections with DLTS digital media production</td>
<td></td>
</tr>
<tr>
<td>Staff support (educational technology)</td>
<td>EDs advise on online Forums (mandatory use), Chat, OASIS, Flexible publishing, IVT - use of Learning Media Lab coordinators for specialist technology advice &amp; development</td>
<td>Wider range of technology in use; full LMS capability; specialist knowledge more dispersed; all EDs advise on Interact &amp; core educational technology</td>
</tr>
<tr>
<td>Management/leadership educational technology</td>
<td>Manager Educational Design &amp; Educational Technology (CELT); 3 Learning Media Lab Coordinators; 2 Media Technologists (LMC)</td>
<td>Director Strategic Learning, Teaching &amp; Innovation; two Media Technologists (LMC); secondment of specialist EDs to Interact &amp; other educational technology work</td>
</tr>
<tr>
<td>Production and distribution/delivery of digital media learning resources</td>
<td>LMC Centralised production &amp; distribution for print; limited centralised production for online; LML and</td>
<td>Centralised production &amp; distribution for print; Media Development Unit with production level capacity for digital media;</td>
</tr>
<tr>
<td>Function of the system</td>
<td>2007</td>
<td>2010</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>Function of the system</td>
<td>LMC boutique style digital media and CDROM; self-publishing online limited to file sharing in Flexible Publishing - no LMS available</td>
<td>widespread self-publishing through Interact; increased personal creation of digital media (use of Captivate, podcasts); fully online subjects and courses</td>
</tr>
<tr>
<td>Professional development</td>
<td>PD in design for online &amp; digital media (mainly specialist EDs LMLCs); DIT provided training in Dreamweaver; use of VLE tools (OASIS, Flexible publishing, Forums); PD for EDs through LML coordinators - specialists</td>
<td>EDs provide PD for academics in use of wide range of technology (Interact and associated tools - ePortfolio, Captivate); design of fully online learning experiences; growing need for course level expertise</td>
</tr>
<tr>
<td>Project management and involvement</td>
<td>LMLC manages digital media projects with LMC; digital media team based approaches developing; project management skills</td>
<td>LTS media technologists manage learning resource projects; EDs involved in subject and course level projects</td>
</tr>
<tr>
<td>Specialist ed tech expertise - design</td>
<td>LML coordinator and a few EDS with specialist expertise; small number academics exploring and using technology outside</td>
<td>All academics exposed to LMS technology in Interact; small number academics exploring and using technology outside</td>
</tr>
<tr>
<td>Function of the system</td>
<td>2007</td>
<td>2010</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>CSU systems</td>
<td>CSU systems</td>
<td>CSU systems; educational LMS</td>
</tr>
<tr>
<td>Specialist ed tech expertise - software</td>
<td>LML coordinators and a few specialist EDs work in Interact project &amp; on ed technology projects; a few EDS with specialist expertise; small number academics exploring and using technology outside CSU systems</td>
<td>A few specialist EDs work in Interact &amp; ed technology projects; developing distributed specialist ed tech skills with introduction of APFs (areas of professional focus) ePortfolio, online assessment</td>
</tr>
<tr>
<td>Educational technology change management</td>
<td>Interact implementation was the first major new educational technology project with full institutional change management support; new role for EDs - EDs have a leading role in Interact rollout in schools</td>
<td>ED role in change management extends to moving full courses online; accelerated familiarisation with new software</td>
</tr>
<tr>
<td>Research</td>
<td>Some EDs involved in research projects with academics; LMLCs investigate new technology</td>
<td>Increased focus on evidence-based practice; EDs source and promote good practice in use of educational technology e.g. ICT Integration site, Learning Design Showcase; Media</td>
</tr>
<tr>
<td>Function of the system</td>
<td>2007</td>
<td>2010</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Educational technology</td>
<td>DIT controls IT; no separate educational technology resourcing;</td>
<td>LTS SLTI has responsibility for educational technology implementation;</td>
</tr>
<tr>
<td>implementation</td>
<td>multi-stakeholder Interact project - under Project Service Centre;</td>
<td>university-wide user reference group informs educational technology developments; EDs part of project teams in APFs</td>
</tr>
<tr>
<td></td>
<td>LMLC &amp; specialist EDs involved; innovations supported under mainstream funding</td>
<td></td>
</tr>
</tbody>
</table>
Table A 9.2. *Changes observed in the Functions (roles) of People.*

<table>
<thead>
<tr>
<th>Function</th>
<th>People responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2007</td>
</tr>
<tr>
<td>Course and subject design &amp; development</td>
<td>Academics, course coordinators, educational designers,</td>
</tr>
<tr>
<td>Teaching</td>
<td>Academics</td>
</tr>
<tr>
<td>Consult around designing learning experiences and environments</td>
<td>Educational designers, Learning Media Laboratory Coordinators</td>
</tr>
<tr>
<td>Communication</td>
<td>All</td>
</tr>
<tr>
<td>Staff support (educational technology)</td>
<td>LMLC, some EDs, DIT (technical)</td>
</tr>
<tr>
<td>Student support</td>
<td>Academics, Study Skills tutors, IT Service Desk</td>
</tr>
<tr>
<td>Management/leadership educational technology</td>
<td>Manager Educational Design &amp; Educational Technology, LML Coordinators, IT Liaison officer, academic early adopters</td>
</tr>
<tr>
<td>Production and distribution/delivery of digital media learning resources</td>
<td>CELT - EDs, LMLC, LMC - Media Technologist, Media processing officers; academics (primarily</td>
</tr>
<tr>
<td>Function</td>
<td>People responsible</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>2007</td>
</tr>
<tr>
<td></td>
<td>2010</td>
</tr>
<tr>
<td>authoring not production)</td>
<td>All EDs, ed technologists, media technologists (limited), DIT (limited)</td>
</tr>
<tr>
<td>Professional development</td>
<td>LML coordinators, some EDs, DIT (limited)</td>
</tr>
<tr>
<td></td>
<td>All EDs, ed technologists, media technologists (limited), DIT (limited)</td>
</tr>
<tr>
<td>Project management and involvement</td>
<td>LML Coordinators, DIT, other stakeholders</td>
</tr>
<tr>
<td></td>
<td>Specialist EDs, SLTI team, other stakeholders</td>
</tr>
<tr>
<td>Specialist ed tech expertise - design</td>
<td>LML coordinators, some EDs</td>
</tr>
<tr>
<td></td>
<td>Educational technologists; specialist EDs</td>
</tr>
<tr>
<td>Specialist ed tech expertise - software</td>
<td>DIT, LML coordinators</td>
</tr>
<tr>
<td>development</td>
<td>Educational technologists; some specialist EDs</td>
</tr>
<tr>
<td>Educational technology change management</td>
<td>DIT, LML Coordinators, CELT Manager Ed Design &amp; Ed Technology</td>
</tr>
<tr>
<td></td>
<td>Director Strategic Learning, Teaching &amp; Innovation, SLTI Virtual team - programmers,</td>
</tr>
<tr>
<td></td>
<td>solutions coordinator etc., educational technologists, educational designers</td>
</tr>
<tr>
<td>Educational technology implementation</td>
<td>DIT, LML coordinators, CELT Manager Ed Design &amp; Ed Technology</td>
</tr>
<tr>
<td></td>
<td>Director Strategic Learning, Teaching &amp; Innovation, SLTI Virtual team - programmers,</td>
</tr>
<tr>
<td></td>
<td>solutions coordinator etc., educational technologists, educational designers</td>
</tr>
<tr>
<td></td>
<td>(change agents)</td>
</tr>
</tbody>
</table>
Table A 9.3. *Impact of the Availability of Interact on the Functions and Activities of Different Areas of the System.*

<table>
<thead>
<tr>
<th>Learning &amp; Teaching Support Services</th>
<th>Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upskilling of EDs in: use of new technology; designing online learning experiences; becoming change agents in the implementation of technological (and other) University learning and teaching initiatives; providing professional development in use of educational technology &amp; designing learning experiences using technology; project management</td>
<td>Upskilling of academics in use of new technology; designing online learning experiences; collegial support in use of educational technology &amp; designing learning experiences using technology</td>
</tr>
<tr>
<td>Change in workload: Increase in PD role; increased requirement for personal learning and familiarity in an increasing number of technologies; more hands-on support work with online technology (Modules, subject outline etc.)</td>
<td>Change in workload: more interaction required online – DE and internal students; Rewriting print-based subjects for online delivery; more personal responsibility for provision of learning resources to students (fewer controls, but less reminders)</td>
</tr>
<tr>
<td>Changes in operational processes: Centralised production of online resources to DIY model in use of <em>Interact</em>; move to digital media project model; decrease in print-based DE learning resources; decrease in Production</td>
<td>Changes in operational processes: adjustment to changing support processes in LMC/CELT/LTS; more independence in working in the online environment, less dependence on support services.</td>
</tr>
<tr>
<td>Learning &amp; Teaching Support Services</td>
<td>Schools</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Change in modes of teaching and working: requirement for new forms of learning and teaching support for schools precipitated the formation of new DLTS: Faculty team based model of educational design support; formation of SLTI to support educational technology and L&amp;T innovation</td>
<td>Change in modes of teaching and working: availability of <em>Interact</em> provided new ways of delivering cross-campus courses/online subjects; increased uptake of team based models of course and subject design</td>
</tr>
</tbody>
</table>
Appendix 10  The Bridge Support Framework

The Bridge Support Framework as applied to *Good Practice in Online Assessment Workshops* for Division of Learning and Teaching Services, 2010.

![Figure A 10.1. The Bridge Support Framework.](image)

*Figure A 10.1. The Bridge Support Framework.*
Table A 10.1. *Pillars of the Bridge Support Framework.*

<table>
<thead>
<tr>
<th>Pillar</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pedagogy – learning design and research</td>
<td>Use and design of technology grounded in pedagogy and research</td>
</tr>
<tr>
<td>2. Communication</td>
<td>Communication between support units, staff-student communication connects and informs other Bridge components</td>
</tr>
<tr>
<td>3. Policy and guidelines</td>
<td>Administrative and institutional support. Development of policy and guidelines</td>
</tr>
<tr>
<td>4. Evaluation</td>
<td>Learning outcome and technology affordances, cost/benefit analysis (feed into improvements in all systems)</td>
</tr>
<tr>
<td>5. IT support for end users: staff and students</td>
<td>i. Training/professional development ii. Troubleshooting – Help Desk oriented iii. Self-help resources</td>
</tr>
<tr>
<td>6. Software</td>
<td>Reliable, user friendly, flexible and adaptable to institutional needs, needs balanced by institutional resourcing and costs</td>
</tr>
<tr>
<td>7. IT Infrastructure</td>
<td>Reliable servers and networks capable of supporting the projected use and loading of the system</td>
</tr>
<tr>
<td>8. Budget resources</td>
<td>Operates at a number of levels: organisational, divisional, faculty, school and individual</td>
</tr>
</tbody>
</table>