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ANALYSIS OF THE E-LEARNING INNOVATION PROCESS IN HIGHER EDUCATION

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ABSTRACT

E-Learning perhaps is the exciting topic related to higher education in the current decade. Large numbers of researchers devote their enthusiasm to this area. The early days of E-Learning were product-driven, and the dialogue about E-Learning took place primarily among vendors who were heavily funded by investment capital. Most of the E-Learning vendors promoted their technology, but less attention was paid to the issues surrounding implementation or to the usage of E-Learning by the end users. However, the behaviour of end users or of the organizations which had introduced E-Learning should be the main concern of an innovation in the management process. Included in an entire E-Learning development strategy should be a detailed analysis and action plan to obtain a comprehensive overview of three aspects of innovation processes: organizational, technological, and products/services. A successful E-Learning launch should also pay close consideration to all of the interactions during the triple innovation process, a proposal which will be addressed in this research.

Given the multiple objectives of investigating the processes of E-Learning innovation, the interaction between different aspects of innovation and the issues which influence those processes, a qualitative case study approach is appropriate for establishing empirical evidence and describing the phenomenon of the E-Learning innovation process in higher education. The fieldwork started in March 2004 and finished in August 2008. It comprised one pilot study at National Chung Cheng University Taiwan, and the main research context at the University of Nottingham. The data collected were used to analyse and conceptualise the E-Learning innovation process with three sub-processes, outlined in detail in a following subsection: research methodology and design.

This research contributes to the understanding of E-Learning innovation processes by providing triple aspects of organizational, technological and service innovation

individually, and maps the E-Learning innovation processes in its different aspects. The relationships and interactions in the E-Learning innovation process within organizational, technological and service innovation are conceptualized in order to explain their complexity, and they also summarized the main interaction categories for different interactions. The series of detailed analyses indicates that organizational, technological and service innovations are inseparable and show a strong link with one another. Moreover, a framework of simplified triple E-Learning innovation with triple interactions is proposed.

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CHAPTER 1 INTRODUCTION

This chapter provides an overview of the research problem and process. A brief introduction is provided to the current E-Learning environment, in which the empirical work has been carried out. This is followed by an overview of the case studies which have been analyzed from the perspective of innovation. Several key findings have been generated by the researcher, based on the data collected from a leading university in the UK with three representative schools.

1.1 Research Problem

Numerous researchers have devoted their enthusiasm to the area of E-Learning which also provided traditional universities with an opportunity to meet the changing worldwide demand for education. While competition has always been an issue for universities, historically the focus was national rather than international. Over the last decade and through the development of distance education, i.e. distance course delivery and new interactive learning methods, competition between institutions of higher education has become 'internationalised'. Some higher education institutions are able to export themselves and, as a result, intense competition has extended beyond national boundaries. Institutions which are actively seeking new markets and are able to utilize technological advantages to structure themselves to deliver programmes anywhere in the world are ideally placed to see their activities expand on a world-wide basis. However, the higher education institutions stressed the ultimate dangers by jumping on the E-Learning bandwagon too soon without giving

it crucial consideration. In other words, they felt that a high quality E-Learning solution might increase their reputation. The early days of E-Learning were product-driven, and the dialogue about E-Learning took place primarily among vendors who were heavily funded by investment capital during the dot-com boom. Most of the E-Learning vendors promoted their technology, but less attention was paid to the issues surrounding implementation or to the usage of E-Learning by the end users.

E-Learning should be perceived not merely as a process (learning/knowing) or simply an artefact/product (learning content/knowledge). Rather, it should be a combination and balance of both (Mentzas et al., 2001). From this perspective, any technology that is employed for E-Learning purposes must have the capacity to support all learning processes, as well as to promote different approaches to develop and deliver different learning contents. Adapting E-Learning will affect the adopting organization, not only in its structure, but also in its practices and business process. These changes cannot be addressed in isolation. Rather, it is necessary to take into account other organizational issues, such as organizational policies, to ensure their success and effectiveness (Alshara and Alsharo, 2007). Fundamentally, E-Learning is more than merely changes in the approaches to teaching preparation and teaching delivery (Jebeile and Reeve, 2003).

According to Gupta, Tesluk and Taylor (2007), all innovations are basically socially constructed phenomena that involve actors, e.g. individuals and potentially teams,

and the broader environment of which the actors are a part. However, the complexity of E-Learning development, compared to some of the Information Systems (IS), lies in the need to introduce multi-level changes, including the organizational context and the services that it provides. In other words, the innovation of E-Learning involves three aspects of innovation: organizational, technological and service. Despite its underlying complexity, up to now most research on innovation only focuses on one single aspect of analysis. As pointed out by Gupta et al. (2007), it is relatively rare to find research that looks at different levels in conjunction. This research therefore combines three aspects of innovation to ensure a more comprehensive investigation of E-Learning development. Based on the above points, the proposed research questions are outlined as follows:

What are the underlying processes of E-Learning development in the context of a higher education institution from the aspects of:

- Organizational innovation
- Technological innovation
- Service innovation

How do **these key innovation processes interact?**

1.2 Research Methodology and Design

Empirical evidence is necessary in order to answer the above research questions, and to achieve the research objective of building emerging theories (Eisenhardt, 1989; Orlikowski, 1993; Langley, 1999) that are able to depict the phenomenon of

E-Learning innovation process and interaction. Based on the seminal work of Glaser and Strauss (1967), Miles and Huberman (1984), Eisenhardt's (1989) generative account of using case studies for theory building provides a useful guideline for shaping the research design. The case study research design adopted in this thesis is based on the rationale of flexibility in using multiple data collection methods, as well as the ability to articulate insightful stories embedded within the chosen social context (Van Maanen, 1979). The development of the case study protocol helped not only to clarify the necessary procedures, but also to enhance the reliability of the study (Stake, 1995; Yin, 2003b). A pilot case study conducted at National Chung Cheng University enabled the researcher to acquire first-hand research experience, to improve the research design and to provide an excellent example of how to develop a relationship of mutual trust with the research subjects.

Based on the concept of theoretical sampling (Glaser and Strauss, 1967; Eisenhardt, 1989; Eisenhardt and Graebner, 2007), the University of Nottingham and three schools were selected. Such selection also helped to accommodate both theoretical similarities and differences (Orlikowski, 1993). Despite the fact that the information and data appeared to be complex and numerous, valuable lessons were gained and are illustrated in Chapter 3. The three cases studies finally conducted were in the School of Mathematics, School of Geography, and School of Education. The data collected through the interviews, on-site observation and documentation were analysed systematically based on the strategies of narrative, visual-mapping and pattern-matching (Campbell, 1975; Campbell, 1966; Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Langley, 1999), as well as the technique of event-listing displays, proposed by Miles and Huberman (1994).

1.3 Research Output

The research has resulted in three distinct outputs:

- The E-Learning development process with triple innovation aspects: organizational, technological and service innovation processes.

- The key interactions and dynamics between organizational, technological and services innovations which are divided into four aspects.

- The framework of the triple E-Learning innovation process within triple dimensions.

1.4 Structure of the Thesis

The remainder of this thesis is structured as follows. Chapter 2 ("Literature Review") highlights the current debates and perspectives related to the areas of E-Learning development, three types of innovation and interaction within different innovations. Additionally, the issues that are essential to the inquiry into the E-Learning innovation process are examined. Two research questions derived from the examination of the current literature are investigated. Chapter 3 ("Research Methodology") outlines the methodological concerns related to this study. Issues including the philosophical stance, research orientation, design, objectives, data collection methods, techniques for data analysis are also elaborated as a means of answering the proposed research questions. Chapter 4 ("Research Context") presents the case study which was undertaken by the researcher at the University of

Nottingham, involving stories relating to the three aspects of E-Learning development at the University of Nottingham: organizational, technological and tool project development. Chapter 5 ("School Case Study") details stories of how E-Learning development was planned, designed and implemented with three innovation aspects within the three schools. Insights relating to various stages of the programme are presented. Chapter 6 ("Data Analysis") provides a detailed analysis on three aspects of E-Learning innovation processes in each case and highlights a case of triple interaction. Chapter 7 ("Comparative Analysis and Discussions") elaborates the research findings based on the analysis of empirical data collected from the three research sites, and the proposed research framework also introduced at the end of Chapter 7. Finally, Chapter 8 ("Conclusions") concludes the thesis by reflecting on all preceding chapters, addressing contributions and implications, as well as elaborating on the research limitations and future research directions.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

With the growth of Internet usage, E-Learning has become a vital tool for frontiers in the education sector (Rungtusanatham et al., 2004). E-Learning enables changes in the way in which information and educational contents are delivered. Through Internet technologies, accessing educational materials at any time and in virtually any place has become both feasible and economical (Katchen, 2008). For traditional universities, a move towards E-Learning requires a fundamental change in a number of aspects of the institution (Kayte O'neill et al., 2004; Doppler et al., 2002). Many studies have proposed that E-Learning implementation is a process of innovation (Lin et al., 2008; Hardaker and Smith, 2000; Wild et al., 2002). The perception of E-Learning as an innovation, particularly a technological innovation, is reflected in the large amount of research in the area of learning platform technology development (Hsui-Ping and Shihkuan, 2008; Garro et al., 2006; Payr, 2005). It is clear from the three areas of literature that E-Learning development includes not only technological advancement, but also organizational, and service innovation. Nevertheless, the interplay amongst these three areas, particularly how they impact on one another in the context of E-Learning development, remains an under-researched area. It seems clear that one of the key factors in understanding the process of E-Learning development lies in insights into the interaction within these three aspects. This chapter concludes by identifying gaps in the body of literature which has led to the formulation of the research objectives and research questions for this thesis.

2.1.1 Definitions

To begin with, it is important to define some key terms that will feature in the subsequent discussion and analysis. The term E-Learning is often used generically; even its definition changes accompanying its development (as shown in Table 2.1). A more precise E-Learning definition depends on the focus of E-Learning features. The research is interested in the management aspect of E-Learning. The preliminary definition adopted for E-Learning in this research is: "*A complete software, hardware, and network system using Internet technologies to deliver a broad array of solutions that enhance knowledge and performance*" (p26) (Paulsen, 2003; Rosenberg, 2001). Most current research on E-Learning in a higher education context adopted "Learning Management System" (LMS) for the E-Learning definition in their research (Samarawickrema and Stacey, 2007; Ho et al., 2009; Rossiter, 2007; Shurville and Brown, 2006). E-learning will be redefined later in the thesis following the case study work and model development.

Secondly, building upon the work of Oerlemans et al (1998) and the previous definition of organisational innovation, this study defines organisational innovation as "*the adoption of an idea or behaviour that is new to the organization*". Freeman (1989) defined technological innovation as "*an iterative process initiated by the perception of a new market and/or new service opportunity for a technology based invention which leads to development, production, and marketing tasks striving for the commercial success of the invention*" (p794). Furthermore, service innovations are defined as "*innovations in processes and innovations in organization for existing service products*" (p8) by Gadrey et al. (1995).

2.1.2 Objectives and Scope of the Literature Review

This literature review has three interrelated objectives. Firstly, it seeks to review the chosen literature critically and sympathetically in order to outline the current debates and perspectives in the chosen areas of investigation. This leads directly to the second objective, which is to identify the major theoretical gaps that need to be filled. Following on from this, the third objective is to formulate researchable questions and an appropriate data collection strategy that address the need for further theoretical development.

The three main bodies of literature reviewed in this study are those concerning E-Learning development - three aspects of innovation and their interactions. In addition, various theories and ideas rooted in the study of innovation processes are also examined. In the field of E-Learning, considerable attention has already been paid to the implication and development process of E-Learning (Govindasamy, 2001). The literature on E-Learning development examines three vital and distinctive yet interrelated aspects of innovation - organizational, technological and service innovation. The different definitions of these three levels of innovation attribute specific characterizations and processes to all of them. The above rationale serves as the basis for structuring the main body of this chapter.

2.2 E-Learning

2.2.1 Introduction

E-Learning is capturing a large proportion of learning activities both among academics and within industry. According to a report by Global Industry Analysts Inc. entitled "E-Learning: A Global Strategic Business Report," the forecast of the demand for E-Learning worldwide is expected to exceed $52.6 billion by 2010 (2007). By 2006, nearly 3.5 million students were participating in on-line learning at institutions of higher education in the United States (Oblinger and Hawkins, 2005).

While the application of Information and Communication Technologies (ICTs) has become firmly embedded in the contemporary education sector, it has become substantially impossible to deliver or receive formal education without the application of such advanced technologies in the processes. In other words, there is no doubt that everyone in the digital world has a sense of E-Learning. However, the definitions of E-Learning also include a wide spectrum of activity such as online learning, virtual learning, distributed learning, networked or web-based learning, computer-based learning, and synchronous and asynchronous learning (Naidu, 2006). Nevertheless, E-Learning is a common term in the contemporary digital world, used inconsistently, revealing a varied and mysterious identity - Aristotle, the Greek philosopher, mused, "*If you would understand anything, observe its beginning and its development.*" The renowned professor of History, Kenneth Stampp, also stated, "*With the historian, it is an article of faith that knowledge of the past is a key to understanding the present*"(Harris, 2009). To illustrate the nature of E-Learning, it is

necessary to give an outline of its history, describing its origin and character, its mission, successes and failures, and its strengths and weaknesses, as a foundation for the further development.

An investigation of the history of E-Learning reveals that it is an evolutionary process involving educators and trainers in a variety of sectors, including business and military applications, to enhance teaching and learning (Charp, 1997; Molnar, 1997; Nicholson, 2007). In the higher education setting, E-Learning delivered knowledge and experience through formal and informal, synchronous and asynchronous learning channels, also demonstrating collaborative learning (Nicholson, 2007; Campbell et al., 2004). It was clear that E-Learning brought certain benefits (Rosenberg, 2001; Kruse, 2002) such as innovative ways of teaching and learning, reduced costs, wider audiences and also a paradigm shift for education (Nicholson, 2007).

2.2.2 Evolution of E-Learning

2.2.2.1 Origin

The earliest footprint of computer-assisted learning practices were found in business (Uttal, 1962), higher education (Porter, 1959; Holland, 1959; Bitzer et al., 1962; Suppes, 1964) and even in military training services (Fletcher and Rockway, 1986). Furthermore, Nicholson (2007) indicated that Suppes and Bitzer clearly positioned potential use of technology within a broader educational agenda (e.g.,Suppes, 1964; Suppes, 1966; Suppes, 1986; Bitzer et al., 1962).

Patrick Suppes - one of the most revered names in technology-assisted learning - gave this field his serious attention when computer interface capabilities first made computers usable by learners during the 1960s (Allen, 2008). He also foresaw the potential for the wider application of technology-enhanced learning in education and also argued that learning theories should inform course design and practice (Suppes, 1972; Suppes, 1971).

Programmed Logic for Automatic Teaching Operations, well-known as "Plato", one of the first computer-based teaching systems, was developed at the University of Illinois by Don Bitzer in the 1960s. Plato initially demonstrated computer-based education focused on literacy programmes (Bitzer et al., 1962; Bitzer and Skaperdas, 1968; Bitzer and Skaperdas, 1969). The system also represented the concept of online community with forums, chat rooms, instant messaging, and multiplayer games two decades before the World Wide Web was launched during the mid-1990s (Woolley, 1994). Plato became the direct predecessor of contemporary E-Learning platforms such as WebCT and Blackboard.

Comparing the work of these two eminent scholars on the application of computers in education, it can be seen that Suppes emphasised the importance of learner orientation and the use of computers as a powerful tool for the design of learning materials; he also recommended greater pedagogical consideration be given to developing richer learning theory, and suggested that technology would be a strong tool for this. His view was more focussed on delivering individualized instruction

and support (Suppes, 1966). However, Bitzer was more concerned with creating and developing a new technology to support learning.

2.2.2.2 The Changing Definition of E-Learning during Historical Phases

As previously stated there is always some uncertainty and debate about how to define the various methods of E-Learning: Computer Assisted Learning (CAL) (Barker and Yeates, 1985), technology-mediated learning (Alavi and Leidner, 2001b; Suppes, 1964; Suppes, 1966), online learning, Internet-based learning, computer-mediated communications (Romiszowski and Mason, 2004), web-based education (Mccormack and Jones, 1997; Alonso et al., 2005), and asynchronous learning networks (Spencer and Hiltz, 2003), to name a few. We can recognise that all the terms are related to educational usage with technological elements. The descriptions of those terms reflect the evolutionary history of computer technology. Rather than engage with an arguably necessary and endless debate about appropriate terms and their definition, this section illustrates an historical perspective based on macro-level features (Table 2.1)(Nicholson, 2007). In other words, it is argued that there is no fixed definition for E-Learning - descriptions will vary according to the time period to which they belong.

Era	Focus	Educational Characteristics
1975-1985	Programming; Drill and practice; Computer-assisted learning –CAL.	Behaviourist approaches to learning and instruction; programming to build tools and solve problems; local user-computer interaction.
1983-1990	Computer-Based Training; Multimedia;	Use of older CAL models with interactive multimedia courseware; Passive learner models dominant; Constructivist influences begin to appear in educational software design and use.
1990-1995	Web-based Training	Internet-based content delivery; Active learner models developed; Constructivist perspectives common; Limited end-user interactions.
1995-onward	E-Learning	Internet-based flexible courseware deliver; increased interactivity; online multimedia courseware; Distributed constructivist and cognitive models common; Remote user-user interactions.

Table 2.1 The Changing Focus of Educational Technology Over the Past 30 Years (Nicholson, 2007)

The rapid development of learning technologies has tended to locate the technology as the driver of change in learning, rather than in the ways in which it is used (Goodyear et al., 2004). As outlined above, the changes over the past two decades have been rapid, in both the range of software platforms available to support learning and teaching - for example, high level Learning Management Systems (LMS) (Joyes and Frize, 2005) - and the hardware on which they run, with the enhanced capacity in memory to support data storage, increased speed of microchips to enable

acceptable processing response times, and the necessary increased bandwidth to facilitate data transfer and speed of communication (Burns, 2007). WebCT and Blackboard owned by Blackboard Inc.[1] are two popular Learning Management Systems. They are used every day by more than ten million students at over 2,500 universities and colleges in eighty countries (Columbia, 2004). There are also some similar open-source softwares, such as ILIAS[2], Moodle[3], and Sakai[4]. They offer open architecture for customization of course materials and course management, and allow for integration with student Information Systems and authentication protocols. The platform can be installed locally or hosted by Blackboard ASP Solutions (Greasley et al., 2004).

Following the popularization and maturity of E-Learning platforms, there are many E-Learning application tools developed to manage information and to communicate (Ruiz et al., 2006). The communication technologies are generally categorized as asynchronous and synchronous technology e.g. web boards (Upton, 2006), email (Nikos Mattheos et al., 2001), and other forms of communication (Spinello and Fischbach, 2004). Blogs and wikis emerged rapidly as a popular application and have been widely adopted for use in higher education during the past three years (Lin et al., 2006). The rise in popularity of blogs and wikis is probably attributable to their scope for interactivity, especially the creation of opportunities to engage actively in communication between the person who launched the site and

[1] www.blackboard.com

[2] http://www.ilias.de/

[3] http://moodle.org/

[4] http://sakaiproject.org

other users (Sandars, 2007). In addition, Podcasts have become one of the major emergent technological trends and has been chosen by many institutes of higher education (Koo and Sandars, 2008). A Podcast is a delivery mechanism to store audio/video on a portable player. Organizations can produce and provide audio and video broadcasts (infotainment) that can be downloaded and played on a portable player ("iPod") (Kerstetter, 2009).

The E-Learning platforms and application tools work on different levels, such as WebCT, which is one of the institutional administration systems (Britain and Liber, 2004); and the E-Learning tools (e.g. blogs or Podcast) which are applied in response to the personal demands of staff (Lin et al., 2006); meanwhile, the acceptance of E-Learning application tools varies according to the interests of students and staff. For example, in the "top 100 Tools for Learning 2009" (Hart, 2009; the most important is 1) voted by 278 learning professionals, Podcast is ranked 41st; in a survey on the use of Podcast in undergraduate healthcare education, conducted by Brittain et al. (2006), Podcast were used mainly by students to review lecture material, although more than one-third of the students downloaded Podcast infrequently. However, more recent studies draw attention to the soaring popularity of podcasting (Grailey, 2009) which has changed the way in which students and educators interact in the classroom and in cyberspace (Tavales and Skevoulis, 2006). In addition, podcasting provided the bottom-up approach in which the media content is localized and defined by a known two-way relationship (instructor to learners, learners to learners, learners to instructor) (Shim et al., 2007; Peng et al., 2004).

2.2.3 Stakeholders of E-Learning in Higher Education

In an organizational context, a stakeholder is a constituency of an organization (Thompson et al., 2006). In the same sense, the stakeholders of E-Learning are those that are affected by it (Wagner, 2008). As summarized by Henry et al. (1991) and Wagner (2008), the main stakeholder groups in the context of higher education for E-Learning development can be divided into internal and external stakeholders. Each of these stakeholder groups is described in the following sections, along with their roles in E-Learning development.

2.2.3.1 Internal Stakeholders

The main internal stakeholders for E-Learning in higher education institutes are the instructors, students and employees (Wagner, 2008). In the E-Learning project development process such as that described by Khan (2004), these are: the research and design (R&D) coordinator, the subject matter experts (instructors), and the administrative staff and students. From the perspective of E-Learning strategy, the stakeholders are the people involved in strategic decision-making, including top management, team leaders and E-Learning group members (Stoltenkamp et al., 2007). In order to simplify the internal stakeholder group, this research summarizes it into five types: top management, instructors, coordinators, students, and other related members of staff.

- **Top Management**

Academic staff usually view "the university" as comprising the senior management, the Senate and central administration (which is expected to align its efforts with organizational mission and vision), and national and organizational strategies and policies. The leadership of "the university", together with its support and willingness to provide funding, is recognized as the main critical factors (Mcpherson and Nunes, 2006).

The executive and management of the University identify, for example, elements of the teaching and learning environment that focus on quality and E-Learning from the perspective of enhancing the institution's current educational practice and profile (Rossiter, 2007). The organizational management policy influences those responsible for academic and educational settings through the introduction of administrative procedures and the availability of resources, which impact on realistic pedagogical models; and which in turn affect the design of E-Learning (Mcpherson and Nunes, 2006). Teachers may emphasize pedagogy and the quality of learning as the crux of E-Learning standards, whereas administrators and policymakers may focus on efficiency and processes as a measure of quality, within the contemporary climate of scarce resources and popularization of the higher education system (Cleary et al., 2006). The role of directors is to direct E-Learning initiatives and to develop plans and strategies for E-Learning; while project managers take responsibility for supervising the overall E-Learning processes such as design, production, delivery, evaluation, budgeting, staffing, and scheduling, working with coordinators of E-Learning teams (Khan, 2004).

E-Learning development is a particularly difficult process that requires strong and supportive leadership. The lack of experienced top management is one of the key reasons for the UKeU failure. Despite being wholly dependent on E-Learning knowledge, UKeU appointed few staff who could provide this level of expertise. The Select Committee notes that: "*UKeU did not have anyone with E-Learning expertise in a senior management position*"[5]. That was also true at middle management and lower levels(Bacsich, 2005).

- **Instructors**

Instructors guide the educational experiences of students in E-Learning, as in traditional classroom learning. Depending on the mode of E-Learning delivery, instructors may or may not have face-to-face interaction with their students (Lee et al., 2005). Instructors may be motivated to use E-Learning in their courses for a variety of reasons: for example, they may be encouraged or pressurized by their institutions; they may wish to reach a broader student audience; or they may have an interest in the benefits of technology-mediated learning (Wagner, 2008).

E-Learning technologies can significantly affect the role of instructors (Jones, 2003). The E-Learning environment differs from traditional teaching/learning, because instructors shift from being the primary source of students' knowledge to being the manager of resources (Romiszowski, 2004). E-Learning requires instructors to learn new software applications and E-Learning tools, especially in cases where instructors are also the creators of content. Studies have shown that the main challenges of technical support for E-Learning initiatives include the lack of technological

[5] http://www.publications.parliament.uk/pa/cm200405/cmselect/cmeduski/205/20506.htm

knowledge of how to alter instructional design so that it is effective, and the lack of confidence in using these applications to teach (Arabasz and Baker, 2003).

- **Coordinators**

The role of the coordinator is to suggest and supervise the learning plan, to validate content, tools and activities, to supervise the work of tutors and other coordinators, to view navigation and progress reports, and to reassign tutors and sub-coordinators (Uță, 2006). There are four main types of coordinator as outlined below:

Course Coordinator : coordinates the instructional and support staff for online courses (Khan, 2004) and is responsible for academic and administrative planning and implementation of all course activities, including computer-mediated activities (Guterman et al., 2009). The course coordinator may have to liaise with various departments within the institution, including registration, admissions and legal offices. It is important to note that the instructional staff for online courses may or may not be part of the E-Learning management team (Khan, 2004).

Research and Design Coordinator: assists the business developer in analyzing student data and also provides valuable research information about E-Learning on a regular basis. The R&D coordinator is responsible for reviewing course content for pedagogical soundness and the selection of the appropriate delivery medium (Khan, 2004).

Copyright Coordinator: provides advice on intellectual property issues relevant to E-Learning and is responsible for negotiating permission to use copyrighted material, including articles, books chapters, videos, music, animations, graphics and web pages from copyright holders (Guterman et al., 2009).

Technical Support Specialist: provides instructors and coordinators with both hardware- and software-related technical support and training (Wagner, 2008). As stated above, studies have drawn attention to the lack of technical expertise in altering instructional design to make E-Learning effective, and the lack of confidence of instructors in using these applications (Arabasz and Baker, 2003). E-Learning requires technical sophistication from both instructors and students (Jones and O'shea, 2004).

- **Students**

Students are the consumers of E-Learning (Wagner, 2008). They are the receivers of E-Learning products and service, and in the context of higher education, they are mainly undergraduate/ graduate students or staff enrolled at a university or college.

Compared with traditional education, E-Learning presents an entirely new learning environment to students without the constraints of geography or time (Wagner, 2008). Students are much more independent than in the traditional setting as E-Learning requires them be highly motivated and committed to learning, and to gain access to increasing volumes of information from a variety of sources (Huynh et

al., 2003). E-Learning also requires a certain level of technical sophistication, although this becomes less of an issue over time as computer literacy improves , especially among young people (Prensky, 2001). Studies have found that the perceptions of purpose and enjoyment are very important to students in adopting E-Learning applications (Lee et al., 2005). In order therefore to avoid the disappointment and tedium of mundane E-Learning applications, simulation or digital game-based learning is applied to increase student satisfaction (Zhang et al., 2006).

- **Other related members of staff**

Besides the stakeholders introduced above, there are others such as financial officers and librarians who are involved indirectly in E-Learning development. As stated in the previous section, financial support is a critical factor for E-Learning development (Vatnal et al., 2004): an organization that seeks to introduce an E-Learning system should secure adequate funding. The funding officers assist the financial arrangements for E-Learning projects and activities (Williams and Goldberg, 2005).

Libraries and librarians are very important to E-Learning. Library professionals need to understand the mechanics and concepts of E-Learning in order to provide effective distance library services which can store a large amount of information in various forms: text, audio, video and graphic material (Mclean and Sander, 2003).

2.2.3.2 External Stakeholders

- **Content Providers**

In the context of higher education, online course content may be created by instructors or acquired from external sources (Veal et al., 2004). The growth in E-Learning has created a market for commercialized educational content, particularly for introductory courses that are offered consistently at multiple institutions (Wagner, 2008).

Commercial content providers are motivated by profit to develop content modules which are flexible enough to be readily utilized across institutions with minimal adaptation efforts and which will result in effective learning. E-Learning content providers need to consider that learning is influenced by the type of content, the learning environment, and even the characteristics of each learner (Zhang et al., 2006). Content should be created in a format that will allow its utilization across various E-Learning technology platforms (Teo and Gay, 2006). Failure to do so would restrict their potential target market. It is equally important to make certain that the content provided is consistent with the learning methodologies in use at various institutions and thus more likely to result in successful learning (Greenagel, 2002).

- **Technology Providers**

Technology providers develop the technology that enables E-Learning delivery. This category consists of a broad range of services, ranging from the facilitation of individual distance learning courses, to complete Learning Management Systems provided by companies such as Blackboard (Paulson, 2002). It can be necessary to utilize, in addition to platforms, various tools in order to achieve competence in, for

example, WordPress[6], Wikipedia[7], ObjectSpot[8] and XoWiki[9] (Kieslinger et al., 2006). Technology providers are as motivated as content providers to provide learning environments that will result in effective learning for students.

Constant evolution in hardware and in consumer expectations creates pressure for technology providers to promote new product offerings (Huynh et al., 2003). It is argued that many products are not developed on proven educational principles and thus do not take into consideration the different ways in which people learn (Woodill, 2004).

- **Accreditation Bodies**

Accreditation bodies are organizations that assess the quality of offerings from educational institutions. However, the evaluation does not affect E-Learning in the institutes of higher education with the same magnitude as it affects stakeholders (Henry et al., 1991). Those institutions meeting the minimum requirements will be accredited, providing them a level of credibility that non-accredited institutions will not possess. As the proportion of education delivered by electronic means grows, it is increasingly important for accreditation bodies to encompass E-Learning in their standards. Neglecting to do so will limit the relevance of their accreditation since it will only be relevant to the traditional education component of offerings from educational institutions (Wagner, 2008).

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[6] www.wordpress.org

[7] www.wikipedia.org

[8] www.objectspot.org

[9] www.openacs.org/xowiki

2.2.4 Critical Success Factors in E-Learning

Critical success factors (CSFs) are viewed as those activities and constituents that must be addressed in order to ensure successful competitive performance for the individual, department, or organization; they should be few in number, measurable and controllable (Ngai et al., 2008).

Many research studies have summarized the CSFs for E-Learning in three dimensions: IT, instructor and student. For example, Volery and Lord (2000) identified three main CSFs in E-Learning: technology (ease of access and navigation, interface design, level of interaction); instructor (attitudes towards students, technical competence, classroom interaction); and previous use of technology by the students. Soong et al. (2001) concluded that the main CSFs of E-Learning are: human factors concerning the instructors (motivational skills, time and effort investment); technical competency of instructors and students; the constructivist mind set of instructors and students; a high level of collaboration; and a user-friendly and sufficiently supported technical infrastructure.

The efficient and effective use of IT in delivering E-Learning based components of a course is of critical importance to its success and to students' acceptance of E-Learning. Hence, ensuring that the university IT infrastructure is rich, reliable and capable of providing the courses with the necessary tools to make the delivery process as smooth as possible is critical to the success of E-Learning (Selim, 2007).

Communication tools are extremely important in an E-Learning environment. Asynchronous tools could be used for providing students with work in teams, rather than by trying to respond to each individual posting (Branon and Essex, 2001). On the other hand, synchronous communication tools could be used for meeting with smaller groups of students online (Salmeron, 2009).

The adoption of an LMS as a piece of enterprise architecture that operates as a "service" to host E-Learning courseware produced by (or for) the component elements of the organization (Huddlestone and Pike, 2008). The usability of Learning Management Systems can significantly affect learning (Debevc and Bele, 2008). The need for usability has been recognized as critical in web design and development literature when determining user satisfaction in such systems (Salmeron, 2009). Learning environments implemented in traditional HE settings require processes of change management which usually involve a complex technical component and require a systematic design and development methodology to translate those pedagogical models into the reality of practice (Mcpherson and Nunes, 2006).

Student perspective is important as many higher educational institutions endeavor to attract and retain students to adopt E-Learning courses or programs (Masrom et al., 2008). One central point is the students' attitude to IT. If they are comfortable with the LMS, their performance will be higher and online assignments could motivate students to progress further. Finally, multimedia has been included in LMSs in recent years (Salmeron, 2009) .

Academic acceptance has long been recognized as one of the fundamental CSFs for successful E-Learning. Participants proposed that this acceptance was dependent on guaranteeing good communication between educationalists and technologists, creating formalized processes for collaboration, cooperation and evaluation and connecting best practices both within the institution and from the experiences of other institutions (Mcpherson and Nunes, 2006).

Besides these three areas, E-Learning CSFs also include intellectual property, building the course, course content, course maintenance, instruction, measuring success, evaluating learning and student performance, technology, and research on previous use of technology(Masrom et al., 2008). Salmeron (2009) indicated the importance of content structure, usability, cost, and easy maintenance within the ten CSFs described in his study.

Content structure focuses on the structure of the learning materials, rather than classical system usability (Salmeron, 2009). LMS costs and maintenance are obviously an important factor for managers rather than for students, but they are critical in assessing the efforts associated with LMS use in the long term (Salmeron, 2009). There are two main costs to be considered: delivery factors, which include learning context and the characteristics of students and of instructional management (Lee and Owens, 2001); or learning context factors, i.e. part of the constraints that operate on the context of instructional delivery (Smith and Ragan, 2005).

University support is indicated as a CSF for E-Learning (Salmeron, 2009) and learning (Selim, 2007). For institutional support, the availability of technical

assistance or help desk was the most critical success factor (Selim, 2007). It is necessary for university administrators and faculties, when attempting to adopt E-Learning courses or programs, to be cognizant of technological and institutional support factors, based on student perspectives, that affect success in E-Learning. This study supports the view expressed by Masrom et al. (2008) that technological and institutional support factors play an important role in the usage of E-Learning. The transition from a traditional face-to-face learning process to one based on technology-enhanced environments poses serious challenges, and can lead to cognitive conflicts both with academic staff and with students. Consequently, participants have focused heavily on the need for training and support in the use of the e-leaning environments (Mcpherson and Nunes, 2006).

Strategy factors for effective E-Learning which take into account supporting technologies and generated learning resources, are identified and assessed to enhance its success (Sridharan et al., 2008; Testa and Freitas, 2004). Sridharan et al.(2008) stated the importance of strategy factors for identifying and evaluating the critical success factors based on the perceptions of key stakeholders in an E-Learning environment.

The management strategy is concerned with scheduling lessons, production and allocation of required resources, assessment handling, production of management information and evaluation of the effectiveness of the system (Huddlestone and Pike, 2008). A 'clear and defined project plan' was another factor that was commonly cited in all of the regions and countries (Ngai et al., 2008). The challenge for

managers is also greater as there are few experts in the subject. Wrong decisions may jeopardize the success of a program under development, and among the several choices that must be made while establishing a strategy, it is important to keep the focus on the critical success factors (Testa and Freitas, 2004).

Although a number of empirical and non-empirical studies have addressed a variety of CSFs for Information Systems implementation, a range of studies has produced different sets of factors. Hence there is no general agreement on which set of factors are the key to success (Zhang et al., 2003). One possible reason why different factors were generated is that these studies were based on diverse samples and research settings, which may have placed more emphasis on some CSFs but less on others. This may explain why studies have reported different subsets of CSFs rather than a comprehensive set of similar factors. In addition, the research was conducted in different countries or territories. Cultures, government regulations, and economic environments differ among countries, a fact that raises some issues and challenges for Information Systems implementation (Huang and Palvia, 2001).

2.2.4.1 Project-based critical factors in E-Learning

Project management has become a key activity in most modern organizations (Belout and Gauvreau, 2004). It is a combination of management and planning and the management of change (Atkinson, 1999). White (2007) reported on a meta project that was working to promote change in the institution, and which was using mini projects as a device to enable that change. Project management can be considered an organizational innovation that may influence both the technical and social system of

the organization through new structures, methods, technical systems, and behavioral patterns (Martinsuo et al., 2006).

Projects usually involve attention to a variety of human, budgetary and technical variables. Although many definitions exist, most researchers agree that projects generally possess the following characteristics: limited budget, schedule, quality standards, and a series of complex and interrelated activities (Belout and Gauvreau, 2004). Project success has been widely discussed in the project management literature (Wang and Huang, 2006). Critical success factors can be described as characteristics, conditions, or variables that can have a significant impact on the success of the project when properly sustained, maintained, or managed (Mccollum and Sherman, 1991).

With regard to critical success factors, numerous lists and models have been proposed in the literature (Belassi and Tukel, 1996). The focus of most studies of project success is on how to measure it (dimensions and on the factors influencing it (Wang and Huang, 2006). Project success can be interpreted widely (Wang and Huang, 2006) and it is difficult for authors to reach a consensus about its criteria (Yu et al., 2005). For instance, Shenhar and Levy (1997) suggest that four dimensions should be considered when determining project success: project efficiency, impact on the customer, direct and business success, and preparing for the future. Brown and Eisenhardt (1997), on the other hand, demonstrate that process, communication, and interpersonal relationships (trust, respect, etc.) influence project success. Other success factors such as project management process, project organization, tools, metrics, and culture should also be considered (Milosevic and Patanakul, 2005).

Furthermore, recent research has investigated differences by nationality. Wang and Huang (2006), for instance, show that success is determined differently in China than in the mainstream project management literature (Müller and Turner, 2007).

The traditional way of measuring project success is the so-called golden triangle of time, budget and required quality (Westerveld, 2003). Wright (1997) reduces that list and, taking the view of a customer, suggests only two parameters are of importance, time and budget. Many researchers all agree cost, time and quality should be used as success criteria, but not exclusively (Atkinson, 1999). Despite the fact that this manner of measuring project success is currently subject to widespread criticism, these criteria are still often used in publications on success in IS projects (De Bakker et al., 2009). Setting time and budget limits and defining the requirements always take place at the beginning of the project, when uncertainty is at its maximum (Pinto, 2006), and it is practically impossible to set realistic limits and goals (De Bakker et al., 2009). The measures can be grouped as (a) internal measures (e.g., cost, time, quality); and (b) external measures, benefiting the organization (e.g., market share, time to market, profitability index), and benefiting the customer (e.g., customer satisfaction) (Milosevic and Patanakul, 2005).

2.2.4.1.1 Stakeholder Perspective on Project Management CSFs

The perception of the various interest groups (e.g. stakeholders, management, customers, and employees) is also regarded as a key factor, as they will view success in different ways (Pinto and Mantel, 1990). Many studies have expanded project success criteria to include such things as organizational objectives, stakeholder satisfaction, customer benefits and the future potential for the organization (Alam et al., 2008). The measures of project success should include the diversity of

stakeholder interests (Milosevic and Patanakul, 2005). Similarly, de Wit (1988) stressed the importance of including the perspectives of various stakeholders in defining project success. Criteria should include the "Iron Triangle" and key project stakeholder satisfaction (Alam et al., 2008).

It is widely agreed that a project has many stakeholders, whose interest may be related or in conflict (Reiss, 1993). Customers and users are stakeholders of IS projects, and so the criteria they consider as important for success should also be included in assessing a project (Atkinson, 1999). A project manager does not limit the project team to within the boundaries of his/her own organization, but also includes other key stakeholders as part of the project team in order to achieve success (Chen and Partington, 2004). It therefore requires separate measurement criteria to measure project management and organizational success for diverse questions and purposes (De Wit, 1988).

2.2.4.2 CSFs for Information Systems Projects

The IS project management has certain characteristics for success that differ from other engineering projects and increase the chances of their failure; for instance, most of the specifics are related to the fact that IS projects involve software (Rodriguez-Repiso et al., 2007). These characteristics must be considered when developing and managing any IS project.

Project management of complex IS projects is challenging even when measures of success are known and understood (Peffers et al., 2003). The practical management

of IS projects beyond the theories for success encounters significant difficulties, as they involve, for example, numerous iterations and continuous interaction between all those involved in design and implementation (Rodriguez-Repiso et al., 2007). IS projects contain a greater degree of novelty than other engineering projects; in particular those related to product innovation development are extremely complex, risky and expensive (Cormican and O'sullivan, 2004).

IS success can be measured in six dimensions: information quality, system quality, system use, user satisfaction, individual impact, and organizational impact (Delone and Mclean, 2003). All the Information Systems implemented by the participating organizations had to be used, regardless of user satisfaction. Also, most users were employees who had limited knowledge of the organizational impact of the IS, so it would have been inadvisable to ask users to assess system use and organizational impact (Yen et al., 2008). User resistance has also been regarded as one of the major reasons why IS implementations failed; that is, users' judgment of the system is an essential criterion in the evaluation of IS success (Yen et al., 2008). At the team member level, technical knowledge and organizational skills such as interpersonal communication and strategic planning have also been considered to be important determinants of project success (White and Leifer, 1986).

2.2.4.3 CSFs Criteria Selection

Project success criteria vary from project to project (Müller and Turner, 2007). What is acceptable in one project without impact on perceived success is abject failure in another project. It follows that different types of projects require management

approaches and procedures tailored to the needs of the project (Chan et al., 2002). Westerveld (2003) demonstrated a link between success criteria, critical success factors and project types. He identified six groups of success criteria, namely project results (time, cost, quality), and appreciation of the client, project personnel, users, contracting partners and stakeholders. Success factors were grouped into leadership & team, policy & strategy, stakeholder management, resources, and contracting. Using five project types he illustrated diverse combinations of success criteria and factors required for different types of project. Ibbs and Kwak (1997) likewise showed that project success differs by industry.

People also judge the success of projects differently depending on their personal objectives, and it can be the case that one person judges a given project a success, while another judges it a failure (Müller and Turner, 2007). Wateridge (1995) suggests that in choosing a project management methodology, the project sponsor or project manager should identify the relevant success criteria, and from these determine appropriate success factors to increase the chance of achieving those criteria, and then select a project management methodology that delivers those success factors. Crawford et al. (2005) have developed a categorization system for projects which they offer as helping to identify appropriate methodologies for projects, but they offer no guidance on whether a variety of success criteria will be relevant for diverse types of projects, and hence different success factors, and whether varying projects will perform differently against those other success criteria (Müller and Turner, 2007).

The above discussion demonstrates the diversity among researchers of success factors for E-Learning and E-Learning projects; the selection criteria also vary in different situations. This research initially aims to identify the E-Learning development process from the three aspects of organization, technology and service, within three E-Learning projects in a single university environment. According to Ngai et al.(2008), 'Critical success factors should be few in number, measurable and controllable', and Peffers et al.(2003) asserts that 'IS project is challenging even when measures of success are known and understood'. This research tries to cover both of E-Learning and project aspects of implementing E-Learning. In order to define 'measurable, controllable, and understandable' factors, the typical critical success factors for E-Learning relate to 'technology, instructor, and students' (Volery and Lord, 2000; Soong et al., 2001), while the critical factors for project management are 'time, budget, and quality' (Westerveld, 2003; Wright, 1997). These are therefore part of the principles for selecting the appropriate cases in this research. Section 2.2.4.2 asserted that as IS projects differ from other engineering projects, the viewpoints of senior management interviewees also become a critical success factor for E-Learning projects.

2.2.5 The Theoretical Gap in the E-Learning Study

For traditional universities, a move towards novel E-Learning requires a fundamental change in the structure of the institution (Kayte O'neill et al., 2004). Somekh (1998) has drawn on a wide range of research that provides insight into the process of innovation and change to see what can be learnt to support innovation in the use of Information and Communication Technologies (ICTs) in higher education. While

recognising that innovation is complex and challenging within large organisations such as universities (Somekh, 1998), many studies have proposed that E-Learning implementation is a process of innovation. Thus most IT researchers, including Rossiter (2007) and Salmon (2005), focus on E-Learning innovation processes, particularly in the sphere of technological innovation. For example, after 1980 significant numbers of projects regarding computer-based multimedia course development and delivery were considered, evaluated and improved. More recently, a growing number of higher education institutions have struggled to deliver learning materials online (Brewer, 1998). It can be argued that the majority of E-Learning initiatives have failed due to various reasons. For example, it is listed in a Parliamentary report[10] that an over-emphasis on technological aspects, in particular the platform, has led to the neglect of other aspects of E-Learning, such as course design. Due to this reason, even though UKeU had sufficient funding from the government and the most advanced platform technology at that time, the project still failed.

The concept of successful E-Learning is attractive. However, there is a huge gap between traditional teaching/learning and E-Learning. Professor James Taylor stated that "*Changing a university is like trying to move a graveyard – it is extremely complex and you don't get much internal support.*"(p1)(Taylor, 2001). Some research findings in the area of "change" as it affects institutions, distinguish between "re-structuring" and "re-culturing" in an organisation (Fullan, 2001). The findings suggest that while re-structuring is relatively easy to plan, re-structuring by itself

[10] http://www.publications.parliament.uk/pa/cm200405/cmselect/cmeduski/205/20502.htm

makes little difference to an improvement in teaching and learning. What does make a difference is re-culturing (Fullan, 2001), that is, how teachers come to question and change their beliefs and habits. That is a more difficult challenge. While both restructuring and re-culturing involve people, the re-structuring can be imposed by those with authority or power to do so, whereas re-culturing requires the co-operation of all the people involved in the change, with their range of attitudes, traditional ways of working and mixed motivations towards change (Burns, 2007). Yet if the students are to benefit from the efficacy and potential cost-effectiveness of E-Learning, it is necessary to revise the traditional organizational structures, institutional cultures and conventional educational paradigms. It is also important for universities to understand the problems associated with the transition from traditional to virtual and to take into account such difficulties when making fundamental changes to the structure of the institution. In order to achieve the above mission, it is necessary to reconsider the e-leaning innovation process (Romiszowski, 2004; De Freitas and Oliver, 2005; Hardaker and Smith, 2000).

Research on E-Learning since the 1960s focussed firstly on the technology perspective (e.g. Uttal, 1962). At that time, there were few educational applications of computers in universities, with most performing routine computational tasks. It was thought that the high cost of technology would prevent widespread uptake as an educational tool. In the 1990s, research was conducted about learning theories on E-Learning, and developed a range of pedagogical practices (Nicholson, 2007). The theories were produced by a number of intellectual paradigms, including philosophy, anthropology, and psychology (Mcfarlane, 2007). According to Burns (2007), re-structure and re-culture is related to people in the organization, changing

behaviour and habits. There are many cases which show that the change to the organization led by E-Learning is complex (Somekh, 1998), therefore in order to understand the E-Learning innovation process in the organization, it is vital to examine three aspects: organization, technology and service.

2.3 Organizational Innovation

2.3.1 Introduction

Organizations are "*socially defined and operate within a web of values, norms, rules and beliefs and taken-for-granted assumptions that they represent values, interests and cognitive schemas of organizational and institutional actors which are hard to change*"(p894) (Hinings et al., 1996). Rogers (1995) defines an innovation as "*an idea, practice or object that is perceived as new by the individual, and diffusion as the process by which an innovation makes its way through a social system*". Mexias and Glynn (1993) defined organizational innovation as "*non-routine, significant, and discontinuous organizational change that embodies a new idea that is not consistent with the current concept of the organization's business*"(p78). Despite the differences found between these definitions, organizational innovation has been consistently used to describe an organization's behaviour when adopting and introducing new ideas into the organization (Oerlemans et al., 1998; Zammuto and O'connor, 1992).

Innovation is a means of changing an organization to respond to changes in its internal or external environment, or as an anticipatory action to influence its environment (Damanpour, 1991). Even in the most stable environment, organizations

still need to innovate continuously in order to survive (Hage, 1980). Hence organizational innovativeness can best be conceptualized as multiple rather than single innovation. This point is reflected in the notion that innovation constitutes parts of the system that produces it (Lam, 2004), suggesting that organizational innovation is an ongoing collective creation process (Van De Ven and Poole, 1995). In addition to the conceptual value, a better understanding of organizational innovation can also contribute to the practice of management (Leifer et al., 2000; Van De Ven, 1986). From the managerial perspective, the primary purpose of innovation is to introduce change in the organization in order to create new opportunities or take advantage of the existing ones (Drucker, 1985).

In addition to identifying what organizational innovation means, many scholars emphasize the distinction between the "diffusion" and "adoption" of innovations (Kimberly and Evanisko, 1981), while others differentiate "innovating" from "innovativeness" (Van De Ven, 1986). One of the key purposes of differentiating between "diffusion" and "adoption" and between "innovating" and "innovativeness" is that diffusion and innovating refer to the process through which innovation occurs and evolves. By contrast, adoption and innovativeness represent a snapshot to highlight the status and reality of organizational innovation.

In literature relating to technology diffusion, researchers have usually perceived technological innovation within an organizational context as an organization's efforts to initiate, adopt, and/or implement one or more emerging technology (Fichman,

2000; Prescott and Conger, 1995), in this case E-Learning technologies. What is reflected in these accounts is that technological innovation has a close relationship with organizational innovation. More importantly, organizations which can manage innovation well typically demonstrate not only an understanding of both the technology and the context in which it will be used, but also the creation of an organizational environment to foster frequent and ongoing innovation.

2.3.2 The Process of Organizational Innovation

More recently, there has been a significant shift in the focus of conceptualizing organizational innovation and a move away from the inquiry into formal structures towards an understanding of organizational processes, relationships and boundaries (Pettigrew and Fenton, 2000). It is argued that the process of innovation consists of four distinctive steps, starting with the generation of an idea, then the dissemination of the proposed idea, next, the decisions to adopt, and finally, implementation (Lozada and Calantone, 1996).

This approach to conceptualize the organizational innovation process represents a significant shift in the way in which such processes were understood. For example, as reported by Zaltman et al (1973), most studies of organizational innovation addressed organizational innovativeness by viewing an organization as a whole and its innovation as a collective result, without identifying how such a result was achieved. However, in the 1980s, many areas of research, namely communication technology, management Information Systems and computing, have started to

emphasize the importance of organizational innovation from the individual process point of view (Ven and Rogers, 1988). Another vital trend that was evident in the 1980s is the incorporation of computer-related equipment into the conceptualization of organizational innovation. Despite the popularity of examining the impact of IT, it is argued by Rogers (1995) that many prior accounts have failed to take sufficiently into account the characteristics of IT when theorizing organizational innovation. To address this shortfall, the research will examine the literature related to technological innovation in Section 2.4.

Based on the accounts of Rogers (1995) and Bowes (1997), organizational innovation processes should consist of four key elements: the innovation itself, the communication channels to transmit the innovation knowledge, a mechanism to track innovation adoption over time, and the social system within which individual adopters exist. The innovation process consists of a sequence of five stages, as outlined in Figure 2.1 below. The figure illustrates two sub-processes in the initiation stage and three in the implementation stage. Later stages in the organizational innovation process cannot be undertaken until the earlier stages are settled. Other models - for example, that of Tidd, Bessant, & Pavitt (2005) - similarly describe the innovation process by portraying organizational innovation as a simple linear flow.

According to Rogers (1995), there are two stages in the *Initiation* phase, including the agenda setting stage and the matching stage (Figure 2.1). Within the agenda

setting stage, various problems and opportunities become apparent and are articulated by the management. Resulting from the agenda setting stage, various potential innovations will then be evaluated in order to match the problems and opportunities identified. As part of this phase, information gathering and planning, resulting in the decision about innovation adoption also occurs. If an innovation is then adopted, the *Implementation* phase will follow. There are three main stages in the implementation phase. Firstly, there is the *redefining/restructuring* stage. This stage involves identifying a better fit between the innovation and the needs and expectations of the organization by often re-inventing the innovation. Secondly, there is the *clarifying* stage. During this stage, the clarified relationship between innovation and an organization's needs and expectations is then communicated and agreed across the entire organization. Thirdly, there is the *routinizing* stage, through which the innovation quickly becomes part of the organizational routine of the organization. As a result, the novelty factor and innovative character start to recede (Van De Ven, 1993).

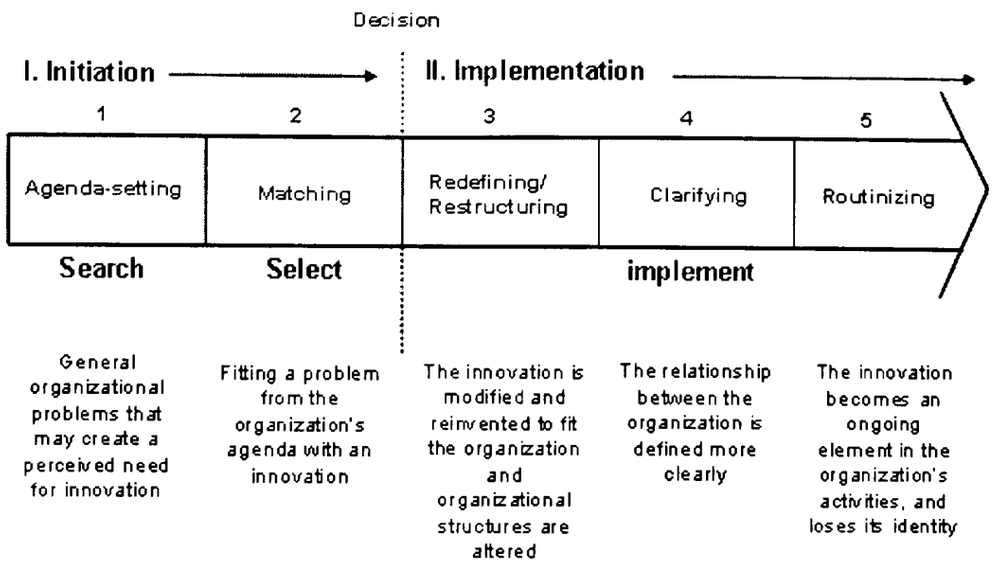


Figure 2.1 The Organizational Innovation Process (Rogers 1995, *p392*)

Despite the fact that Rogers' account laid down a vital foundation to theorize the organizational innovation process, some limitations related to his framework are also evident. For example, it is pointed out by King and Anderson (1995) that his innovation process framework is far too complex, yet failed to capture the dynamics of organizational innovation by using such as a linear pattern. Moreover, the lack of organizational innovation research in higher education institutes provides a very limited understanding and explanation about the relevance and appropriateness of Rogers' (1995) framework. To address this issue, the following section will discuss the literature related to organizational innovation within the context of higher education, with a specific focus on the introduction and implementation of E-Learning.

2.3.3 Organizational Innovation in E-Learning

From the earlier discussion, it is clear that, while a robust technology infrastructure can facilitate successful E-Learning, technology alone is not enough. Changes in budgeting, organizational relationships, policy, procedures, and culture must be considered and introduced to make E-Learning effective. For example, the business model of an E-Learning project is different from that of a traditional classroom course. With a traditional course, the costs remain fairly constant. In contrast, an E-Learning project pushes most of the costs up front, with dramatically lower ongoing implementation and maintenance costs. Although E-Learning promises significant cost savings over time, the early stages of an E-Learning project may be more expensive than the stakeholders expect. These differences must be communicated in advance to enable better planning and appropriate funding.

Organizational relationships are also affected by the introduction of E-Learning. While human resources, training, and information technology functions bring their own strengths to an E-Learning project, each has the ability to affect the success or failure of the project. For example, during the project implementation, the training function can team up with HR to educate existing and future users. Training is as vital as activities, such as sharing resources and using templates to improve quality and save development time. Also, it is crucial to note that training existing E-Learning users to master the new system is as important as equipping new users with the right skills and understanding in order to become involved with using the new system. Encouraging the participation and support of each stakeholder group from the start is as important as sustaining their involvement throughout the project,

to ensure that the level of commitment and involvement can significantly facilitate the success of a project (Skolits and Boser, 2008).

From the above discussion, it is clear that E-Learning implementation is more than merely the adoption of a technology to change the way in which education is delivered and received. Rather, it can often be a change that requires the adopting organizations to perform radical reengineering and adjustment in a relatively comprehensive manner. As noted by Alshara and Alsharo (2007), to ensure the success of E-Learning implementing, educational organizations need to recognize the importance of aligning changes in the policies and procedures of their practices. Despite the importance of perceiving E-Learning adoption as an organizational innovation, there are very few prior studies that conceptualize the dynamic relationship between the adoption of E-Learning in conjunction with the level of organizational change within the context of E-Learning implementation. There are even fewer accounts that consider the role of technology in relation to such dynamic relationships. In order to address such a shortfall, the following section will review the current literature on the area of technology innovation.

2.4 Technological Innovation

2.4.1 Introduction

Before explaining different types of technological innovation in detail, it is important first to define "technological innovation". Freeman (1989) proposes that '*innovation is an iterative process initiated by the perception of a new market and/or new service*

opportunity for a technology based invention which leads to development, production, and marketing tasks striving for the commercial success of the invention" (p112).

The above definition makes two crucial distinctions. Firstly, the innovation process requires the technological development of an invention that is introduced to a market where the end-users are able to access the invention and then adopt and diffuse such an invention (Abernathy and Clark, 1985). Secondly, the innovation process is persistent and ongoing in its own nature, and so, after the introduction of the first invention/innovation, an improved innovation will follow (Ali et al., 1995). In other words, technological innovation can often be difficult to launch. However, once it is started, many waves of innovation which can vary in their scope and scale will be introduced and reintroduced with some degree of continuity.

The unique nature of technological innovation, in particular its continuity, has attracted attention from both the academic and practitioner communities. Its importance is reflected not only in its vital role for economic growth, but also its significance in contributing to an organization's competitiveness. For example, in recent years, technology has been identified as an important competitive weapon for research-intensive firms in many industries, for example in pharmaceuticals and IT. For technological innovation to deliver its strategic value successfully, it is vital that the process of technological innovation is clearly understood and effectively managed. Without a comprehensive and insightful understanding of the innovation process, it can be extremely difficult for managers to manage the process and the

other strategic and organizational changes that are directly and/or indirectly related to the technological innovation.

2.4.2 Technological Innovation as the Evolution of Information Systems

In this research, technological innovation includes E-Learning platform development, course delivery methods, and E-Learning infrastructure development, which are typically the key ingredients of an E-Learning innovation. However, in many cases, decisions related to the selection of technology and knowledge to use and implement such a technology to support E-Learning are not made solely by the project owners, who can be a subject group, department or school. Rather, it is the IS department that makes such decisions about acquiring and deploying certain technologies. The way in which the decision about technology adoption is made indicates that the role played by an IS department is more than a passive one in making the technology work. Instead, it should be perceived as a department that drives the technological innovation (Drazin and Schoonhoven, 1996).

From this perspective, it is clear from the IS literature that an IS division should play an active role not only in promoting the adoption of a new technology, but also in supporting the process of implementation (Burton Swanson, 1994; Kwon and Zumd, 1987; Rogers, 1995). Further, the expertise possessed by the IS staff is crucial in integrating technology with business processes (Checkland and Holwell, 1998). It therefore seems reasonable to assume that an organization's technological innovation

is indeed closely related to the evolution of the organization's IS department. In the context of E-Learning, it is clear that E-Learning as a technological innovation is also an evolution of the IS department. Such an evolution not only represents a technological innovation, but also echoes an organizational innovation. This connection again brings out and justifies the need to examine E-Learning from the organizational and technological points of view, as well as the importance of taking the two views in conjunction.

2.4.3 The Process of Technological Innovation

In the current literature, three types of technological innovation processes - IS innovation, technology adoption and tool adoption - are evident. An IS innovation process can cover a collection of concepts, techniques (such as structured programming), and tools, such as CASE[11](Iivari et al., 2000). Due to this reason, it is important to differentiate the acceptance of a new IS innovation process from the acceptance of development tools and techniques. Further, it is essential to distinguish between the acceptance of a new IS innovation process and the acceptance of tools and techniques that are used within the IS innovation process (Dietrich and Walz, 1997).

Compared to the adoption of technologies, tools and techniques, an IS innovation process is more radical in its nature (Gatignon and Robertson, 1989). According to Orlikowski (1993), there are two occasions when technology and tool adoption,

[11] CASE (Computer Aided Software Engineering)

instead of the IS innovation process, is more likely to occur. The first is the adoption of a tool/technique to support the existing system. The second is the adoption of a new technology to enhance the existing IS.

A multi-stage model, based on the work of Cooper and Zmud (1990), is used to represent the IS innovation process. It is a variation on the earlier model by Kwon and Zmud (1987). This is because the new model incorporates post-adoption behaviour. In addition, in this later model the activities that occur during each stage are elaborated. The contributions made by these two accounts need to be recognized. In particular, the earlier framework by Kwon and Zmud (1987) was developed in response to the absence of an integrated approach to the IS implementation research. This model incorporates not only the observations made in literature describing organizational change, but also in the research on innovation and technological diffusion.

The IS innovation process model by Cooper and Zmud (1990) consists of six main stages, as demonstrated in Figure 2.2:

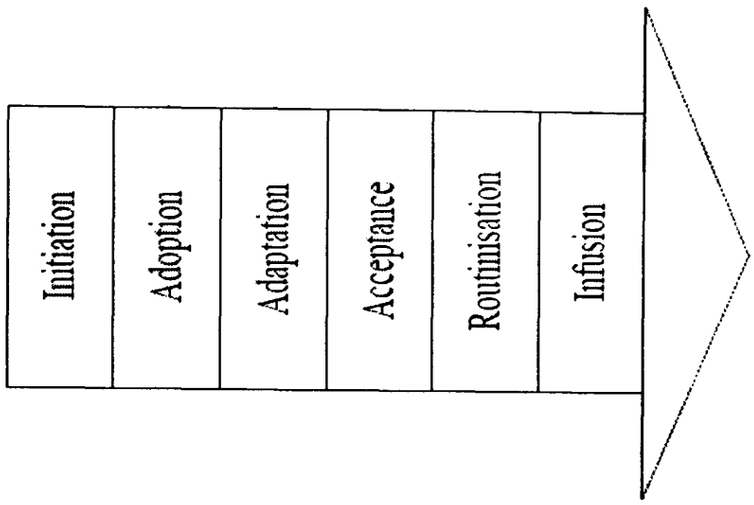


Figure 2.2 Information Systems Innovation Process (Cooper and Zmud, 1990)

As well as seeking to explain the IS innovation process model, the present research also recognizes the need for understanding the technology adoption process. The literature portrays the process of technology adoption as progressive linear stages or as systemic cycles of change (Gyambrah, 2007). For example, Rogers (1995) presented the technological adoption process as a series of five linear stages, with a specific focus on innovation decisions. The first stage is called "*knowledge*" to illustrate a developing awareness of innovation, as well as the increase in related knowledge and skills. The second stage is "*persuasion*", through which interaction with other stakeholders helps to communicate the idea and generate supporting behaviour for the innovation. This stage is followed by the "*decision*" stage when the two main activities include seeking additional information to clarify the innovation and understanding of stakeholders' intentions to experiment with the innovation. The fourth stage is labelled "*implementation*", through which innovation is introduced to become part of the organizational routines. The final stage is "*confirmation*", which

can include the evaluation of the anticipated benefits of the innovation to form the basis of whether or not to continue using the innovation. As part of this stage, a user might also decide to promote the innovation to different parts of the organization or outside the organization.

From the above review, it is clear that the frameworks of these stages are very useful in identifying and categorizing the various activities that occur and/or which are required during the technological innovation. However, as Sabherwal and Robey (1993) claimed, stage frameworks are also problematic in explaining how feedback loops function between stages and how different stages can overlap. It also seems clear that these frameworks assume that stages occur consistently in the same order. The lack of empirical evidence in illustrating these frameworks inevitably limits their potential usability and reliability, and highlights one of the motivations behind this research to investigate the process of technological innovation as a vital step to conceptualize E-Learning.

2.4.4 Technology Innovation in E-Learning

Advancement in technology has provided more solutions to design and implement E-Learning than ever before. In particular, broadband and interactive technologies have expanded further the feasibility of different E-Learning modes that previously would not have been possible. It is crucial to understand that advanced technological features in E-Learning applications might not always be understood and appreciated by conventional learners. Compromise in functionality and sophistication is therefore

often evident in E-Learning applications in order to generate a wider level of acceptance and usage. Moreover, technological limitations can also be an issue that affects the design and planning of an E-Learning project. For example, limited bandwidth and other technological constraints in some countries do not permit the realization of interactive learning scenarios.

As indicated by Mentzas et al. (2001), E-Learning must be perceived as a process (learning/knowing), as well as the development of an artifact/product (learning content/knowledge). From this perspective, technology needs to fulfil two purposes. Firstly, the technology is employed for E-Learning purposes and has to prove its capacity to support the process of learning in any aspect. Secondly, the technology has to promote improvements for the development and delivery of learning content. For example, preparing content for E-Learning purposes is time-consuming and costly, so Learning Management Systems are typically used to manage preparation efforts (Wild et al., 2002).

Despite the importance of technology in relation to E-Learning, it is vital to note that technology is not the sole factor in determining the learning outcomes. Technology therefore provides the means to achieve learning goals, but the performance of learning has to be measured in its own right. In general, these statements raise critical issues for E-Learning. To summarise, these are: interactivity, codification, personalization, customization, metadata, motivation, collaboration and technology - all key factors for the enhancement of E-Learning performance. The selection of appropriate technologies for an E-Learning initiative is challenging. It can be even more problematic when other factors are taken into account in order to understand

the full impact of technology in the context of E-Learning innovation. Such challenges highlight one of the key aspects of this research, which is to understand the dynamic relationships and interrelationships between technology and the context in which it is implemented and used. It is not possible to understand fully such dynamics without considering the content which is developed for E-Learning. The following section will review the current literature in the area of service innovation, and use service innovation as an approach to conceptualize E-Learning development and implementation.

2.5 Service Innovation

2.5.1 Introduction

Before explaining service innovation in detail, it is vital to define products and services. The definition of a 'product' is *"the description of all goods, services, and knowledge sold. Products are bundles of attributes (features, functions, benefits, and uses) and can be either tangible, as in the case of physical goods, or intangible, as in the case of those associated with service benefits, or can be a combination of the two"* (Kahn et al., 2004). In contrast, the definition of a service is often more problematic due to its ambiguity and the lack of consensus in the current literature (Looy B. V. et al., 2003). Grönroos (1990) defines a service as *"a process consisting of a series of more or less intangible activities that normally, but not necessarily always, take place in interactions between the customer and service employees and/or physical resources or goods and/or systems of the service provider, which are provided as solutions to customer problems" (p46).* Based on this definition, services are

activities and/or processes characterized by two central notions, including intangibility and simultaneity (Looy B. V. et al., 2003). The differences between services and goods are obvious, as shown in Table 2.2.

Services	Goods
An activity or process	A physical object
Intangible	Tangible
Simultaneous production and consumption: Customers participate in production	Separation of production and consumption
Heterogeneous	Homogeneous
Perishable: cannot be kept in stock	Can be kept in stock

Table 2.2 The Differences between Services and Goods
(Looy B. V. et al., 2003)

From the above table, it is clear that E-Learning development involves both product and service innovation. For instance, E-Learning changes the delivery approach of the traditional course. Students/users can therefore access the courses at anytime and anywhere, thus allowing self-paced learning. E-Learning also creates new products, such as e-materials and Podcast, to enhance the quality of teaching.

According to Gadrey et al. (1995), service innovation is defined as "*innovations in processes and innovations in organization for existing service products" (p8).* Service innovation is usually described as new developments in activities for various reasons during the delivery of core service products. Service innovation also involves the interaction with customers and suppliers, and the interaction process is typically an integral part of an offering (Johne and Storey, 1997). The major categorizations of the new services are summarized below:

Booz and Hamilton (1982)	Avlonitis et al. (2001)	Gadrey et al. (1995)	Debackere et al. (1998)
New-to-the-world-products. New in the eyes of customer	New to the market service	Innovations in service products	Breakthrough projects (fundamental changes to existing products)
New product lines. Products that represent new challenges to the firm	New to the company service	Architectural innovations (bundling-unbundling of existing service products)	Platform projects (new product lines)
Additions to existing product lines	New delivery process		
Improvement and revisions to exiting products	Service modifications	Modifications of service products	Derivative projects (incremental changes)
Repositionings. Existing products that are targeted to new segments	Service line extensions	Innovations in processes and organization for existing service	
Cost reductions. New products that offer similar performance at a lower cost	Service repositionings		

Table 2.3 Classifications of Service Innovativeness
(Alam, 2006)

2.5.2 The Process of Service Innovation

The history of research into service innovation can be traced back to the literature of new product development in manufacturing (Oke, 2007). Despite the fact that this literature has provided many useful insights, our understanding of service innovation, in particular in differentiating service innovation from product innovation, remains limited. Stevens and Dimitriadis (2005) identified two fundamental differences that might invalidate the new product development models when applying them to the examination of services. Firstly, this is because the production and consumption of services are simultaneous. Secondly, service innovation cannot be separated from organisational innovation, while new product development can often be examined in

isolation. These differences led the new service development process to be considered as distinct from the Ne Produce Development (NPD) process (Johnson et al., 2000).

According to Alam (2006) , only a few new service innovation models have been formally proposed. For example, Bowers (1989) described a new service innovation process with a set of eight linear stages in the US financial services industry, yet this model is still very similar to the model of tangible product development proposed by Booz and Hamilton (1982). Scheuing and Johnson (1989) developed a more comprehensive model consisting of fifteen stages which cover various activities, starting from the moment when an idea is generated and continuing as far as its launch in the market. Despite the fact that this framework has clearly-outlined key stages according to which a new service innovation can occur, the model falls short in addressing the broader organizational issues, such as organizational culture and the role of cross-functional teams.

Several researchers have applied sequential development models to examine service activities and have provided some valuable insights (Stevens and Dimitriadis, 2005). For example, Reidenbach and Moak (1986) highlight the frequent success of companies using more formal processes during lengthy innovation periods. Edgett and Jones (1991) also observe that a successful new service development project is highly dependent on the use of formal processes and procedures. Johnson et al. (2000) categorize a new service development process into four stages, with thirteen

distinctive tasks which must be performed before launching a new service (shown in Figure 2.3). Based on the framework of Johnson et al., it is clear that service innovation should be perceived as a continuous process, which can be best understood by collectively taking into account issues such as the organizational context, teams, tools, products, people and technology. In other words, service innovation is not merely an activity that solely concentrates on the service itself. Rather, the context in which service is developed and the issues that can affect its delivery and performance should also be considered.

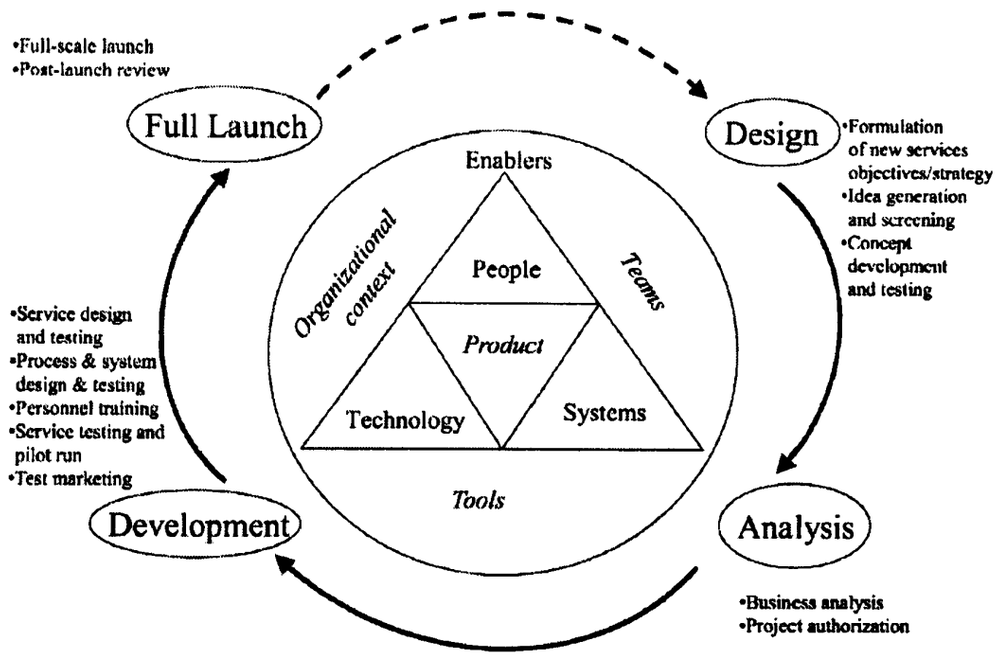


Figure 2.3 The New Service Innovation Process Cycle (Johnson et al., 2000)

The new service innovation process developed by Johnson et al. (Johnson et al., 2000) provides a descriptive view of the ongoing processes; however, these sequential development models also have weaknesses. For example, Panesar and Markeset

(2008) suggests that one of the main limitations is that these frameworks tend to under-estimate the difficulties of working cross-functionally, often required for service innovation. Despite the fact that many service innovation project teams are cross-functional, it does not mean that an organization has a cross-functional structure for delivering the service. Further, as highlighted by Stevens and Dimitriadis (2005), these frameworks frequently neglect the importance of informal networks that are vital for facilitating service innovation.

In order to minimize this limitation, the present research recommended an E-Learning process developed by Khan (2004) combined with a service innovation process developed by Johnson et al. (2000). The E-Learning process developed by Khan (2004) is divided into two major phases: (1) content development and (2) content delivery and maintenance (Figure 2.4). According to the phase model, a typical E-Learning process contains planning, design, development, evaluation, delivery, and maintenance stages. Based on this model, evaluation is regarded as a crucial ongoing stage of the E-Learning process. As noted by Khan (2004), "*ongoing formative evaluation for improvement (i.e., revision) should always be embedded within each stage of the E-Learning process"(p33).* Moreover, individual stakeholders are also important in the process, and are usually involved in various stages of the E-Learning process.

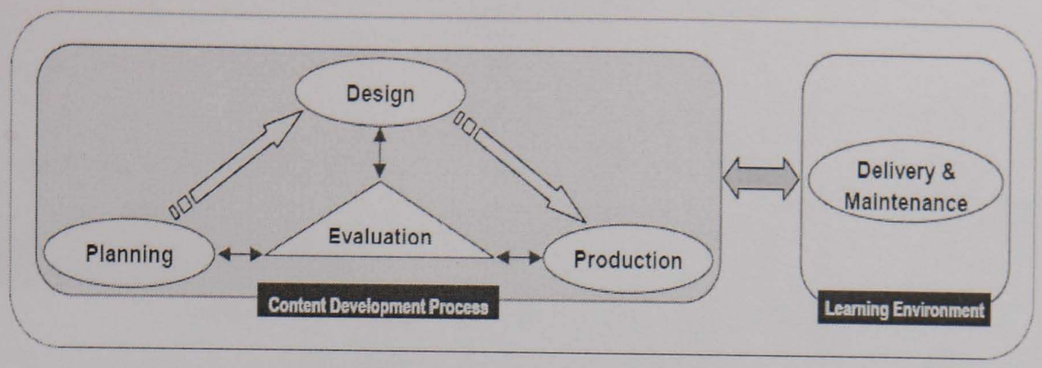


Figure 2.4 The E-Learning Development Process (Khan, 2004)

2.5.3 Service Innovation in E-Learning

The rationale behind perceiving the design and implementation of an E-Learning project as a service innovation are twofold. Firstly, from a survey conducted by the E-Learning Magazine, it is clear that many common drivers to adopt E-Learning share the same characteristics of service, as outlined previously. Despite the fact that the survey is conducted in three different contexts - higher education institutions, the government and military and corporate bodies - the results seem to be rather consistent. Secondly, even though E-Learning is defined very differently across a variety of higher education institutions, it commonly refers to the use of technology to support students in achieving their learning outcomes (Ellis et al., 2007). This clearly echoes the definition of service innovation provided by Gadrey et al. (1995).

Driver	Higher Education (%)	Government and Military (%)	Corporate (%)
Available anytime, anywhere	**80**	75	80
Cost savings	**65**	57	65

Allows for self-paced learning	**57**	75	57
Provides just-in-time learning	**52**	52	52
Ease-of- use	**44**	44	44
Content can be altered easily	**42**	42	42
Fast distribution	**32**	32	32
Improves instructor availability	**25**	25	25

Table 2.4 E-Learning Magazine's Business Drivers Ranking

(E-learning User Survey, 2001)

Teachers adopt and utilize E-Learning for the purposes of teaching preparation and teaching delivery (Jebeile and Reeve, 2003). Service innovation in the context of E-Learning is therefore mainly developed in two stages - namely, course design and course delivery. In traditional course design, the teachers' major task is the preparation of teaching materials such as hand-outs. In contrast, E-Learning can assist teachers to design courses on an E-Learning platform by possibly utilizing some E-Learning tools. IS staff are seldom involved in traditional course design or delivery, but in the context of E-Learning, demands for interaction between IS and academic staff are clearly increasing. Moreover, Gibbons (2001) suggests that a lack of online content and advanced teacher training means that many higher education institutions are still struggling to incorporate Internet applications such as Web publishing (for teaching delivery) with traditional teaching methods.

As mentioned in the previous section, the main drivers for E-Learning adoption in higher education institutions are for delivering higher quality teaching for the benefit of their students. For example, in the traditional teaching environment, students acquire knowledge from the classroom, while through E-Learning students are

provided with an alternative approach to access the course and its content anywhere and at any time. The course content also differs from traditional modes of delivery. For instance, as well as receiving hand-outs in the classroom, students can access e-resources from the E-Learning platform. Moreover, e-materials, such as Podcast, video, and audio, can also enhance the students' learning experience.

Several authors (Box, 1999; Kirby, 1999) argue that one of the most critical elements of online learning is that it permits interaction amongst students and interaction between instructors and students (Davis and Wong, 2007). Mesher (1999) claims that interactivity is the "*key to successful online learning....The effects of interactions between the learner and tasks at a cognitive level can, in many cases, be richer and more effective in online than face-to-face situations. It is here that the computer comes into its own, allowing interactions in the virtual situation that are not always attainable in real life.*" By using E-Learning, teachers and students can interact not only in the classroom, in their teacher's office or by email, but can also communicate on the E-Learning platform using different communication channels. In the traditional classroom, besides whole class or group coursework, students do not often interact. However, through using E-Learning, especially the E-Learning platform, such as the intra-network and course blogs, students can discuss with their classmates the courses and related problems. Such an interaction may to some extent reduce the teachers' workload.

In addition to the benefit derived from interaction, E-Learning can potentially lead to the sharing of resources across different schools. This may be difficult for some universities, even though the need to share is clearly evident, for instance, by re-using course materials. E-Learning provides the opportunity for teachers not only to share their subject knowledge, but also to communicate their experience with their colleagues through an E-Learning platform. As a result, course design and delivery can become more effective than previously.

Another service innovation in E-Learning development is to establish educational administrators as facilitators to carry out the planning. As Stefl-Mabry (1999) argued, E-Learning development helps educators to get a better overview of the design and planning of educational courses, electronic resources and infrastructure planning, as well as identifying ways to improve the evaluation and assessment methods.

2.6 Interaction between Different Levels of Innovation

The previous sections have reviewed each element separately and raised the need to understand organizations, technology and the services together as a means of conceptualizing E-Learning development. This section will now introduce the relationship and interaction in turn between organization, technology and service:

2.6.1 Interaction between the Organization and Technology

To improve service quality, it is crucial to incorporate and take advantage of available technology. Despite the necessity and importance of this, many

organizations still struggle to embed new technologies into their existing structure, business processes and routines (Gosain, 2004). The concept of embeddedness is important in order to understand the relationship between technology and organizational change. The term "embeddedness" has been used in various ways. According to Volkoff et al. (2007) it refers to "*the way in which technology introduces a material aspect to organizational elements such as routines, roles, and data*" *(p843).* The material aspect, just like a mode of delivery enabled by an E-Learning platform, is a physical characterization of the technology. Further, the material aspect is a vital part of the organization and is key to the process of change. To enable technology to perform, therefore, some organizational restructuring is often required. In institutions of higher education, restructuring is compulsory at the administrative level, and, more importantly, at the academic delivery level.

The way in which technology-related change takes place within an organization affects and is affected by the way in which decisions are made in the organization. For example, Hardgrave and Johnson (2003) argue that adopting a technology is a combination of organizational and individual decisions and can be perceived from two different views. From a bottom-up view, the growing number of individuals using a process can often result in the decision to standardize it as an organizational process. However, from the top-down view, the way in which a decision is made within and by the organization to adopt a particular technology can have a strong effect on the willingness of individuals to use it.

In addition to the impact that an organization can create on a technology, some impacts in a reverse manner are also evident. As Oblinger and Maruyama (1996)

pointed out, institutions can react to pressure derived from technology in various different ways, such as changing organizational structures and relationships. Tracing back beyond the past twenty years, it is clear that at the end of the 1970s, institutions generally reacted as individuals. In other words, key decisions on, for example, the use of technology and whether to create their own materials or purchase these from other institutions, were made solely for and within the institution. However, in the 1980s, institutions were forming consortia to share the high cost of course development and delivery. When the Internet technology started to gain popularity in the 1990s, institutions encountered a new wave of pressure to expand their market. An even larger scale of collaboration and innovation across different organizational boundaries was called for.

In summary, it is clear that E-Learning technology can significantly affect the structure, business process, practices and politics of an educational organization (Alshara and Alsharo, 2007). The interrelationship between technology and organization in the context of E-Learning is best illustrated by Gallick's account (1998), when he argued that advancement in E-Learning technologies and capabilities have forced the institutions of higher education to revisit, and - in some cases - redefine their key objectives. New technologies are therefore a vital tool for challenging fundamental assumptions that are often taken for granted by an organization (Carnevale, 1991; Kelly, 1998). New technologies can also alter the competitive landscape, even in typically stable sectors such as higher education. For example, Gladieux and Swail (1999) indicate that a range of unconventional providers, e.g. corporate universities, have increasingly become more influential in

the higher education sector by offering new services with credentials and with flexible schedules. The following section highlights the relationship between technology and service.

2.6.2 Interaction between Technology and Service

Services are essentially processes with the characteristics of simultaneity and intangibility. Moreover, the process of creating and delivering service is fundamentally rich in information exchange (Looy B. V. et al., 2003), suggesting that service development and delivery are deeply affected by technology. From the 1970s, IT has played a vital role in service innovation. In addition to the role of IT in facilitating and enabling the high information intensity of most service activities, IT is also found to be a key factor that led to a radical transformation of the producer-user relationship in service (Buzzacchi et al., 1995).

According to Barras (1986), IT was initially developed and used in the service context to improve the efficiency of the delivery of existing services. The role played by IT has become increasingly multi-faceted, particularly in its growing importance in improving service quality. More recently, IT is perceived and utilized as a vital tool for generating new service activities. Technological innovation has therefore become a key enabler in service innovation, while service innovation has become a key driving force for technological innovation, particularly in its application.

Technological innovation is increasingly playing a key part in educational development. According to Winn (2002), trends in educational technologies are reflected in the development of several areas, including learning content, the formats of instructional messages, and the computer interface between materials and learners. Another type of educational technology is the enhancement of both teaching and learning through Learning Management Systems to evaluate the students' learning processes (Gyambrah, 2007).

2.6.3 Interaction between Organizations and Services

As suggested by Stevens and Dimitriadis (2005), organizational features can have considerable impact on determining the successes and failures of new service development. For example, a new service that requires collaboration between different divisions will be influenced by the existing organizational structure, as well as by its culture of collaboration. Like NPD, new service development is demanding on resources. Therefore, support from the organization is essential in ensuring its success and continuity. Further, how a service innovation project team is structured can significantly influence development processes and their budgets, as well as their efficiency (Pearson, 1991). As with new product development, service innovation can be perceived as a collective knowledge creation process (Takeuchi and Nonaka, 1995) which can only be supported when systematic organizational learning is nurtured (Senge, 1990). This is because organizational learning serves as a vital mechanism to explore and exploit knowledge (March, 1991) that is fundamental to service innovation. In other words, service innovation can be radical and generative. By contrast, some of the service innovation can be incremental and adaptive - that is,

simply a refinement of the existing service. This argument for the relationship between an organization and its service innovation is therefore clear, and it is also evident that, regardless of the types of service innovation, to deliver and manage the services successfully, and the efforts that have to be made to innovate them, often requires some systematic organizational changes in organizations (Stevens and Dimitriadis, 2005; Fitzsimmons and Fitzsimmons, 2001).

For E-Learning development to be effective in higher education institutions, some organizational changes are needed. First of all, it requires changes in the roles of the faculty members. Compared with conventional teaching, E-Learning will require the faculty members to become familiar with the fundamental shift in paradigm, as well as with the available technologies that can be applied to innovate the courses and their delivery (Kayte O'neill et al., 2004). As echoed by Laurillard (2005), faculty members are facing challenges in acquiring new skills sets that are very different compared to the past. It is also becoming increasingly clear that the lecturer has to engage in more multi-tasking than previously. As Laurillard stated, four core competencies are particularly vital for faculty members involved with E-Learning, namely - administrator, facilitator, technician and evaluator. Fundamentally, for E-Learning development to be successful, academic staff will have to focus on ensuring the smooth operation of the course. As a result, faculty members will have less capacity to look after the students' needs to overcome issues such as the barriers against using technology (Gyambrah, 2007).

The implications of E-Learning for lecturers are clearly significant. For more effective E-Learning development, institutions of higher education need to provide sufficient time and resources for lecturers to be re-skilled. Of course, this will largely depend on the general direction through which E-Learning initiatives are structured and managed. More importantly, it is vital to ensure that E-Learning development which is perceived as service innovation needs to take into account one of the most crucial stakeholder groups, the students (Laurillard, 2005). In addition to the provision of training and re-skilling, institutions must also provide full support to lecturers, as the introductions of E-Learning can often significantly increase the workload of faculty members in the initial stages (Masterman and Lee, 2005).

2.7 Theoretical Gaps and Researchable Questions

2.7.1 Introduction

The above analysis has scrutinized the literature on E-Learning development and related innovations, and the interaction between different aspects of innovation; it has also examined other insights contributing to this debate. In this section, the key issues raised in each part of the discussion are summarized and synthesized in order to identify any theoretical gaps, leading to an identification of the major research questions to be explored in this thesis. However, it must be recognised that not all gaps in theory can be investigated in a single study; indeed, not all theoretical gaps are researchable. The emphasis in this present study therefore is on selecting the questions that are researchable and sub-questions that are of broad conceptual significance.

2.7.2 The Identification of Researchable Questions

As outlined earlier, E-Learning should be perceived not merely as a process (learning/knowing) or simply an artifact/product (learning content/knowledge). Rather, it should be a combination and balance of both (Mentzas et al., 2001). From this perspective, any technology that is employed for E-Learning purposes must have the capacity to support all learning processes, as well as to promote different approaches to develop and deliver diverse learning contents. Adapting E-Learning will affect the adopting organization, not only in its structure, but also in its practices and business process. These changes cannot be addressed in isolation. Rather, other organizational issues, such as organizational policies, should be taken into account, to ensure the effectiveness and success of E-Learning (Alshara and Alsharo, 2007). Fundamentally, it is more than merely the changes in the approaches of teaching preparation and delivery (Jebeile and Reeve, 2003).

According to Gupta, et al. (2007), all innovations are socially constructed phenomena that involve actors - individuals and, potentially, teams - and the broader environment in which they find themselves. However, the complexity of E-Learning development, compared with some of Information Systems, lies in the needs to introduce multi-level changes to the organizational context and the services that it provides. In other words, the innovation of E-Learning involves three levels of innovation: organizational, technological and service. Despite its underlying complexity, until now most research into innovation focuses only on a single level of

analysis. As claimed by Gupta, et al. (2007), it is rather rare to find research that looks at different levels working in conjunction. This research therefore combines three aspects of innovation to ensure a more comprehensive investigation of E-Learning development. Hence, it is necessary to re-think the E-Learning definition. Taking into account the concept of innovation processes, the author proposes a definition of E-Learning which explains more broadly how the organizational innovation process secures E-Learning system development; how the technological innovation process constructs the system; and how involving the service innovation process can enhance the diversity of E-Learning materials. Table 2.5 shows the formulation of the research problem. Based on the arguments above, this study proposes the following research questions:

What are the underlying processes of E-Learning development in the context of a higher education institution, taking into account the following aspects:

- Organizational innovation
- Technological innovation
- Service innovation

How do these key innovation processes interact?

Issues Process Study Design	Your Process Research Study	Statements and References
1. State your process research	What are the underlying processes of E-Learning development in the context of a higher education institution?	Importance and need to be further developed (Romiszowski, 2004; De Freitas and

question		Oliver, 2005; Hardaker and Smith, 2000)
2. Research difficulties	the E-Learning development process is too large and complex to observe carefully	Somekh (1998)
3. Solutions	We focus on three aspects of innovation: technology, service, and organization	• According to history of E-Learning development, the research of E-Learning chronologically focuses on technology, service, and organization. (Uttal, 1962; Mcfarlane, 2007; Nicholson, 2007). • Three aspects of E-Learning (Mcpherson and Nunes, 2006) (Jones and O'shea, 2004) • Pilot study approved by the University of Nottingham, UK and National Chung Cheng University, Taiwan
4. integrations	Three aspects into one group practice and how this group **integrates** with the system.	Importance and lack of research (Abdomerovic and Blakemore, 2002; Leonardi, 2007)

Table 2.5 Worksheet for Designing a Research Study
(See Van de Ven, *Engaged Scholarship* Chapter 7, for guidance in completing this worksheet)

CHAPTER 3 METHODOLOGY AND RESEARCH DESIGN

3.1 Introduction

The literature review has identified some under-researched areas that require further examination. Based on the proposed research questions, this chapter outlines and addresses various methodological concerns that are vital to carry out the empirical research. After the illustration of the research design and the rationale, this chapter then elaborates various activities, primarily the four case studies conducted at the University of Nottingham. A critical comparison across the cases is used and incorporated into part of the overall research. The thinking that underpins how the researcher carried out the fieldwork is also discussed. Finally, a discussion of how the gathered data were analyzed and how the results support the research objectives is presented.

3.2 Research Design

3.2.1 Introduction

The ontological, epistemological and methodological elements are the foundations of a research study. Specifically, the paradigms of symbolic interactionism and phenomenology, which contain a constructionist ontology and interpretivist epistemology, are core to the design and strategies of this research. By contrast, the positivist paradigm, which involves a realist/ objectivist ontology and an empiricist

epistemology, has led to the process of quantitative methodology producing fixed designs and quantitative methods.

The functions of a research design are threefold. Firstly, a research design represents a research strategy that translates ontological and epistemological principles into workable guidelines. Secondly, a research design is a vital tool for establishing the boundaries of a research. Thirdly, a research facilitates the researchers to focus their research efforts in a specific direction and to anticipate potential problems that might arise during the enquiry (Lather, 1992; Glesne and Peshkin, 1992; Cook and Fonow, 1990). The specific objectives of the research, the nature of the research topic and the characteristics of the research areas must also be considered jointly when forming the research design (Locke and Golden-Biddle, 1997). Moreover, the scope of the research, the availability of the resources, the researcher's skills and experience, and the potential time constraint can also influence the formulation of the research strategy(Yin, 2003b). The following sections highlight three of the fundamental issues that influenced the underlying design of this research, including the philosophical stance, the contrast between quantitative and qualitative research, and the research orientation.

3.2.2 Quantitative versus Qualitative Research

In the early stage of developing this research study, the researcher found challenging certain determinations of methodological concerns. The initial concern of his investigation was whether quantitative or qualitative research would be primarily

appropriated to the study. What was the narrative the researcher would like to recount and what the arrangements made in order to stress the value of the research? According to the natural setting of this research, interactions on the complex E-Learning innovation process within different aspects has been given less attention (Gupta et al., 2007). In particular, an exploration of the experiences, narratives and illustrative innovation processes is hard to quantify by traditional means. Hence, the research has chosen a qualitative set of methodological approaches, including semi-structured interviews by email, phone and in-person, as well as experiential notes from observations, undertaken in order to illustrate the research theme. A brief argument follows about the nature of qualitative and quantitative research.

Qualitative research methods provide rich descriptions of the social reality that facilitate the understanding of un-conceptualized relationships and provide greater insights into the interrelationships (Neumann, 1997). On the other hand, quantitative measurement is a deductive process that involves taking a concept and developing a measure through which to observe it empirically (Draper, 2004).This process begins with concepts and ends with specific, concrete indicators. The language of quantitative research is a language of the variables and relationship among variables. Such a language allows the researchers to test the relationship between each of the constructs and its significance among them. Table 3.1 summarises the differences between quantitative and qualitative research:

Quantitative Style	Qualitative Style
-Measure objective facts	-Construct social reality, cultural meaning
-Focus on variables	-Focus on interactive processes, events
-Reliability is key	-Authenticity is key
-Value free	-Values are present and explicit
-Independent of context	-Situationally constrained
-Many cases, subjects	-Few cases, subjects
-Statistical analysis	-Thematic analysis
-Researcher is detached	-Researcher is involved

Table 3.1 Quantitative Style versus Qualitative Style

(Source: Neumann, 1997)

In this study, the researcher again adopted a qualitative approach to guide the research design and activities. This is because qualitative methods for the study of organizations are particularly important and relevant (Lee, 1991). Compared to quantitative methods, a qualitative approach is deemed to be more suitable and appropriate for this study. This is not only because of the exploratory nature of the study, but also due to the inherent complexity and dynamic nature that characterize the integration processes of the studied organization. Moreover, as Lofland and Lofland (1995) explained, many aspects of social life can only be seen, felt and analytically articulated through qualitative methods. These methods are enabled by the direct experience of a researcher.

Qualitative research designs permit the researcher to get close to the research phenomena. By so doing, researchers are able to observe and record what they see and experience. Hence, it enables researchers to capture the complexity and multi-faceted patterns of the observed social reality that exists within the organization. Moreover, qualitative observations can unravel some of the un-researched phenomena and form the basis for new hypotheses and the discovery of 'grounded theories' (Glaser and Strauss, 1967; Strauss and Corbin, 1998). Through qualitative research, it is possible to suggest alternative explanations for conflicting evidence which can then lead to further inquiry. This is because qualitative studies allow a greater awareness of the underlying organizational process which is often unrecognized or taken for granted by the organizational members.

According to Patton (1990), qualitative data typically consist of detailed descriptions of events, contexts and interactions between social actors, with a greater emphasis on depth and details. As Weiss (1968) argued, qualitative data are superior to quantitative data in terms of their information intensity, vividness and clarity of meaning and characteristics. In summary, qualitative research methods are used to yield richer descriptions of the researched social phenomena, to facilitate the exploration of unforeseen relationships, and to reveal greater insights within an organizational setting.

3.2.3 Selection of Process Research

Van de Ven (2007) argued that variance and process models were two approaches to understand the question of change on "what" and "how". Those two different types of research questions are associated with different methodologies which are grounded on different assumptions and epistemologies. Table 3.2 shows a comparison of variances and process theory:

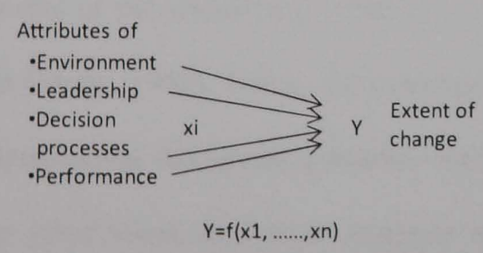
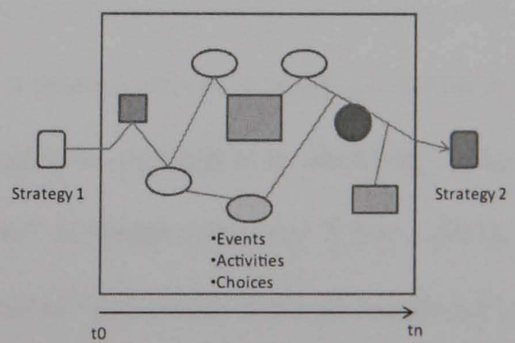
Variance Theory	Process Theory
"what" research questions (Mohr, 1982)	"how" research questions (Bruner, 1991)
Outcome-driven (Aldrich, 2001)	Event-driven(Aldrich, 2001)
Required evidence of co-variation, temporal precedence and absence of spurious associations between the independent and dependent variables (Blalock, 1972)	Required narratives explaining an observed sequence of events in terms of a plot or an underlying generative mechanism that has the power to cause events to happen in the real world and the particular circumstances or contingencies that occur when these mechanisms operate. (Bruner, 1991; Tsoukas, 1989)
change with a variance model  	change with a process model 

Table 3.2 A Comparison of Variance Theory and Process Theory

Source: Blalock (1972), Bruner(1991), Tsoukas(1989), Aldrich (2001), Mohr (1982), Langley (1999).

Mohr (Mohr, 1982; Poole et al., 2000) first noted variance and process approaches to social scientific research, and which influenced organizational studies. Aldrich(2001) stated that most scholars focus on outcome-driven research rather than on event-driven research. A variance model clarifies change in terms of relationships among independent variables and dependent variables (Langley, 1999).

In addition to associating the basic features of this research with qualitative methods, this study can be characterized as process research. Process research typically examines the dynamics of evolving *processes*, rather than investigating the relationships among *variables*. Process research often addresses dynamic research questions centred on constantly evolving phenomena. As Van de Ven and Huber (1990) pointed out, beyond this elementary idea the precise definition of what process research is or is not can be rather difficult to reach.

Some of the process theories can be particularly powerful in providing explanations, in terms of the underlying patterns of researched events, activities and choices over time (Mohr, 1982). Often, the outcomes from a process research study are useful in understanding diachronic patterns, and these patterns are helpful in depicting "*who does what when, and what happens after that*" (Chakravarthy and White, 2001). Some of the process theories might take the form of "deterministic phase sequences", but a variety of other forms are also possible, including "parallel paths", "feedback loops", "non-deterministic branch points", "interactions" and "reversals" (Van De Ven and Huber, 1990; Van De Ven, 1993). As Van de Ven noted, to develop a

process theory, a researcher needs to ensure the development of underlying logic or mechanisms, through which the described temporal patterns are produced. Contrary to variance research, process studies aim to unravel the "black box" of managerial processes. In particular, process researchers focus on how managerial actions impact on the readiness and resistance to various strategic change initiatives, as well as how they affect the overall outcome of the strategic change (Rajagopalan and Spreitzer, 1996).

Quantitative methods are often used to examine static patterns, rather than to understand the dynamics of change; as a result, they may not appear to be suited to research on change processes (Poole et al., 2000). The process research carried out by this study, similar to many prior accounts, aims to examine constantly evolving phenomena directly in greater detail. Longitudinal types of approach, as in case studies, are most suitable for research questions related to how strategic change emerges, develops, and/or terminates over time (Eisenhardt and Tabrizi, 1995; Yin, 2003b).

By comparing this with variance research, a process model illustrates how a sequence of events leads to an outcome. The two approaches supply quite different propositions of change and infer different views for judging research on change and development in social entities. According to the nature of this research question, which aims to understand how E-Learning development processes grow, terminate or

stretch out over time in a higher education context, the process research method is appropriate for this research inquiry.

3.2.4 Case Study Research Design

3.2.4.1 Introduction

According to Yin (2003b), research design for a case study generally covers two aspects. Firstly, there is the question of the kind of data to be collected. Such a requirement can be decided based on a study's research questions and its propositions, as well as the unit of analysis. Secondly, it is necessary to plan activities which should be carried out after the data collection. As Yin (2003b) noted, "*the main purpose of the design is to help avoid the situation in which the evidence does not address the initial research questions. In this sense, a research design deals with a logical problem, not a logistical problem*" *(p29).* Another important function of research design for a case study, as Philliber, Schwab and Samsloss (1980) outlined, is to deal with at least four problems. These problems include: (1) what questions to study (2) what data are relevant (3) what data to collect and (4) how to analyse the collected data. A more detailed consideration of the issues related to case study research design is outlined as follows:

3.2.4.2 Definition of Case Study

Schramm (1971) defines a case study as "*the essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result*"

(p12). However, Yin (2003b) argues that this definition is insufficient to establish the required information. This is because Schramm (1971) only emphasises the decision aspect and neglects other issues, such as individuals, organisations and processes.

To address this shortfall, Yin (2003b) defines a case study as "*an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used. The case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and benefits from the prior development of theoretical propositions to guide data collection and analysis*" (ibid., p.13).

A case study is therefore not simply a data collection tactic, nor is it merely a design feature (Stoecker, 1991). Instead, it presents a comprehensive research strategy. It is a systematic approach to find out what is happening, the approaches deployed to collect and analyze the evidence, and the reporting of the results. Rather than using a large sample to examine a limited number of variables, case study methods are more appropriate for an in-depth examination of a single case or event (Lynn, 1991).

As a method of qualitative research, a case study is not necessarily equal to qualitative research (Schwartz and Jacobs, 1979; Strauss and Corbin, 1990; Van Maanen, 1988; Van Maanen et al., 1982). This is because case studies can rely on data collected through either qualitative or quantitative research, or a combination of both(Yin, 2003b). Moreover, it is not always necessary for a case study researcher directly to observe the researched phenomena, even though, in most cases, observation can be exceptionally useful (Yin, 2003b).

3.2.4.3 Different Types of Case Study

Hakim (1987) categorizes case studies into three types, including descriptive case study, explanatory case study and combined methodology. A descriptive case study is conducted mainly to describe a real-life event and the context in which such an event occurred (Yin, 2003b). An explanatory case study is conducted to collect evidence to explain the causal links between real-life interventions in relation to an event (Datta, 1990). By comparison, a combined methodology is useful in bringing together the findings from several cases to perform a cross-case evaluation(Bryman and Burgess, 1999).

According to Datta (1990), there are six types of case study: "illustrative", "exploratory", "critical instance", "program implementation", "program effects" and "cumulative". The first three types are essentially a descriptive case study, while cumulative case studies are similar to the combined methodology. Moreover, the other two forms share the characteristics of the explanatory case study (Datta, 1990).

Illustrative case studies use one or multiple events to elaborate what happened and why (Datta, 1990). This type of case is particularly useful for interpreting other data, informing readers who do not have much prior knowledge about the project, and providing readers with a common idea about the topic (Yin, 2003b). Exploratory case studies can be conducted prior to the implementation of large-scale investigations (Datta, 1990) in order to identify the research questions and select the types of measurement (Stake, 1986). The third type is critical instance case studies, which are particularly useful for answering cause and effect questions (Datta, 1990). Typically, program implementation case studies are explanatory and useful for either discerning whether the implementation is aligned with the proposed goal or illustrates the implementation problems (Datta, 1990). The fifth type is cumulative case studies which combine evidence from several sites and sources, often collected at different times (Datta, 1990). The sixth type is perspective cumulative case studies which involve designing a series of investigations for different time periods to allow generalisation without conducting an excessive number of cases within a given timeframe (Datta, 1990). Based on the rational of the research design, this research belongs to combined methodology case study with illustrative, exploratory and perspective cumulative characters.

3.2.4.4 Strengths and Weaknesses of Case Studies

According to Stoecker (1991), Minnis (1985) and Curtain et. al (1992), there are two main strengths of case studies. One is flexibility. Case studies examine the process of change in a wider context with the potential to discover new theoretical insights and

principles. Thus it can be useful in explaining some of the "unexplained variance" of statistical research (Stoecker, 1991). In addition, the case study is useful in exploring rather than prescribing or predicting a social reality (Yin, 2003b). Hence, the researcher has more freedom to uncover problems compared with methods, such as experiments (Stoecker, 1991). Moreover, there is no established format for conducting case studies (Minnis, 1985). This allows researchers to start with a broad topic, and gradually narrow down their foci along with the progress of the data collection (Hammersley and Atkinson, 1995).

The other strength is the emphasis on the research context. Case studies support a longitudinal analysis of events or problems, and therefore can be a powerful approach to investigate and explain complex processes and their underlying relationships (Yin, 2003b). Researchers can therefore concentrate on a single subject or a small group of subjects, and obtain empirical evidence within a particular context (Hammersley and Atkinson, 1995). In addition, researchers can conduct a cross-case comparison between their first-hand observations and the results generated from others' research (Curtain et al., 1992). By so doing, it helps to bridge the gap between abstract theories and real-life events.

Besides the strengths, scholars also outline some weaknesses of case studies. For example, there are limitations in terms of how far social phenomena can be generalised and represented, as well as difficulty in ensuring the validity of the findings (Scott, 1997; Gummesson, 1991; Yin, 2003b). In addition, there are three

issues that are commonly mentioned in the literature. Firstly, case studies are essentially narrative constructions (Becker, 1992; Boehrer and Linsky, 1990; Stake, 1995). This is because "*case studies use chronology as a minor organising device*" (Czarniawska, 1997, p. 26). Likewise, Hartley (1994) stated that a case study can easily degenerate into a 'story' without the discipline of theory. For instance, in order to protect the interviewee's confidentiality, researchers often need to construct pseudonyms. This characterizes the fictive nature of case studies (Watson, 2000). Case studies are therefore often criticised as falling *"halfway between fact and fiction"*(Czarniawska, 1998, p. 16).

Secondly, case studies rely heavily on the interviewee's experience and the researcher's personal interpretation. They are therefore inherently subjective (Curtain *et al.*, 1992). Hence, there is a potential bias issue arising from the close association between the researcher and the researched and consequently, the result obtained is rather difficult to validate and very rarely applicable to the broader population (Yin, 2003b). Thirdly, ethical considerations can often result in incomparable data collection processes (Curtain et al., 1992). Moreover, potential problems related to the credibility of the study can occur due to a conflict of interest.

3.2.4.5 Theory Building from Case Studies

It can be argued that case studies are one of the most commonly used methods to develop theory specific to group process (Edmondson et al., 2001), development processes (Gersick, 1988), and organization and strategy (Gilbert, 2005; Mintzberg

and Waters, 1982; Sminia, 2009; Fulford and Rizzo, 2009). Eisenhardt and Graebner (2007) also reported that the majority of scholars are using this method to present the most interesting researches. In addition, using the case study method to build a theory is one of the best connectors between rich qualitative evidence and mainstream deductive research with inductive theory building research.

The revised research design of this study is based on a single context involving three cases (as explained in Section 3.2.5.3 and Section 3.2.7). There are many research studies in E-Learning encompassing organizational, technological and service innovation as separate fields, yet there is little research which has considered the interaction within organizational, technological and service innovation, and especially the implication of this for E-Learning development (Leonardi, 2007). The present research is replication logic from the selected cases in order to build the theory and explore the interactions between the processes to extend the theory.

3.2.4.6 The Issue of Triangulation

To overcome some of the weaknesses mentioned above, it has been argued that triangulation is one of the most important approaches (Yin, 2003b). Yin states that triangulation is used mainly during the gathering and analysis of the data. According to Patton (1990), there are four types of triangulation. Firstly, data triangulation uses a variety of data sources in a study. Secondly, investigator triangulation involves different researchers in a research project. Thirdly, theory triangulation uses multiple perspectives to interpret a single set of data. Fourthly, methodological triangulation

uses multiple methods to study a single case. According to Rohner (1977), the effectiveness of triangulation lies in how the weakness of each single method can be compensated for by the counter-balancing strengths of other methods. Triangulation, therefore, is generally useful for exploiting the strengths of each method and overcoming the weaknesses. Moreover, multiple viewpoints help to enhance accuracy and uncover the hidden dimensions of a social reality. In this study, both data triangulation and method triangulation were employed.

Data triangulation is crucial to the analysis of interview data when comparing people with different views. The goal here is not necessarily to obtain a consistent picture. Rather, it is to examine how each element of the organization, technology and service evolves on its own and impacts on others. It is therefore important to note that any inconsistency is not necessarily caused by invalid data. Instead, such inconsistency can prove extremely valuable in elaborating different aspects of the subject matter.

The objective of this study is to obtain a holistic view of E-Learning development. Multiple methods therefore serve to strengthen the research design by reducing the potential bias inherited in each method, particularly when using each method in isolation (Jick, 1979). This explains why the researcher uses three methods to collect data. More details are given about the data collection methods in the following sections.

3.2.5 Case Study Protocol

Following on from the discussion of how the philosophical stance, the nature of research, and the research orientation influence the research design and the choice of case study, this section now highlights various processes through which the proposed objectives can be achieved. Drawing on the current methodological literature, especially the work of Eisenhardt (1989), Miles and Huberman (1994); Stake (1995), Strauss and Corbin (1990), and Yin (2003b), a number of issues require attention: shaping the case study protocol; conducting a pilot study, selecting cases, collecting data from the field; and data analysis, These can be categorized into two broad phases: the preparation phase, which includes the case study protocol, the pilot study and the selection of cases; and the data collection phase covering access to the case sites and the deployment of multiple methods for data collection. The vital processes (data analysis) will be outlined in Section 3.4.

3.2.5.1 The Pilot Case Study

The advantages of conducting a pilot study are threefold. Firstly, it helps the researcher to evaluate the appropriateness of the case study protocol (Yin, 2003b). Secondly, it helps to determine whether the research skills possessed by the researcher are suitable for the research objectives (Stake, 1995). Thirdly, as Janesick (1994) notes, it "*allows the researcher to focus on particular areas that may have been unclear previously*" *(p. 213).* After completing the case study protocol, a pilot case study protocol was formulated to help researchers to develop hands-on research experience by conducting a "full scale" pilot case study. The following discussion

highlights some of the key problems associated with gaining access and outlines some of the lessons learnt from the pilot case study.

3.2.5.2 Theoretical Sampling of Cases and Gaining Access

Case selection is probably one of the most common questions first asked by readers about a theory-building research study. Yin (2003a, P.9) comments that "*selecting the cases to be studied is one of the most difficult steps in case study research*". Furthermore, selecting of cases is also a decisive step for building theory from case studies (Eisenhardt, 1989; Wilson and Vlosky, 1997). Some readers assume that the selected cases should be represent the viewpoint of large-scale assumption or theory testing research, which is problematic (Bryman, 1989). The leading qualitative researcher Eisenhardt (2007; 1989) signifies that from the theory-building viewpoint, the cases are not necessarily representative of some members of the population. As Pettigrew (1988) noted, the cases selected for theoretical sampling (Glaser and Strauss, 1967) can be chosen for non statistical reasons but are likely to illuminate or extend the emergent theory. The sampling of the cases can be therefore be done for theoretical reasons. By contrast, traditional and large-scale sampling aim to test the theory, so the scale and the representativeness of the population become priority factors. To sum up, many qualitative researchers adopt purposive sampling rather than random sampling methods. In particular, the purposive sampling method has often been chosen for studying the process for groups, settings and individuals (Denzin and Lincoln, 2000), which is the core of this research.

3.2.5.3 Screening Case Study Nominations and Selection of Pilot Cases

Yin (2003b, P79) indicated that selecting the pilot case or cases was highly complicated. However, convenience, access and geographical proximity can be the main criteria to be taken into account. Based on his initial research plan, the researcher aimed to compare the E-Learning development process in the context of seven western and eastern universities. It would be preferable to say that selecting the cases for qualitative research needs a holistic view rather than be determined by statistics alone. Drawing from the researcher's background and circumstances, and a small amount of information collected from the Internet, his preliminary plan selected these seven universities as the potential target cases. The researcher collected the information through the Internet in order to gain an approximate picture of E-Learning achievements, followed by unstructured interviews to determine the ideal cases. The potential accessibility for depth study is one of the essential elements. Table 3.3 gives more detailed information.

No.	University	Country	Reason for selection as potential target cases
1	Nottingham University	U.K	The Researcher is a full time research student and member of E-Learning focus group in the institution. The institution also demonstrates strength in E-Learning. In particular, E-Learning experts also suggest that Nottingham University is an E-Learning pioneer in the UK[12].

[12] http://www.timeshighereducation.co.uk/story.asp?storyCode=400348&sectioncode=26

2	Warwick University	U.K	According to one of the earliest documents (No. NPD 86 in Appendix 3) collected by researcher, Warwick University could be the catalyst inspiring Nottingham University to adopt E-Learning, stated in the first report of E-Learning strategy group for Nottingham University in 2000.
3	Bristol University	U.K	One of the top ten universities in the UK according to the university ranking by Times[13], by record, the E-Learning board was set up in 2004[14].
4	Tsinghua Univeristy	China	One of the famous universities in the capital of China. This institution can be recognized as receiving the most funding for research in China[15].
5	Shanghai Jiao Tong University	China	This institution is famous for scientific and technology research, located in Shanghai, the Chinese economic capital[16]. The researcher has personal relationships which he can access at the University.
6	Southern Taiwan University	Taiwan	The researcher has good access at this University. It is the best privately funded university in Taiwan
7	National Chung-Cheng University	Taiwan	National Chung-Cheng University is one of three universities famous in E-Learning in Taiwan[17]. After several email communications, this institution shows high level of interest in the research.

Table 3.3 Characteristics of Potential Case Studies

Table 3.4 clearly addresses how the researcher selected the pilot cases. He not only took the necessary steps to verify access issues but also investigated requirements on

[13] http://extras.timesonline.co.uk/tol_gug/gooduniversityguide.php

[14] http://www.bris.ac.uk/esu/groups/elb/elearningboard.html

[15] http://www.tsinghua.edu.cn/docsn/rsc/rcxq/post/general/intro.htm

[16] http://www.sjtu.edu.cn/intro/overview/

[17] http://english.education.edu.tw/public/Attachment/87210192271.doc

theoretical grounds. After those steps, University of Nottingham (UoN) and National Chung-Cheng University (CCU) were confirmed as the pilots.

No.	University	Country	Actions and Decisions
1	The University of Nottingham	U.K	UoN is one of the pioneer universities for E-Learning in the UK. The researcher has access to the institution; he is also a member of the E-Learning Development Community in UoN.
2	The University of Warwick	U.K	The University of Warwick showed strength in research and was ranked a little higher than UoN. They also started their initial E-Learning plan earlier than UoN. However, the researcher can only access their Business School. After informal conversations with their staff, the researcher realized that it was impossible to proceed with a full interview schedule.
3	The University of Bristol	U.K	From the initial interview with staff in their Education School, the researcher noticed that UoB does not have a central E-Learning platform but instead three platforms controlled by individual schools. The development pattern might be far more complex and difficult to fit to the research questions or to compare with other cases.
4	Tsinghua Univeristy	China	After the preliminary investigation with Tsinghua University, the researcher understood that E-Learning development in China was still undeveloped.
5	Shanghai Jiao Tong University	China	In 2005, the researcher could find a small E-Learning development footprint in their Computer Science school. Nor was there any evidence of E-Learning activities in the other schools at the University.

6	Southern Taiwan University	Taiwan	After interviewing their leader of IS Division and some staff from the IS division, the researcher noted that there was no significant E-Learning achievement due to the lack of E-Learning content.
7	National Chung-Cheng University	Taiwan	CCU showed high level of interest in the research; the researcher also found that CCU had great achievement in E-Learning. So this University was selected as one of the pilot cases.

Table 3.4 Selection of Pilot Study

With the research objectives in mind, the selection of the pilot case site was based on the concept of theoretical sampling (Strauss and Corbin, 1998): site selection must have strong theoretical relevance and potentially fulfil the research purposes (Eisenhardt, 1989; Orlikowski, 1993); E-Learning development was identified as a key area to address. It was felt necessary to select a university with some E-Learning implementation experience. The rationale behind this decision was that it was intended to explore the processes of E-Learning development by examining its richness from the aspects of organization, technology and service, and, more importantly, the dynamic interaction amongst the three aspects.

The process of gaining access to the pilot site started in 2006. The original plan was to access several universities in different countries, but due to limited resources, primarily the funding available for travel, the researcher had to compromise. The researcher contacted several universities in Taiwan, where the main E-Learning development in universities began around 1998. Overall, the performance of E-Learning development was found to be encouraging. Three universities in Taiwan are recognised by the Ministry of Education (MoE) as the leading universities for

E-Learning development, including the National Chung Cheng University. In March 2006, the National Chung Cheng University became the designated case for the pilot study. The researcher interviewed eight core members of staff, including three key senior managers, who were involved in E-Learning development.

Following the pilot case, the University of Nottingham was selected as the main case site for a number of different reasons. E-Learning implementation in UK universities started around 1999, the University of Nottingham being one of the pioneers. Unlike other UK universities, E-Learning development at the University of Nottingham covered all campuses, schools and centres. Benefiting from studying at the University of Nottingham, the researcher was able to observe E-Learning development within the University from 2004.

3.2.6 The Report from the Pilot Study

3.2.6.1 Case Study One—University of Nottingham

3.2.6.1.1 Introduction

The University of Nottingham is known as one of the world's leading universities, with 30,000 students and staff members worldwide, and excellent standards of teaching and learning. It is the UK's largest campus. Nowadays, the University is an international university with two overseas campuses. In order to enhance the teaching quality and learning efficiency, a comprehensive E-Learning strategy is a vital element in developing a next generation university.

3.2.6.1.2 Pressure of E-Learning — Bandwagon

As a consequence of technological development and globalization, and with the growth of the Internet, universities have been confronted with numerous problems in their external and internal environments since the 1990s. During this period, E-Learning – identified with web-based learning – was taken up by pioneers and innovators. Discussion and development focussed mostly on the technical possibilities and requirements for E-Learning software. Despite having more limited budgets, universities were under pressure to react to some serious emerging challenges previously never experienced, such as the continual development of information and communication technology (ICT); changing industrial needs; a shift in learner expectations; the changing demographics of learners; and the growing competition between different academic institutions.

Almost 90% of all universities in the US and most UK universities have an individual E-Learning plan (Svetcov, 2000), and nearly all use the Internet as the media through which to deliver knowledge. In addition to the Internet and university sites, private corporate companies and government organizations, currently spending a large amount on training, have reported that E-Learning courseware is the best alternative solution to classroom training.

The institutes of higher education need to adapt to the new trend. The University of Nottingham is known nationally and internationally for its excellence in research and teaching that can attract outstanding students. E-Learning is one of the major agenda

related to the competitiveness of Nottingham University. Jumping onto the E-Learning bandwagon shows that the University of Nottingham has introduced some innovative ideas. Empirical evidence indicates that Nottingham University's E-Learning strategy is a top-down process. The University believes that E-Learning can bring huge benefits to teaching and learning activities. In order to gain maximum benefit, the University's management group endorsed an initial draft E-Learning strategy. However, there are several issues that need to be taken into consideration - the foundation infrastructure guide to success is a comprehensive E-Learning innovation process.

3.2.6.1.3 Timetable of E-Learning

E-Learning began in the early 1990s, as the Internet introduced the digital world and the Internet infrastructure grew more mature. In 1994, Mosaic was introduced, which is the concept behind Internet Explorer. After 1996, the growth of broadband capabilities became the major goal of the Internet, which, it could be argued, also became a catalyst for distance learning. The case description is divided into three periods: the revolutionary period, and the evolutionary periods before and after this revolution.

First Stage: 1994-2000 (the Initial Stage)

The University of Nottingham encountered huge pressure from the E-Learning bandwagon and dotcom era from 1994 to 2000. Nottingham University ran the school in a conservative manner. During this period, computer hardware and Internet broadband capabilities were maturing, which, it can be argued, is one of the major

elements of E-Learning development. The decision-making processes at Nottingham University included schools and departments that were mechanistically centralized, but with little control. Most schools felt the desire to change but no proposition was carried out. Each school at the University had a separate IS management unit executed in a decentralized fashion, aiming to provide direct support for each department. However, IS was playing a subordinate role at Nottingham University as IS activities were driven by the requirements of each school, with little direction from the central management and without subjectivity. Although the IS investment remained high, there was little control of specific activities. IS resources were spent largely on maintaining the old systems or updating computer hardware. Before 2000, some of the teachers in different schools explored some computer-assisted learning activities (CAL) which provided supplementary course materials and tutorials. However, the IS department could not support each and every technology that any individual member of staff wished to utilise.

Second Stage: 2000-2004 (the Pilot Stage)

The revolutionary change began with the establishment of the E-Learning strategy group in December 2000, in response to demand, with a brief to review the University's involvement in E-Learning; evaluate the options for potential future involvement; and identify the potential human capital and infrastructure requirements associated with further investment in technology mediated learning. From the organizational innovation point of view, this was a step towards setting an agenda and initiating a process for finding a solution. At the same time, E-Learning became a fashionable trend that every institute sought to adopt. Since the Internet capabilities,

software, and hardware had now matured, many UK leading universities jumped onto the E-Learning bandwagon and began to develop their preliminary E-Learning strategies. The University Management Group sought to improve practices of E-Learning strategy by using the response from each school. Each E-Learning activity in different schools was developed within its own IS unit, and then reported to the central E-Learning strategy group. In this way, the IS strategy was to seek growth and innovation simultaneously.

In April 2001, the E-Learning strategy group forwarded an initial report and recommendations to the Management Group. During this period, WebCT and Blackboard (well-known VLE systems) were widely adopted by schools and achieved some success, but it was quite clear that the higher management group had little control over it. It was reported that the Heads of Schools were in favour of supporting "bottom-up" developments rather than working to centrally imposed targets. The exact meaning of "bottom-up" was questioned, due to concern that it may be implemented as *laissez-faire*. It was suggested that Schools should be asked to partake in a centrally-led review of their current position and be requested to include the development of E-Learning in their relevant School plans (while still seeking solutions). Indeed, this stage led to a considerable amount of wasted investment in E-Learning. A significant number of staff members who were asked to adopt new technologies were resistant to change. It can be argued that there still existed a wide range of opinions in each school. In other words, it was be necessary to reconsider a comprehensive E-Learning strategy for the University (the solution finding phase).

Third Stage: March, 2004- Present

The primary risk is the inability to respond to major bandwagon shifts. Nottingham University also suffered from this problem. In order to respond to the increasing pressures from the E-Learning bandwagon, the University established the E-Learning strategy group in late 2000, which had previously been operating in a stable fashion, and which now jumped onto the bandwagon to seek a better way for the University to maintain its competitiveness. During late 2000 until spring 2004, the E-Learning strategy group made considerable progress with initial E-Learning activities, including the extensive collection of opinions; staff development for both academic staff (to support them in using technology in the areas of teaching and learning) and administrative and technical staff; and the building of foundational Internet infrastructures. In 2004, E-Learning activities were widely popularized on the campus. However, the stable situation that had previously existed needed to be reconstructed in order to handle the increasingly complicated challenges now facing the University, to ensure the direction of E-Learning implementation and to coordinate work with different schools.

A new IS learning team leader, Andy Beggan, was appointed in March 2004. His mission was to implement the e-Nottingham plan, to structure and integrate E-Learning activities, to evaluate previous E-Learning strategy, and to develop an insight for further developments. The University E-Learning strategy shifted to combine the resources and efforts to identify an improved E-Learning platform. Beggan invited the academic users of both WebCT and Blackboard to take part in a focus group to examine the future direction of central VLE, looking at integration issues (with the Portal), pedagogic issues, and technical concerns. In late July 2004,

WebCT - with a preferred single VLE - was confirmed by the E-Learning focus group; this was a crucial turning point. Once the major decision had been made, the next task was to shift the centralized IS structure, which was considered unsuitable for rapid changes, to a shared IS structure. The Central IS Department oversaw the foundational implementation (for example, providing training sessions for academics), and the IS unit in each school (providing essential support for staff creating the teaching materials). The shared IS structure, it was argued, would lead to an improved performance. Since then progress in implementing E-Learning has been quite satisfactory, and nearly 800 course sections have been made available online.

3.2.6.2 Case Study Two- National Chung Cheng University, Taiwan

3.2.6.2.1 Introduction

National Chung Cheng University was the first public University established after Taiwan's economic boom in the 1980s. It was founded as a research-oriented university which aimed to provide students with the necessary skills in Humanities, the Sciences, Technology, Law and Management. It is this type of liberal arts education that allows students effectively to deal with the complexity of life in the 21st century.

3.2.6.2.2 The Reason for E-Learning Adoption

Generally speaking, before 2000 universities around the world perceived the pressures of adopting E-Learning in a relatively similar way. Most pressure came from competition from other universities:

- Since the 1990s, E-Learning implementation was taken dramatically as a new style of teaching channel because of the rapid development of the Internet.
- Strong E-Learning software development in Taiwan
- The height of the dotcom era
- Taiwan's political situation was exceptional, and it joined the WTO (World Trade Organization) in 2001. This had huge implications and made a great impact on the original closed education market which needed to be opened up.

Motivation for E-Learning came from Government Support:

- Jul 1995: Participated in the plan of "E-Learning pioneers" formed by MOE, Taiwan.
- Sep 2006: "The methods for universities' E-Learning implementation" by MOE
- Oct 2006: Received certification from MOE for "Master's Degree for E-Learning in Vocational Education". Fifteen universities and seventeen courses applied, with three universities and five courses obtaining permission

3.2.6.2.3 Timetable of E-Learning

Starting in the early 1990s, the timing of the initial E-Learning development has resembled that of leading western universities, yet the foundation of the infrastructure of broadband capability is superior to that in most countries around the world. It can be suggested that this is because Taiwan is at the heart of IT hardware development, producing cheaper and more reliable IT products. However, the Taiwan education market was small and did not have a close connection with western countries, so during the 1990s they sought to create a route to establish a better connection with the other universities in order to recruit more new students.

First Stage: 1995-2002 (the Initial Stage)

National Chung Cheng University has been recognised as a pioneer in providing distance learning courses in Taiwan since 1995, by participating in distance learning projects which have led to significant results - 45 courses online and over 6000 students enrolled. During this period, the University gave distance learning to the IS department as an extra workload, an organisational policy that has not changed since that time. After the University had decided to participate in the pioneering distance learning course with MOE, they started to develop their own platform (conforming to SCORM1.2 standard) in 1999, instead of buying the platform from LMS vendors. Teachers were keen to put their courses online, though the quality, arguably, was relatively low.

Time	Events
Jul 1995	• Participated in the plan of "E-Learning pioneers" by MOE • Start syncronic distance learning. To date, 45 courses have been established, and over 6000 students have enrolled • High-speed ATM network to support the syncronic E-Learning courses
1999	• Developed their own teaching platform • Start a synchronic E-Learning platform (more than 50 courses were established on this platform), conform to the international Scorm1.2RTE3 standard.

Table 3.5 First Stage: 1995-2002

Second Stage: 2002-2004

The revolutionary change began with the establishment of the E-Learning studio which was affiliated with the audio-visual centre in the library. From the

organizational view, the University still assumed that E-Learning activities were a pilot project. There were still many areas that remained to be covered. In 2002, Sever 4 was implemented by two postgraduate students using PHP as the main language compatible with SCORM 1.2 Standard[18].

In August 2004, the E-Learning centre was renamed and upgraded from the E-Learning studio which had been established in January 2002. It was made independent of the library in order to resolve two key delays:

(1) It was difficult and time-consuming to create multimedia instructional materials.
(2) The need for a professional platform server and video and audio server remained unfulfilled.

The aims of the E-Learning centre were particularly focused on obtaining support from staff and equipment for building a professional and effective team to support lecturers creating online courses.

To overcome these issues, the CCU needed to establish a professional team for producing multimedia instructional materials and arranging appropriate multimedia facilities. E-Learning materials were produced according to the needs of the lecturers in order to address their teaching principles, allowing them to focus on preparing teaching materials without being concerned about their technical skills. It was

[18] The Sharable Content Object Reference Model (SCORM) integrates a set of related technical standards, specifications, and guidelines designed to meet SCORM's high-level requirements—accessible, interoperable, durable, and reusable content and systems. It is a collection of standards and specifications for E-Learning.

expected that there would be an increasing number of lecturers willing to become involved in creating E-Learning courses.

From the technological point of view, the equipment for E-Learning also needed to be upgraded. For the past three years, the servers for E-Learning had been subjected to the advanced Linux system and PC which were unsuitable for creating video-based materials. In addition, the video and audio server was merely replaced by a PC with a real video server, which did not meet the increasing need for more high-quality video-based materials in the near future. Both the system server and the video and audio server had to be upgraded and a comprehensive scheme planned in advance if the service was to be available to a large number of users simultaneously. At this stage, the CCU completed the evolution of the technological requirements and gained much valuable experience which helped to prepare for the next stage.

Third Stage: 2005-Present

Aiming to maintain both its strength and competence, the CCU provided the E-Learning centre with a new organizational setting, "CyberCCU", which was established in September 2005. At the same time, the MOE also responded to the demand for E-Learning by acknowledging the course credits obtained through E-Learning. CyberCCU also have an alliance with Hong Kong Polytechnic University, Tokyo Metropolitan Institute of Technology, the National Dong Hwa University and MITiCampus in order to enlarge the market. The service from Cyber-uni is not restricted to the campus. On the contrary, Cyber-uni is expanding its service to make the most of its platform by seeking opportunities to cooperate with

other institutions, and by using its own resources. In the near future, CyberCCU will be expected to make ends meet, which implies that it will become a new source of revenue for the University and even improve its competitiveness.

From the perspective of course development, CyberCCU began to recruit students from February 2007. Half credits of courses are delivered online. This brings great benefits to part-time students who are employed but are who willing to improve their abilities and gain an advanced degree.

Time	Events
Sep 2005	Establish "CyberCCU" (Chung Cheng University)
Sep 2006	"*The methods for Universities' E-Learning implementation*" by MOE
Oct 2006	Obtained the certification by MOE for "*Master's Degree for E-Learning in Vocational Education*". 15 universities and 17 courses applied; 3 universities and 5 courses received permission
Feb 2007	To enrol students for "*Master's Degree for E-Learning in Vocational Education*"
Future plans	• The E-Learning centre is to put great efforts into promoting and creating online courses on campus, encouraging learners to learn online. The final step is to create world-wide links between all online courses • The E-Learning centre is expanding its service by seeking opportunities to cooperate with other institutions. • The E-Learning centre will be expected to be financially independent. This means that it will become a new source of revenue for the University and even improve its competitiveness.

Table 3.6 Third Stage: 2005-Present

3.2.6.3 Lessons Learnt from the Pilot Study

As Robson (1993) suggests, a pilot study can offer a researcher valuable opportunities to "learn on the job". The following discussion highlights some of the

vital lessons acquired from the pilot study. Firstly, in terms of developing research skills, the pilot study provided an excellent opportunity for the researcher to improve his formulation of interview questions, interview technique, and observation and writing skills. Analysing and managing the data collected from the pilot study also provided a real-time experience that could not possibly have been gained through reading alone.

Secondly, the experience gained from both Universities produced three key aspects, namely organizational, technological and service, in E-Learning development that are not fully explored in the current literature. Moreover, during their interviews, the interviewees also drew attention to the existence and importance of the interaction between these three aspects.

Thirdly, the pilot studies with National Chung Cheng University helped to improve the research design. The researcher found that the foci of E-Learning development differed in Taiwan and UK. For example, in the UK E-Learning development focuses heavily on the organizational level, such as resourcing, strategy and policies, or on E-Learning content. By contrast, many Taiwanese universities emphasize the development of an E-Learning platform. However, the interviewees from National Chung Cheng University identified that collaboration with other universities was one of the most challenging issues for them, due to the differences in the technologies deployed. National Chung Cheng University had therefore already planned to replace the existing E-Learning platform with WebCT or Blackboard, although their own developed E-Learning platform was already very powerful. The findings generated from the pilot case help to reinforce the decision to use the University of Nottingham as the research site.

There were two reasons why the researcher did not pursue the data from CCU following the pilot study. Firstly, the original research plan aimed to collect data from both UoN and CCU in order to enable a comparison to be made. However, the results from the pilot studies implied that the wide diversity of data in the initial platform selection / creation stages might affect the results of any comparison at a later stage. Secondly, the researcher realized that time limitations meant that it was impractical to collect the data at two research sites. In order to present better quality research, the researcher had to modify the research design and therefore chose UoN as the research site. Nevertheless, the results of the pilot study did illustrate a general E-Learning innovation process which was a blue print for the later research.

3.2.7 Selecting Cases from the Chosen Research Site

Following completion of the pilot report by the researcher, the preliminary analysis results influenced the way in which the research design was altered from the original idea. As stated in Section 3.2.4.5, the researcher modified the scope of his research to a single context with an embedded multiple-case study design(Yin, 2003b).

Yin also stated that multiple-case design can be more compelling and robust (Herriott and Firestone, 1983). The rationale of this research is provided by the multiple-case studies which employed a replication technique (Hersen and Barlow, 1976) in order to build the theory from selected cases. The logic for constructing a theory is to find out the patterns from collected process data and compare with the current theory. Multiple-cases strengthen the results by replicating the pattern-matching which was proposed by Trochim (1989). Pattern-matching is also

one of the popular techniques for case study analysis (Yin, 2003b, p116) and will be explained in detail in Section 3.4.3.3).

3.2.7.1 Criteria for Selecting Cases

However, the ground of pattern matching in this research is to collect the relevant cases for theoretical comparison. Each nominated case should be carefully selected from theoretical concerns (Yin, 2003b, P47). The researcher initially aimed to identify the E-Learning development process from the three aspects of organization, technology and service, in particular confirming the E-Learning critical factors: technology, instructor, and students (Volery and Lord, 2000; Soong et al., 2001) and project management critical factors: time, budget, and quality (Westerveld, 2003; Wright, 1997), which became the principles for selecting the appropriated cases. During the early days of his investigation, the researcher became a member of the University E-Learning focus group, thus becoming able to screen all E-Learning projects within the University. During that period (2005~2006), there were more than forty E-Learning projects that could be traced from the Central E-Learning Development Community. However, most of the E-Learning projects were relatively small and lacked the theoretical patterns sought by the researcher. It was decided that case studies would be better made at school level rather than from individual E-Learning projects, taking ideal cases and theoretical requirements into account (Figure 3.1),. In addition, interviewees from top management also made suggestions for case studies.

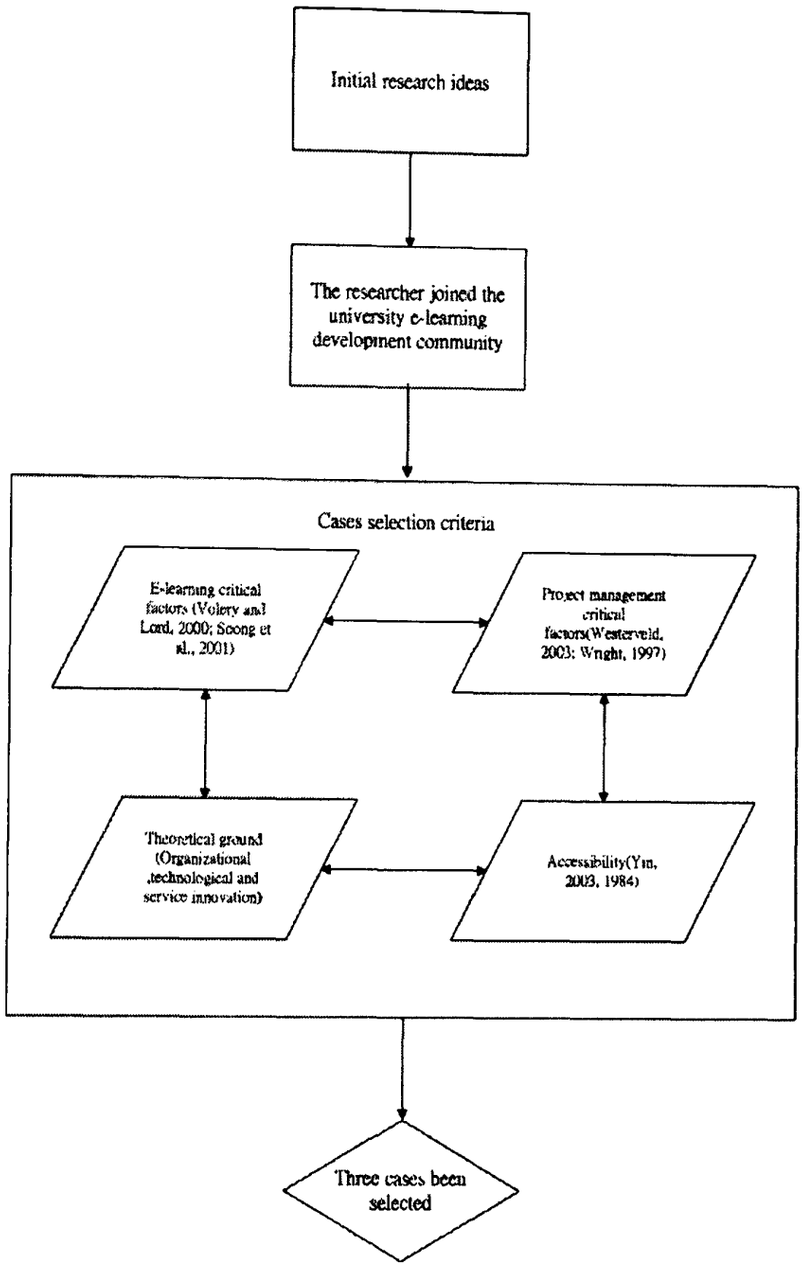


Figure 3.1 Theoretical Considerations for Case Selection

Having surveyed the E-Learning projects and evaluated the suggestions made by senior management, the researcher identified six schools that had made significant efforts in school-wide E-Learning development - namely the Schools of Mathematics (MELEES), Geography, Education (eELT), Nursing, Graduate School and the School of Biosciences. These nominated cases are briefly introduced in Table 3.7:

Project	Introduction
The University of Nottingham (Research Context)	The research context represents the collective effort at the university level. It can therefore be perceived as a higher level project than the other cases. In addition, this project is also an important indicator of the University of Nottingham's commitment to E-Learning as one of the pioneers among the higher education institutions in the UK.
MELEES	This project was one of the initial official E-Learning projects supported by the University in early 2002. In addition to its relatively long history, MELEES was also the first large-scale E-Learning project delivered to the Malaysia Campus, and it was expected to be delivered to the China Campus in 2009.
School of Geography E-Learning Project	E-Learning development in the School of Geography started in 2004, after an official university-wide E-Learning platform had already been established by the Central IS Department. This project currently offers 72 modules online.
eELT Training Project (Part of e-China Project)	The eELT project is a part of the e-China project, which co-operated with its Chinese partners internationally. The initial project was relatively successful and, currently, the team is working on the following project, which is sponsored jointly by the HEFEC and the Minister of Education in China.
Graduate School E-Learning Project	The Graduate School Centre and Faculty-based Graduate Centers offer dedicated provision for postgraduates. In theory, all the postgraduate students also belong to the Graduate School. Before 2003, the Graduate School offered four standalone online courses for students. After 2006, the Graduate School was interested in joining the latest E-Learning development scheme within the University.
School of Nursing E-Learning Project	The archive collected by the researcher indicated that the School of Nursing showed a high level of interest in participating in the University E-Learning development scheme. The researcher observed that the School of Nursing had a large number of part-time students, so it was crucial they should provide learning materials that were accessible anywhere.
School of Biosciences	The School of Biosciences invested a large amount of funding to develop a pioneering Brewing Science programme. They also gained support from the EPSRC and BBSRC Modular Training for Industry Scheme.

Table 3.7 Six School-Wide E-Learning Projects

These six school-wide E-Learning projects were generally affected by E-Learning and project management critical factors. They received technological support from Central IS Department; eELT, the School of Bioscience, MELEES and the School of Geography also appointed professional E-Learning developers. Only the Graduate School complained about a lack of budget for E-Learning development. Regarding theoretical sampling requirements, it had a large student population but lacked sufficient staff to become involved. In the case of the School of Biosciences, they announced just one MSc course, so had difficulty in establishing an organizational innovation pattern. Yin (2003b) argued that accessibility for data collection is crucial for case study research. After the initial contact with all the nominated cases, and considering geographical proximity issues, it was decided that the Graduate School, the School of Nursing and the School of Bioscience were not suitable for this research.

After these careful considerations (Table 3.8 below), MELEES from School of Mathematics, the School of Geography E-Learning project and eELT from the School of Education were chosen as the target cases.

Research Criteria	MELEES	School of Geography	eELT	School of Nursing	Graduate School	School of Biosciences
E-Learning Critical Factors	√	√	√	√	√	√
Project Management Critical Factors	√	√	√	√	×	√
Organizational Innovation Patterns	√	√	√	√	×	×
Technological Innovation Patterns	√	√	√	√	√	√
Service Innovation Patterns	√	√	√	√	√	√
Accessibility & Geographic Proximity	√	√	√	×	√	×
	√: fit the criteria		× : not fit the criteria			

Table 3.8 Detailed Presentation of the Features of Theoretical Sampling Cases

3.3 The Data Collection Phase

3.3.1 Introduction

One of the key purposes of this section is to outline how the sites of the case studies were accessed and how various data collection methods were used to implement the research design. As one of the objectives of conducting a process research study, various data sources are used that are vital to that research, including observation, interviewing and use of archival documents (Van De Ven and Huber, 1990). The integration of the data collection methods and the problem of ensuring the validity of multiple sources of data are also discussed.

These methods are well known to have complementary strengths and weaknesses (Patton, 2002). According to Van de Ven and Huber (1990) , observations focus on the present, documents are suitable for understanding the past, while interviewing is a useful linking phenomenon across different time periods. In practice, most process research depends on the interviewees' memories. To compensate for this potential limitation, combining various sources of data is necessary (Dawson, 1997).

3.3.2 Observation

The key purpose of observation is to gain first-hand knowledge of how social actors behave in their own social settings (Robson, 1993; Hunt and Benford, 1997; Altheide and Johnson, 1997; Yin, 2003b). This is a vital aspect of the role played by the researcher in investigating, understanding and interpreting the studied research phenomena. As already explained, the ontological and epistemological

underpinnings of the researcher determine how the social reality is perceived and how such knowledge can be obtained. Positivists stress the externality of social reality and emphasize the achievement of objectivity. It is therefore crucial for the researcher to be independent of the observed social phenomena. In contrast, the phenomenological tradition is rooted in the paradigm of the social construction of reality, and argues that no researcher can be independent of the social phenomena which he or she studies (Blaikie, 1993; Easterby-Smith et al., 1991; Robson, 1993). This differentiation recognises the importance of observation, particularly for case study researchers.

In this study, the main goal of the observation was to experience how E-Learning development unfolds, based on the social interaction between various stakeholders, primarily E-Learning team members, the senior management of the University, the Central IS team and the rest of the University. A four-year period of observation was carried out. The researcher has attended most of the E-Learning related meetings held at university level. Notes were taken during each meeting, and further reflections were completed soon after the researcher had left the meeting room. Informal discussions with the team and other organisational members were found to be exceptionally valuable as participants were often more willing to talk about their personal viewpoints than during formal interviews. It is also vital for the researcher to compare the differences between the stories told by the same interviewee on different occasions. These meetings and discussions enabled the researcher not only to obtain vital details about the development process, but also to observe group communication and interaction.

3.3.3 Interviews and Interview Schedules

One of the main advantages of interviews is that they enable the researcher to probe for a clearer or more comprehensive explanation. It also provides the researcher with a considerable amount of flexibility. Through interviewing, the researcher can also provide feedback to clarify any questions that the interviewees might have during the interview. According to Cassell and Symon (1994), qualitative interviewing is a powerful tool for exploring the social reality that occurs in an organizational setting, particular through the use of focused questions. These characteristics associated with interviewing suggest that this method is highly appropriate for examining the topic of E-Learning development, which requires an understanding of the dynamic interplay between the organization, technology and service.

Various types of interview can be allocated on a continuum based on the degree of structure and the type of interview question (Jones, 1985). On one side of the continuum, interviews based on predefined sets of questions and standardised schedules are commonly called structured interviews. The other side of the continuum is unstructured interviews, in which the interviewers have a general idea in terms of what questions to ask and the interviewing process largely depends on the flow of conversation (Robson, 1993; Powney and Watts, 1987). The middle ground of this continuum is called semi-structured interviews. A semi-structured interview will typically contain a clearly defined research objective with some degree of flexibility in the wording and ordering of the questions (Robson, 1993). According to Jones (1985), interviews can be further divided into two categories based on whether open-ended or closed questions are asked. Another distinction is between in-depth

and survey interviews. While the former is used to obtain the insights of individual interviewees, the latter is often used to achieve a broad coverage of the sampled population (Powney and Watts, 1987; Jones, 1985).

In this study, the main aim is to understand the dynamic interplay between organizational, technological and service issues within the context of E-Learning development. In-depth interviews were therefore appropriate and were conducted on a semi-structured basis by using open-ended questions. This approach corresponds to the rationale suggested by Jones (1985):

> *"to understand other persons' constructions of reality we would do well to ask them (rather than assume we can know merely by observing their overt behaviour) and to ask them in such a way that they can tell us in their terms (rather than those imposed rigidly and a priori by ourselves) and in depth which addresses the rich context that is the substance of their meaning (rather than through isolated fragments squeezed onto a few lines of paper)." (p. 46)*

Based on the concept of theoretical sampling (Glaser and Strauss, 1967), the selection of interviewees was based primarily on the importance of ensuring that the interviewees can represent the reality constructed by the whole (Robson, 1993; Smith, 1983). Taking each E-Learning development project as the unit of analysis, therefore, one of the most essential issues to consider was to select interviewees who could collectively represent the E-Learning project from various aspects.

To fulfil the proposed objectives of this research, three cases based on the research context were conducted to represent two different levels - the research context at the university level and three cases at the school level. The interviewees targeted and selected for this research ranged from senior management, Central IS Department to the academic staff. For the research context at the university level, the pro-vice chancellor, several project managers and members of the Central IS team were interviewed. At the school level, the researcher interviewed all of the core team members for all three projects. It is vital to note that there are three types of stakeholder involved in the school projects, including the core team members who were involved in developing and driving the project; the academic staff who implemented the outcome of the project or were involved at a later stage; and the students or staff who were the end users of the projects. It was equally critical to take into account those organizational members who were not involved in the projects at the school level, but were involved in E-Learning development.

In total, 51 interviews were conducted for the research. The interviewee list is in Appendix 3.2. Due to the different roles of each interviewee, this research designed several types of interview questions for a variety of interviewees with different research purposes (listed in Appendix 2). There were 31 interviews lasted between 60 and 90 minutes and were recorded with the interviewees' permission. The conduct of most of the interviews was supported by an interview guide based on the key themes that this study aimed to explore. Rest of the interviews were conduct from variety of occasions e.g. conferences, informal meetings or discussions. Requests for follow-up interviews or email communications were also made at the end of several interviews. In total, there were fifteen follow-up interviews conducted,

mainly to ask further questions and clarify the ambiguities that arose during the initial interviews.

3.4 The Data Analysis Phase

3.4.1 Introduction

This section discusses the process through which the collected data were analyzed and interpreted to derive a new conceptual understanding towards the development of E-Learning. In particular, this section highlights the coding process which was used to reduce, organise and compare the collected data (Strauss and Corbin, 1990) within each of the three cases related to the selected research context.

3.4.2 Comprehensive Coding and Analysis Process

At the heart of any longitudinal study is the measurement and analysis of process data (Van De Ven, 2007). This research also belongs to a qualitative longitudinal study so it is necessary to review the data gathered by the researcher during this study using the following methods:

- Interviews with key persons and selected participants
- Direct observations of regular scheduled E-Learning Community meetings
- Recordings and field notes
- Emails, reports, presentation files and non-public documents.

Van de Ven, Angle and Poole (1989) reported that whatever data collection methods were used to observe change process in the field or from archival documentation, the capacity of the data would in most cases be overloaded. Initially, the author employed open coding technique (Glaser and Strauss, 1967; Corbin and Strauss, 2008) on the data from the first five interviews in order to explore established concepts. The open coding approach requires brainstorming by the researcher to investigate all potential concepts which are interpretive according to the data and theoretical grounds. Many methodology literatures on process research data analysis have emphasized that the volume of data is usually greatly beyond the capacity of even an experienced researcher (Van De Ven, 2007; Corbin and Strauss, 2008; Langley, 1999). After the open coding had been completed on data from the initial five interviews, the researcher realized that the process research coding approach would overstretch his capacity, confirming the argument for using efficient methods of arranging process phenomena (Langley, 1999). The researcher therefore realized that it was necessary to introduce Evolution of Innovation Concepts, Poole et al. (2000) to the research in order to achieve improved performance of coding results. However, the simple normative models cannot be applied to process research to illustrate the complex phenomena. As Van de Ven (1992) argues, the construction of a theoretical process theory should adopt a mechanism from definition, clarify it, and then be able to observe the process. This is an alternative way to explore the complex process research. From a macro view of theorizing the process data, Langley (1999) suggested more comprehensive strategies for analysing the process data. However, there still remains the challenge of analyzing the vast quantity of process data.

3.4.3 Making Sense of the Data

The observations of the last section led the researcher to realise that it would be necessary to examine all possible methods to analyse the process data. Langley (1999; 2005) reviewed seven strategies for this purpose, each having advantages and disadvantages while representing the range of abstract processes as realistic output. The determination of chosen strategies for making sense of the data is dependent on the nature of the theoretical grounds of research. Langley's contribution can be used as a guide for process design. Table 3.9 gives more details.

Strategy	Key Anchor Point(s)	Fit with Process Data Complexity	Specific Data Needs	"Good Theory" Dimensions (Weick, 1979)	Form of Sense-Making
Narrative Strategy	Time	Fits with ambiguous boundaries, variable temporal embeddedness, and eclecticism.	One or few rich cases. Can be helped by comparison.	High on accuracy. Lower on simplicity and generality.	Stories, meanings, mechanisms
Quantification Strategy	Events, outcomes	Focuses on "events" and their characteristics. Eschews ambiguity.	Needs many similar events for statistical analysis: one or few dense cases are best.	High simplicity, potentially high generality, modest accuracy (abstraction from original data)	Patterns, mechanisms
Alternate templates strategy	Theories	Adaptable to various kinds of complexity. Different templates capture different elements	One case is enough. Degree if freedoms come from multiple templates.	Each theory can be simple and general. Together, they offer accuracy, but simplicity and generality disappear with theory integration.	Mechanisms
Ground Theory strategy	Incidents (units of text) Categories	Adapts well to eclectic data and ambiguity, May miss broad high-level patterns.	Needs detail in many similar incidences. Could be different processes or individual-level analysis of the case.	High in accuracy, moderate simplicity. May be difficult to go from substantive theory to more general level.	Meanings, patterns
Visual mapping strategy	Events, orderings	Deals well with time, relationships, etc. Less good for emotions and interpretations	Needs several cases in moderate level of detail to begin generating patterns	Moderate levels of accuracy. Simplicity and generality. Not necessarily good at detecting mechanisms.	Patterns
Temporal bracketing strategy	Phases	Can deal with eclectic data, but needs clear temporal breakpoints to define phases.	One or two detailed case is sufficient if processes have several phases used for replication.	Accuracy depends on adequacy of temporal decomposition. Moderate simplicity and generality.	Mechanisms
Synthetic strategy	Processes (e.g. decisions, change efforts, new products)	Needs clear process boundaries to create measures. Compresses events into typical sequences.	Needs enough cases (5+) to generate convincing relationships. Moderate level of detail needed for internal validity.	Modest accuracy (but much better than questionnaire research). Can produce simple and moderately general theories.	Prediction

Table 3.9 Seven Strategies for Making Sense of the Process Data

(Langley, 1999)

Langley (1999) provided justification for possible approaches to process research. According to the nature of research questions, design, and data which the researcher collected for the present study, this information led to an evaluation of strategies suitable for data analysis. The implications of this greatly influenced how the data would be analyzed and what the results would be.

Referring to Appendix 3, the researcher collected a considerable amount of archive data during the period 2000 ~ 2008 from attendance at major decision-making meetings and participation at many E-Learning-related events, as well as interviews with key E-Learning stakeholders. The thesis applied narrative strategy to clarify the context, and employed visual mapping strategy to illustrate the process within the case studies.

3.4.3.1 Narrative Strategy

The narrative strategy has its origins in the works of ethnographers. Langley (1999) argues that the construction of a detailed story from raw data is, at least to some extent, part of all process research. When preparing a chronology for subsequent analysis, the researcher is, essentially, utilizing a narrative strategy. For Eisenhardt (1989), the narrative strategy is part of within-case data analysis, in which the researcher prepares detailed write-ups for each case. Eisenhardt (1989) argues that although these write-ups are mere descriptions, they are still central to the generation of insight. She also states that these descriptions help researchers to cope with the enormous volume of data at an early stage of the analysis process. Traditionally, narratives are rich at the level of detail and convey a high degree of authenticity, which is often not economically possible to achieve with larger sample sizes. One or few cases are therefore better suited for narrative data analysis.

The narrative strategy was used in the preparation of a chronology for subsequent analysis and in the summary of this thesis (Langley, 1999). It was used it in the sense

proposed by Eisenhardt (1989) – as a tool for validation. A relatively short narrative description was prepared for each case study.

3.4.3.2 Visual Mapping Strategy

Miles and Huberman (1994) suggest that graphical presentations are useful in many regards. Firstly, this strategy allows large quantities of information to be presented in little space. In addition, a large number of dimensions can be simultaneously displayed, allowing the researcher to develop and to verify theoretical innovations. Such dimensions are, for example, parallel processes, passage of time and different actors.

An attempt was made in this study to make sense of the sequence of events by studying them in a graphical form. During the pilot study, this research produced a graphical presentation of a single case, in which it was possible to embed different organizational levels, actors, commitments, driving forces, elapsed time and outcomes. Conceptualization in graphical form, therefore, seems most useful in gaining an overall view on a specific sequence of events. However, as Langley (1999) warns, the graphical presentation has a tendency to become overly simplified or too complex; nevertheless, it provided a good starting point for this study, and it also proved useful as a communication tool with the other researchers and practitioners involved.

3.4.3.3 Pattern-Matching

This research is structured around multiple-cases within a single context. Yin (2003b) implied that pattern-matching logic is one of the common and popular techniques for case study analysis. The concept of pattern-matching is "*a situation where several pieces of information from the same case may be related to some theoretical proposition*"(Campbell, 1975, p.179). In other words, pattern-matching is a consistent mechanism linking the data to propositions (Campbell, 1975; Campbell, 1966). The essential idea of pattern-matching is shown in Figure 3.2. The upper

section of the figure shows the theoretical realm i.e. what might be extrapolated from a well-developed theory; this might only be the opinions or "hunches" of the researcher. The conceptualization task concerns the transformation of these ideas into an orderly theoretical pattern presented by the ellipse in the upper part of the figure. The lower part of the figure represents the observational realm. This is an ambiguous term which should include direct observations, field notes, archival records, and interviews. The series collection or relevant information can be termed the "observed pattern", indicated on the lower ellipse in the figure. This is also part of the data analysis process. Furthermore, the consequent task of linking, or attempting to relate or match theories, might demonstrate a similar observed pattern and receive support (Trochim, 1989).

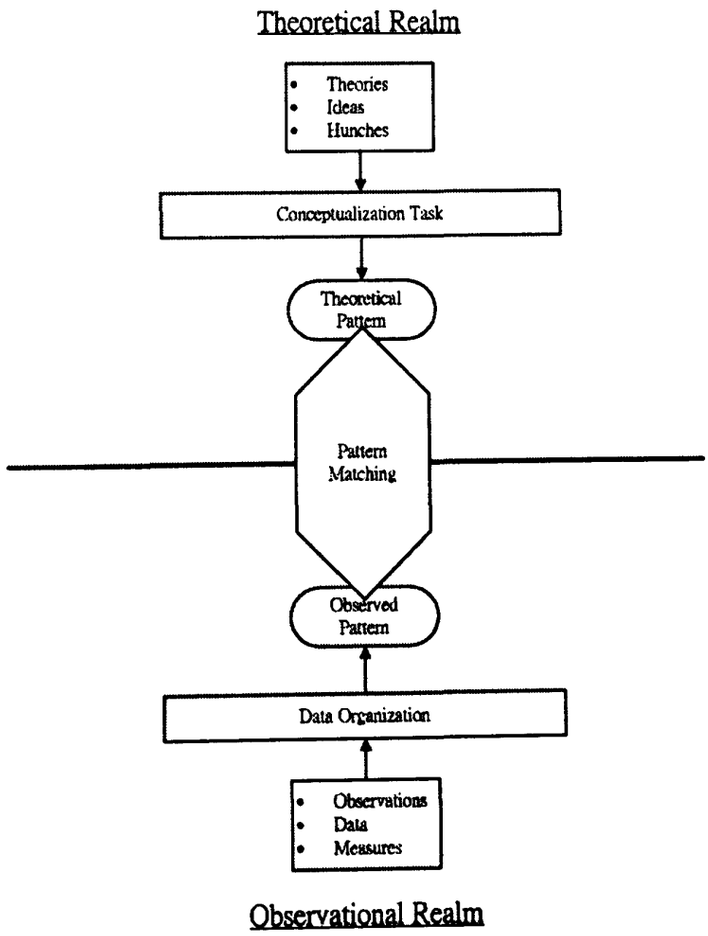


Figure 3.2 Pattern Matching Model

Source: Trochim (1989)

3.4.3.4 Example for Data Analysis

The following section describes the processes through which data analysis and interpretation led to the construction of the emerging theory. The section on "Making Sense of the Data" illustrates the different types of strategy which could be employed in the research - namely narrative, visual mapping and pattern-matching (Langley, 1999; Eisenhardt, 1989; Miles and Huberman, 1994; Yin, 2003a; Yin, 2003b; Campbell, 1975; Trochim, 1989; Trochim, 1985). Those strategies were applied to reduce, organise and compare the data extracted from the case studies.

The data analyses for the qualitative researches are usually highly abstract and obscure (Miles and Huberman, 1994). In addition, the data collected in qualitative longitudinal studies presented verbally rather than in numbers fails to convince traditional quantitative researchers. On the other hand, the nature of qualitative data is well-grounded and provides a rich explanation of processes in the accounts of research contexts (Miles and Huberman, 1994). This is particularly useful to generate or revise the conceptual framework (Langley, 1999; 2005). The MELEES organizational innovation process has been selected as an example which explains how the data was collected, generated patterns and matched theory.

1) Generating Pattern Codes

In describing the design of this research, the author clarified how to deal with the massive amount of chronological and rich qualitative data. In the early stage of data analysis, the first priority was to identify patterns from the data collected.

Initially, the researcher identified from data acquired during 2000~2004 some appropriate and interesting cases for study. A high level of integrity was required to ensure validity of results. The researcher also labelled and categorized all documents and interview transcriptions collected (see Appendix 3). Data was surveyed and reduced into a small number of concepts that could be encoded, stored and easily

retrieved for application at a later stage. In the initial coding stage, the visual mapping method (Miles and Huberman, 1994; Langley, 1999) and open coding of ground theory (Glaser and Strauss, 1967; Strauss and Corbin, 1998; Corbin and Strauss, 2008; Charmaz, 2006; Bryant and Charmaz, 2007) were fairly similar, although they differed slightly in their practical applications (Table 3.10).

Visual Mapping Method	Open Coding of Ground Theory
Deals well with time, relationships. The events and ordering sequences are the focus for the researcher (Miles and Huberman, 1994), having identified what he was seeking. Adopting this method could prevent the danger of "drowning in data" (Boeker, 1989).	Open coding is to explore theoretical possibilities discernible in the data. Concepts are central elements represented by the data and are the foundations of the emerging theory (Charmaz, 2006; Bryant and Charmaz, 2007; Glaser and Strauss, 1967).

Table 3.10 The Difference between Visual Mapping and Open Coding Method

2) Case Displays: Exploring and Describing

Eisenhardt (1989) stated that the within-case data analysis is at the heart of the qualitative research. The present research employed the visual mapping method which focussed on each event in order to generate innovation processes; this method was straight forward and easily applicable.

3) Time-Ordered Display

The visual mapping method deals with time and events. Time-ordered displaying the analysed data by time and sequence was therefore the preferred way to present the extracted data. Two examples which illustrate the critical event listing, as shown in Table 3.11:

- ***Example 1. MELEES Organizational Innovation Process***

In an excerpt from the MELEES case study in Table 3.11 below, the author has displayed the events associated with the MELEES organizational innovation process, placing them into different phases over time. After the initial coding steps, the author

mapped out the events and also categorized them according to organizational level. The expansion stage represents the extension of the MELEES project:

Time Period (1998 – 2009) — Critical Events and Sources

Level	Central Information Systems	Project Technician	Individual Module Convenor	Data Source	Research Note	Researcher Labelled
			Few people in the School of Mathematics in interested in computer assistance learning.	IV19, IV20, NPD86	During the field study, the researcher realized that some of the academics interested in CAL might devote some of the strengths individually	Idea
	The E-Learning Strategy Group was established			NPD86, IV5, IV2, IV19, IV20, IV21, IV22	The Official E-learning Strategy Group established in order to clarify the e-learning strategy and responded the pressures from the bottom of the university and competitors.	
	Call for the E-Learning development fund			NPD86, IV19, NPD87	Actions taken from the top management	Funding Bid
			Prepared for the funding proposal	IV19, IV20	The individual staffs who were interested in the funding prepared the solutions and apply for the finding.	
		Project leader invited the most senior staff in the department as a coordinator.		IV19, IV20	Tried to setup a team, the project leader realized that he need a senior staff to support him in order to reduce the conservative comments.	Core Team Setup
		The project leader decided to hire one of his student as a technician.		IV19, IV20, IV22, IV21	The project leader need a technician to produce the E-Learning materials and website. (First team)	
		Recruit one professional multimedia developer.		IV19, IV20, IV22, IV21	After the technician student graduated, the PM recruit a professional multimedia developer which is a catalyst to enhance the performance	Engaged with Technicians
		Official administration role was taken by the school secretary.		IV19, IV20, IV21, IV23	More and more modules online, the MELEES team handed the admin jobs to the school sectary.	More Academic Staffs Involved
			Half staffs in the school of Mathematics involved with this project.	IV19, IV20, IV21, IV23	The MELEES's performance was good, lots of staffs would like to join spontaneously	
	The MELEES service teaching aimed to deliver to Malaysia Campus			IV19, IV20, IV5, IV1, IV2	The performance and feedback of MELEES project was good, the higher management decide to deliver the MELEES service teaching to the overseas campus	Spin Out Phase 1
	The MELEES service teaching aimed to delivered to China Campus			IV19, IV20, IV5, IV1, IV2		Spin Out Phase 2

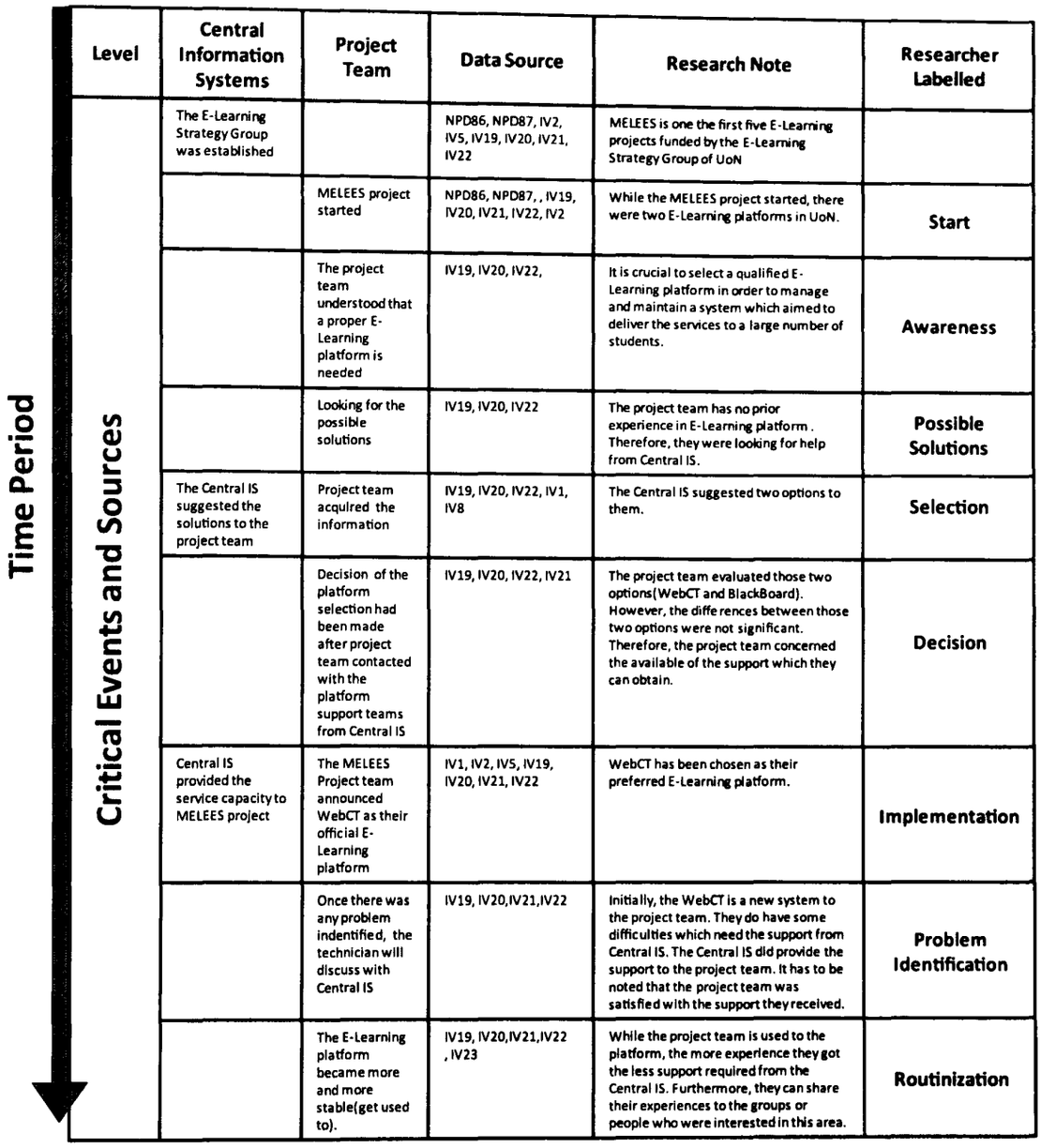
Table 3.11 Event Listing for Organizational Innovation of MELEES Case Study (Please refer to Appendix 3 for data source)

The table illustrates how the author ordered the events embedded in this data into a labelled sequence, observing pattern. Applying the "Pattern-Matching" principle

adjusted the observed and theoretical pattern (Rogers, 1995) and implemented the MELEES organizational innovation process (described in Chapter 6).

- ***Example 2. MELEES Technological Innovation Process***

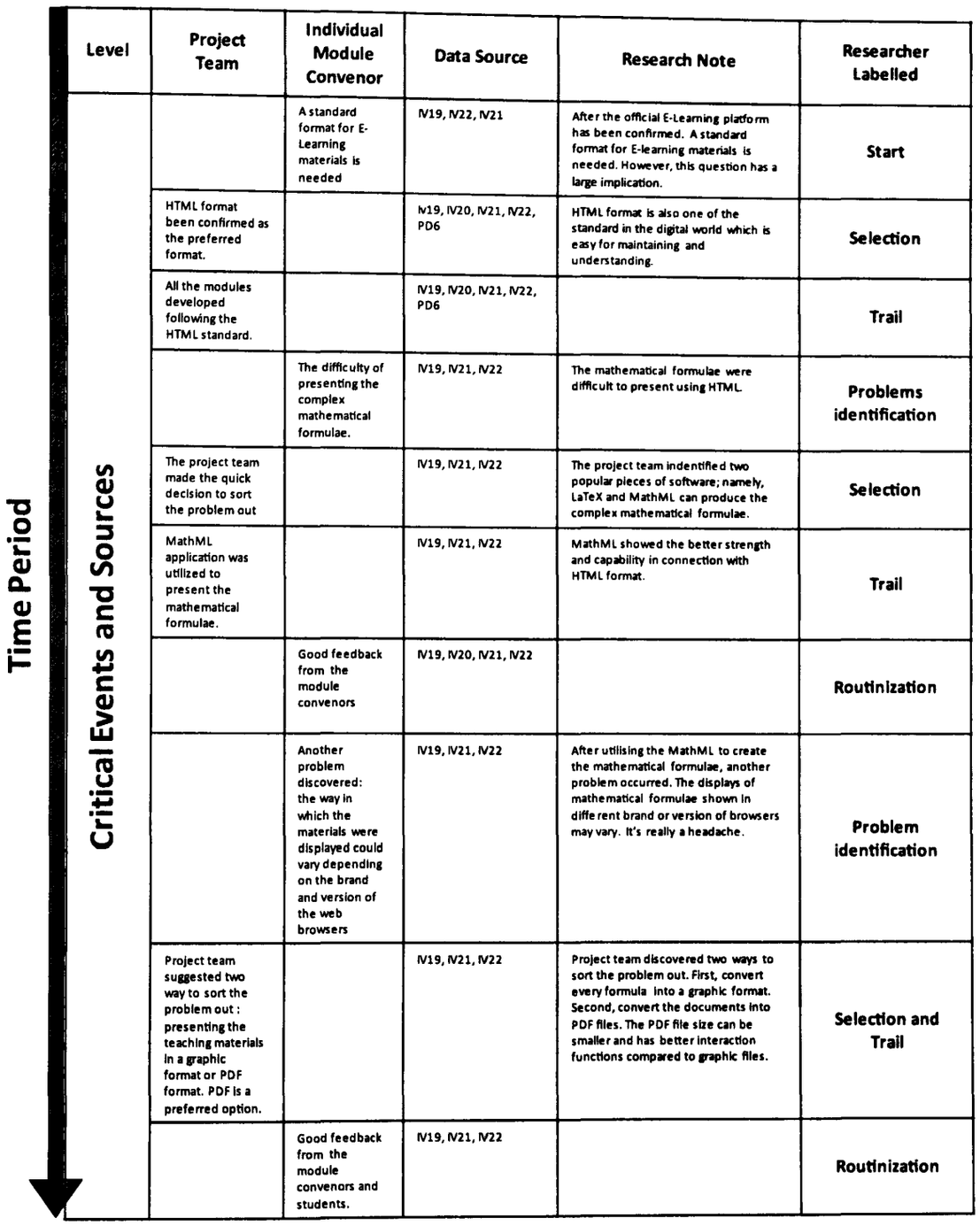
This excerpt from the MELEES case shows how the author also employed the visual mapping method, illustrating the MELEES technological innovation process along the timeline. However, during the data collection phase, the researcher observed that it would be necessary to present platform and tool selection processes separately because an E-Learning platform is the foundation of the system, implying that tool selections are strongly related to platform functions and characters. Once the platform selection has been confirmed, it would be not easy to change to another. Because of these features, therefore, the research separated the E-Learning technological innovation as two separate processes.



Level	Central Information Systems	Project Team	Data Source	Research Note	Researcher Labelled
	The E-Learning Strategy Group was established		NPD86, NPD87, IV2, IV5, IV19, IV20, IV21, IV22	MELEES is one the first five E-Learning projects funded by the E-Learning Strategy Group of UoN	
		MELEES project started	NPD86, NPD87, , IV19, IV20, IV21, IV22, IV2	While the MELEES project started, there were two E-Learning platforms in UoN.	**Start**
		The project team understood that a proper E-Learning platform is needed	IV19, IV20, IV22,	It is crucial to select a qualified E-Learning platform in order to manage and maintain a system which aimed to deliver the services to a large number of students.	**Awareness**
		Looking for the possible solutions	IV19, IV20, IV22	The project team has no prior experience in E-Learning platform . Therefore, they were looking for help from Central IS.	**Possible Solutions**
	The Central IS suggested the solutions to the project team	Project team acquired the information	IV19, IV20, IV22, IV1, IV8	The Central IS suggested two options to them.	**Selection**
		Decision of the platform selection had been made after project team contacted with the platform support teams from Central IS	IV19, IV20, IV22, IV21	The project team evaluated those two options(WebCT and BlackBoard). However, the diffe rences between those two options were not significant. Therefore, the project team concerned the available of the support which they can obtain.	**Decision**
	Central IS provided the service capacity to MELEES project	The MELEES Project team announced WebCT as their official E-Learning platform	IV1, IV2, IV5, IV19, IV20, IV21, IV22	WebCT has been chosen as their preferred E-Learning platform.	**Implementation**
		Once there was any problem indentified, the technician will discuss with Central IS	IV19, IV20,IV21,IV22	Initially, the WebCT is a new system to the project team. They do have some difficulties which need the support from Central IS. The Central IS did provide the support to the project team. It has to be noted that the project team was satisfied with the support they received.	**Problem Identification**
		The E-Learning platform became more and more stable(get used to).	IV19, IV20,IV21,IV22 , IV23	While the project team is used to the platform, the more experience they got the less support required from the Central IS. Furthermore, they can share their experiences to the groups or people who were interested in this area.	**Routinization**

Table 3.12 Event Listing for Platform Selection of MELEES Case Study

(Please refer to appendix achieve list for data source)



Level	Project Team	Individual Module Convenor	Data Source	Research Note	Researcher Labelled
		A standard format for E-Learning materials is needed	IV19, IV22, IV21	After the official E-Learning platform has been confirmed. A standard format for E-learning materials is needed. However, this question has a large implication.	**Start**
	HTML format been confirmed as the preferred format.		IV19, IV20, IV21, IV22, PD6	HTML format is also one of the standard in the digital world which is easy for maintaining and understanding.	**Selection**
	All the modules developed following the HTML standard.		IV19, IV20, IV21, IV22, PD6		**Trail**
		The difficulty of presenting the complex mathematical formulae.	IV19, IV21, IV22	The mathematical formulae were difficult to present using HTML.	**Problems identification**
	The project team made the quick decision to sort the problem out		IV19, IV21, IV22	The project team indentified two popular pieces of software; namely, LaTeX and MathML can produce the complex mathematical formulae.	**Selection**
	MathML application was utilized to present the mathematical formulae.		IV19, IV21, IV22	MathML showed the better strength and capability in connection with HTML format.	**Trail**
		Good feedback from the module convenors	IV19, IV20, IV21, IV22		**Routinization**
		Another problem discovered: the way in which the materials were displayed could vary depending on the brand and version of the web browsers	IV19, IV21, IV22	After utilising the MathML to create the mathematical formulae, another problem occurred. The displays of mathematical formulae shown in different brand or version of browsers may vary. It's really a headache.	**Problem identification**
	Project team suggested two way to sort the problem out : presenting the teaching materials in a graphic format or PDF format. PDF is a preferred option.		IV19, IV21, IV22	Project team discovered two ways to sort the problem out. First, convert every formula into a graphic format. Second, convert the documents into PDF files. The PDF file size can be smaller and has better interaction functions compared to graphic files.	**Selection and Trail**
		Good feedback from the module convenors and students.	IV19, IV21, IV22		**Routinization**

Table 3.13 Event Listing for Tool Selection of MELEES Case Study

(Please refer to appendix achieve list for data source)

3.4.3.5 Cross-Case Analysis

Eisenhardt (1989) argues that the cross-case analysis should preferably be used for searching patterns. To her, the overall idea is to force the researcher to go beyond the initial impressions using structured and diverse lenses on the data. As a result, the likelihood of achieving an accurate and reliable theory is improved. Three tactics are suggested: 1) select categories and look for within-group similarities coupled with intergroup differences, 2) select pairs of cases and list the similarities and differences between each pair, and 3) divide the data by data source to exploit "*unique insights possible from different types of data collection*" (Eisenhardt 1989, pp. 540-541).

Cross-case analysis techniques have been employed in Chapter 7, using the first and second tactics proposed by Eisenhardt (1989). Specifically, the cases are compared with the three aspects defined in Chapter 2, in order to identify any patterns concerning the process. The method proved efficient since it enabled the comparison of different cases from the chosen perspectives; this would not have been possible otherwise.

3.5 Conclusions

This section has elaborated numerous methodological issues and concerns related to the study as a whole. The philosophical discussion explained the epistemological and ontological stances that shaped the perspective of this study. The selection of the case study method provided not only flexibility in adopting multiple data collection methods (Yin, 2003b), but was also crucial in articulating the insights embedded within the organisational context (Van Maanen, 1979). The construction of the case study protocol was extremely useful in clarifying necessary procedures and enhancing the reliability of the chosen case studies (Stake, 1995; Yin, 2003b). The data collected through the interviews, observation and documentation were systematically analysed based on the techniques of several strategies (Strauss and Corbin, 1990). The iteration between the collected data and developing concepts helped the researcher not only to generate more relevant and appropriate categories and sub-categories, but also to identify the potential links between categories. The

following two chapters highlight the data collected from the research site and the analysis results derived from the use of the different coding techniques presented in this chapter.

CHAPTER 4 RESEARCH CONTEXT: THE UNIVERSITY OF NOTTINGHAM

4.1 Introduction

This chapter presents the context of the study undertaken by the researcher at the University of Nottingham. He has been a member of the Nottingham University E-Learning Community since 2004 and has spent almost four years investigating the E-Learning development process in an institution of higher education. One of the key factors for the implementation of successful E-Learning is organizational support, especially in higher educational institutions. The E-Learning development in the University not only enhances course innovation, but also the changes in organizational structure and Information Systems as previously discussed in Chapter 2. This chapter therefore seeks to present E-Learning development within the context of the whole University.

4.2 Background to the University of Nottingham

The University of Nottingham is known as a leading university, ranked 70th in the world, and in the top 1% of the over 7,500 higher education institutions worldwide. It is the fifth largest university in the UK[19] (as measured by numbers of students), with excellent quality of teaching and learning, and it also belongs to several national and international organizations, such as Universities 21[20] , the Russell Group[21], the Association of Commonwealth Universities[22], and the European University Association[23]. Nowadays, the University has become an international university with six campuses across UK, Malaysia and China. The University is usually supported by a vast amount of funding for research. In addition, as a research-led university, Nottingham also has strong links with the private sector, including Powergen (E.ON),

[19] Higher Education Statistics Agency (http://www.hesa.ac.uk/dox/dataTables/studentsAndQualifiers/download/institution0607.xls), Retrieved 16, August, 2008

[20] Universities 21, http://www.universitas21.com/, Retrieved 16, August, 2008

[21] Russell Group, http://www.russellgroup.ac.uk/, Retrieved 16, August, 2008

[22] Association of Commonwealth Universities, http://www.acu.ac.uk/, Retrieved 16, August, 2008

[23] European University Association, http://www.eua.be/, Retrieved 16, August, 2008

the Boots Company, the Ford Company, and Rolls-Royce. There are six faculties housing 31 schools, and more than 33,000 students from over 140 countries, making the University of Nottingham an advanced and comprehensive institution.

4.3 E-Learning Development at the University of Nottingham

The University of Nottingham is a traditional and prestigious university with a high academic ranking, but which is also, inevitably, facing the vigorous challenges of the digital world. Furthermore, the impact of E-Learning is a paradigm shift; the impact is similar to the invention of the "book" on the world. E-Learning is overthrowing traditional teaching and learning; the invention of the book is a kill application for knowledge endurance. In other words, while the impact of E-Learning on academia is immense, little experience existed within the institution to put it into practice, despite the fact that every institution would like to master the skills it involves.

4.3.1 The Reasons for Adopting E-Learning

- **The Influence of the Institutional Context**

It goes without saying that it is important to apply the new pedagogies to teaching and learning. They can be presented in various ways, including Computer Assisted Learning (CAL), Computer Assisted Instruction (CAI), Information and Communication Technology (ICT), and Electronic Learning (E-Learning). Similar in nature, they aim to provide alternative ways of using computers to supplement the traditional learning in universities. Moreover, the nature of E-Learning is to provide an environment in which the students can enjoy interactive pedagogy in order to increase their motivation and improve their learning performance.

Starting in the early 1990s, the Internet developed the digital world and the Internet infrastructure matured. In 1994, Mosaic was introduced, which is the concept of Internet Explorer. After 1996, the growth of broadband capabilities became the

major goal of the Internet which, it could be argued, also became a catalyst for distance learning. It is worth pointing out that the University of Nottingham was responsible for initiating E-Learning activities in the mid-1990s:

> *The origins of a lot of this go back to about mid 90s and something called Enterprising Higher Education which was a programme for getting more imaginative, more skills-based approaches to learning embedded in the universities. (PVC, Prof. Christine Ennew)*

The years between 1995 and 2001 were the era of the dot-com boom. During that time, billions of dollars and pounds were invested in Internet-related industries world-wide. People believed that the Internet boom would happen quickly; that once these mechanisms were up and running, customers would flock to use them. Everyone was saying that the use of Internet technology would bring benefits.

• The Impact of the Educational Industry Environment

Since the dot-com era, E-Learning in the higher educational context still seems to be developing vigorously. The pioneer E-Learning university, *Massachusetts Institute of Technology (MIT)*, initiated free open courses[24] online, establishing tutors as central to the learning process. It shows an alternative way for students to gain professional knowledge other than enrolling at and attending an institution. Indeed, universities seem to attract more students through E-Learning.

Even leading universities such as Columbia University expressed a similar opinion about the profit aspect of E-Learning, illustrating a beautiful future world:

[24] MIT Open Course Ware: http://ocw.mit.edu/index.html

.....the "millions of visitors" will swarm to the new site, including retirees and students will pay to tap into this educational services.....

.....Free pages will feed into profit-generating areas, such as online courses and seminars, and related books and tapes.....If they capture this space, they'll begin to cherry-pick our best faculty..... (Columbia executive vice provost Michael Crow)

During the late dot-com era, the British government also joined in as a major player in dedicating efforts towards E-Learning. U.K. eUniversities (UKeU) jumped onto the E-Learning bandwagon just before the dot-com crash in 2000. In the same period, Oxford, Yale and Stanford also launched the AllLearn project in 2001 as their ambitious E-Learning venture, an international project with huge investment.

- **The Pressure from Competitors in the UK Higher Education Context**

Since the E-Learning bandwagon of the dot-com era, E-Learning has been viewed by many as a "killer app" of the Internet (Oblinger and Kidwell, 2000). Universities, as the investors, are desirous to put their money into E-Learning start-ups because they believe that there will be huge payoffs.

Since 2000, almost 90% of all universities in the US, including NYU[25] Online and the University of Illinois On-line, together with most UK universities e.g. the University of Warwick, Imperial College and the majority of Russell Group[26] universities, have set up an individual E-Learning plan (Svetcov, 2000) in the face of serious pressures of competition . Nearly all have set a trend in using the Internet as

[25] NYU: New York University

[26] The Russell Group: is an association of 20 major research-intensive universities of the United Kingdom which accounted for 66% of Universities' research grant and contract income in 2006/2007 (Source: http://www.russellgroup.ac.uk/)

a medium for delivering knowledge. In addition, private corporations and government organisations that spend large amounts on training have acknowledged that the E-Learning courseware is the best alternative to classroom training. There is no doubt that E-Learning spread widely in the context of higher education in the UK as universities became afraid of being left behind by their competitors and believed that E-Learning would bring them additional strength and benefits.

- **The Demand from the Basic Level (Individual Staff)**

Since the 1960s, language teachers have been considering alternative ways to assist learning (Barson and Debski, 1996), from behaviouristic learning and communicative learning to integrated learning, indicating a trend for computer-assisted language learning. From the early days, drill-and-practice for integrated learning was applied to computers in order to encourage integration between learners and instructors.

From the 1990s, personal computers have gradually become an indispensable aid for teachers and students within a variety of disciplines. The teachers started to utilize the computer as a tool to enhance their teaching performance. In classroom teaching, the students can be isolated and lack motivation. As computer technology developed, teachers who were technologically-advanced users initiated activities using computers as supplements to the traditional teaching methods in multi-disciplines such as Education, Geography and Mathematics:

> ..... *learning mathematics can be very difficult, providing the students with electronic workbooks with instance feedback is a good concept to enhance students' learning performance.....(the Mathematics teacher's comments on the HELM*[27] *project)*

[27] HELM: **Helping Engineers learn Mathematics.**

……what I wanted to do in my first lectures is to have web pages as support information for my lectures. Every course that I have taught from 1998 until the present always has a webpage supporting information, which I write every year……(Professor Michelle Clarke, School of Geography)

There was no formal E-Learning strategy at the University to popularize E-Learning before 2000. Nevertheless, E-Learning was showing its unique abilities as a future star performer for teaching and learning.

4.3.2 E-Learning Organizational Development

Before 2000, E-Learning development was only at a personal level, led by the interest of individual staff (Prof. Michèle Clarke[28]; Stephen Hibberd[29]; Gordon Joyes[30]). Formal E-Learning development at the University of Nottingham began with the establishmentof the E-Learning strategy group in 2000[31]. Subsequent changes of the organization up to 2005 led to different strategies and directions of E-Learning development in the University, the most significant of which are shown in Table 4.1 below. The changes will be detailed in the following sections.

Year	Organizational change
2000	The E-Learning strategy group was set up
2004	IS learning team leader, Andy Beggan, was hired
2004	Focus group was set up
2005	the eLeK Community was set up

Table 4.1 Timetable for E-Learning Organizational Development in the University of Nottingham

[28] Document IV18
[29] Document IV19
[30] Document IV12
[31] Document NPD86

4.3.2.1 The E-Learning Strategy Group

"The E-Learning Strategy Group", established in 2000, is the first formal group to become directly involved in e-leaning development at the University of Nottingham. Its aim was to evaluate E-Learning in the university:

> *..... the group is to review the University's current involvement in E-Learning; evaluate the options for potential future involvement; and identify potential the human capital and infrastructure requirements associated with further investment in technology mediated learning..... (PVC. Prof. Chris Ennew)*

The group undertook a review of the University's former involvement in E-Learning, evaluating the options for potential future involvement, and identifying the potential human capital and infrastructure requirements associated with future investment in technology-mediated learning (E-Learning). The members of the group included staff from the Schools of English, Pharmacy, Clinical Laboratory Sciences, Business, Education, Medicine, Manufacturing Mechanical Materials, Management Engineering, and Politics, together with staff from administration and support departments such as the Centre for Teaching Enhancement and Information Services. All Heads of School (22 in total) were included in the survey. The E-Learning Strategy Group met more or less weekly with those practitioners from late 2000 to April 2001. Their survey also included the evaluation of their competitors, such as Warwick's Distance Learning MBA courseware.

The group's investigation was University-oriented, covering a) E-Learning market research b) potential directions for Nottingham c) implications for infrastructure; d) conclusions and recommendations and e) suggestions for implementation. During the initial investigation phase, which was also an opportunity to raise E-Learning visibility within the University, there may have been some schools that were not yet

seriously taking E-Learning into account, so this may have provided an opening for discussion with them.

The E-Learning strategy group, identifying that there was no University-wide strategy, used the information they had collected, including the sub-schools' demands and suggestions from practitioners, to produce the first version of Nottingham University E-Learning strategy. It is worth noting that the strategy was not stand-alone, but integrated with the University's wider strategy. Up to that time, E-Learning development had no real direction, but in spring 2001 it was confirmed that the University would support E-Learning development centrally. Henceforward, E-Learning strategy was formerly embedded within the University strategy and in June, 2001 the first draft E-Learning strategy was produced following the principal considerations of the E-Learning strategy group.

The strategy group was also restructured in order to carry out further work after the first E-Learning strategy was announced. Professor Pamela Gillies took over from Professor David Greenaway as chair and called for proposals for E-Learning projects in June, 2001. Meanwhile, five initial E-Learning projects were selected and founded across the University (see Section 4.4.4).

4.3.2.2 The Focus Group

In 2004, E-Learning activities have made considerable progress in some schools, e.g. Mathematics, Pharmacy and Education; indeed the demand for E-Learning within the University-wide context has increased significantly. Besides considering the capacities of the IS infrastructure, the demand for technological support from the Central IS Department for sub-schools has also increased. However, a stable situation needed to be reconstructed in order to handle the increasingly complicated challenges, and ensure the direction of E-Learning implementation, working in coordination with different schools. The E-Learning strategy group needed full-time staff to map and devise the strategy at the operational level.

A new IS Learning Team Leader, Andy Beggan, was appointed in March 2004. His mission was to carry out the e-Nottingham[32] plan, to structure and integrate E-Learning activities, to evaluate the previous E-Learning strategy, and to address insights into further developments. He also called for the VLE focus group and held monthly meetings in order to gather more information, exchange experience and discuss the ideas from different schools. The members of the VLE focus group were selected from different schools. The IS learning team replaced E-Learning strategy group, responding to E-Learning development in the University:

> *In order to keep the focus group as representative as possible (across as many schools/ facilities as possible), the nominations were suggested by IS learning team as having a keen interest in using E-Learning to support the teaching and learning from different schools. (Email from IS Learning Team Leader)*

4.3.2.3 The eLeK Community

In 2005, E-Learning development at the University of Nottingham represented a significant achievement, with 800 modules online (from WebCT's official website). E-Learning had become part of teaching and learning in some schools. However, from 2002-2005, E-Learning development in sub-schools was the result of each school's own initiative. The senior management level at the University did not have an agreed policy to respond to the circumstances. Even the Central IS learning team sought hard to provide services. Cooperation from the higher management level is still crucial in driving the E-Learning strategy. In addition, UKeU had forecast failure, and subsequently the HEFCE made surplus monies available from UKeU for individual universities to develop their E-Learning strategies. This was also a key catalyst for universities to move forward in terms of their E-Learning development. The University also established an "E-Learning and E-Knowledge Community" to

[32] E-Nottingham: a comprehensive E-Learning, e-business strategy and information structure for developing Nottingham University's e-campus.
http://www.nottingham.ac.uk/is/about/projects/unopod/documents/Introducepilot.pdf

drive its E-Learning development plan. The members of the eLeK Community stated that its role had the potential to cross-over with ongoing work by the Internationalisation Committee, the Teaching Committee and the IS Strategy Group, and by at least three Pro Vice-Chancellors (PVCs) and senior staff involved in the E-Learning taskforce; hence, including representatives from all of these areas.

- **The eLeK Decisions**

In order to respond to the challenges of internationalisation, enhance understanding by cross-disciplines, and promote E-Learning strategy in practice, the eLeK Community immediately took the following decisions:

1. To Establish an E-Learning Business Committee:

An E-Learning Business Committee meets regularly to support the E-Learning Director and associated projects. The budgets of the E-Learning projects are discussed within the "E-Learning Business Community". Members meet four times a year, more frequently if necessary.

2. To Appoint an E-Learning Director:

This is a new position in the University. The role of the E-Learning director is to lead the E-Learning strategy into practice at the operational level, and also to encourage greater involvement with E-Learning.

3. To Implement a Learning Team Strategy:

The eLeK Community agreed that the IS learning team should expand to include three more learning technologists. They have also identified funding opportunities for schools that have been innovating and exploiting E-Learning for a while, and for those schools that have traditionally underused E-Learning and so require an upfront investment to help to implement it.

Currently, the eLeK Community meets four times a year to investigate any potential opportunities and to discuss policy to support the strategy for E-Learning development. In 2008, the University demonstrated its leadership by spreading this E-Learning achievement to overseas campuses in Malaysia and China.

4.3.3 E-Learning Technological Development

It goes without saying that the development of E-Learning related technology has a long history at the University. However, it can be argued that, if the Internet is the main method of delivering E-Learning material, then the technological maturity of the Internet would be a fundamental aspect of E-Learning technological development. Internet technology also made remarkable progress in the dot-com boom and transformed our everyday lifestyle as well as methods of teaching and learning. As a result, there has been a widespread adoption of the new technology by academics in their teaching.

The potential advantages of using computer-based technology for teaching, learning and assessment to facilitate a flexible provision within the field of mathematics has been apparent for many years. The courseware provision authored within the 1990s was based on the prevailing technology and resulted in a predominantly "CD-based" format, although it was often deliverable over a network. However, the early computer-based learning objectives were stand alone without any interaction with other learners and instructors.

The increasingly available technology associated with E-Learning is now web-based and there is a growing implementation within HE Institutions of Virtual Learning Environments (VLEs):

"*Before 2000, some technology advanced lectures have individually installed Blackboard or set up their servers to provide the additional learning materials to the student*" (Dr. Gordon Joyces, School of Education).

During 2002, the Central IS Department of Nottingham University was piloting two Virtual Learning Environments (VLEs), WebCT and BlackBoard, with an underpinning content management system, which enabled learning and support materials to be configured, targeted and managed to meet the local requirements of the teaching staff and to link readily to the supporting resources.

4.3.3.1 Single Virtual Learning Environment Confirmation

Significant numbers of E-Learning modules were delivered before 2003. Some teaching staff provide their module supplements from the webpages, but a few module conveners set up their own servers for students to access. The virtual learning environments are now most often used to supply traditional learning. From an administrator's viewpoint, managing such vast numbers of modules or students is a priority. The majority of staff who use E-Learning to enhance their teaching do so through a platform that requires promoted management functions. Under the circumstances, an E-Learning system is usually known as a Learning Management System, which offers lecturers and students access to stored work, E-Learning materials, and the facility to track progress, as well as opportunities to communicate and collaborate with one another.

Before 2000, the Internet bandwidth was too narrow to deliver the rich media of E-Learning materials and in any case there were few E-Learning materials on the market. Only a few scholars with an advanced vision could therefore sense the importance of LMS. WebCT is probably the first example, established in 1997, and most followers came on board after that. In 1998, only a few staff at the University applied LMS with the particular intention of supporting their teaching. After 2000, after BlackBoard[33] was introduced to the commercial educational market, the University also bought it as a trial LMS. Along with WebCT, there are two LMSs running in the University and the Central IS Department supports both.

[33] BlackBoard: a Learning Management Systems Vendor.

Until 2004, there had been a rapid increase in the use of VLEs within the University, but few schools had run their E-Learning modules with recognized results. Some of the schools were trying to initiate their E-Learning solutions, while others were evaluating E-Learning demand within their schools. The Central IS Department had to support two E-Learning systems (WebCT and Blackboard) fully, with a limited number of staff:

.....the University was paying twice the amount of money for two systems that did exactly the same job and it was a headache and there was a team supporting both and then it was the question of which is better.....(IS Learning Team Leader)

From the Central IS Department' viewpoint, supporting two VLE systems was not cost effective and wasted labour - both platforms need their own supporters. However, there is not a great difference between these two systems, so in order to select a suitable VLE, the Central IS Department conducted a series of evaluations focussed on the following criteria:

1. **Academic Criteria:**

- Support tools/Facilities: the questions concern the Cyrillic alphabet - including e-mail and instant messenger, online audio-video collaboration and the creation and support of a curriculum map etc.

- Ease of use (of frequently used tasks): the questions focus on querying student data (tracking), file management, the preparation of online teaching materials (including creation, manipulation and editing) and recycling the existing learning materials across different courses etc.

- Enhancing learning and teaching: the questions aim to find out how effective VLE would be in enhancing teaching and learning in different schools; how

flexible VLE is in supporting different pedagogic strategies (for example, self-directed learning, collaborative learning, problem-based learning); and how important it is for the future VLE development strategy to match teaching and learning goals etc.

2. **Technical Criteria:**

- Integration with the Portal
- Integration with GroupWise
- Integration with student records
- Integration with library systems
- E-Learning standards conformance
- Technical support

The evaluation survey designed according to the above criteria was sent to the focus group after demonstrations by the two VLEs vendors. The feedback was enthusiastic, receiving positive comments - see the following table for selected examples (the author also participated in the VLE focus group and these comments are based on the author's notes):

Staff	Comments
Dr. Gordon Joyes – School of Education (academic)	From an academic view I would give Blackboard…and WebCT…Blackboard: I was surprised that they did not demonstrate "pedagogy"- emphasis is the ease of use by academics. The concern is that the platform has a "conventional" tutor-led/ transmission pedagogy feel without covering the "student" view. WebCT: Campus Edition 6 – Made a big play of being pedagogically driven, Discussion group functionality is much improved. The MySQL server database is potentially integrated with innovated pedagogies. Some interesting student management tools which allow students to enroll in a group are also included.
Dr. Richard Windle: School of Nursing	I felt that WebCT was better demonstrated in terms of its pedagogy. The issue of pedagogy, learning and teaching appears to have much more clearly influenced the recent development of WebCT, which, as a VLE, seemed more reactive to the needs of the current trends in the higher education sector, such as e-groupwork, multimedia, etc.
Suzanne Wright- IS Learning team (technician)	WebCT is easier to find information. Blackboard, you have to register to find anything useful and I never received a confirmation email from it which I was expecting and couldn't get in for a while. Not easy to search on the Blackboard site. WebCT is easier to find the information.
Gill Fourt- IS Learning team (technician)	WebCT's presentation consisted of a lot of "vapour-ware". It is easy to talk about what will probably be included in campus Edition 6, but we need to be aware that if they are chosen then they may turn around subsequently and say "*Oh sorry- that feature is only going to be in Vista after all*". Bb did show live, existing products rather than promised software. Blackboard however show parts of their current Content Management package which would be extra, and we are unlikely to buy it.

Table 4.2 Comparison between WebCT and Blackboard by the VLE Focus Group

After serious discussion, the Central IS Department proposed to recommend WebCT as a preferred VLE. However, the Central IS Department still supports Blackboard and helps schools to transfer or move courses from Blackboard to WebCT. Confirmation of WebCT as an official E-Learning platform is a major decision for E-Learning development within the University.

4.3.3.2 E-Learning Tool Projects: Xerte and Podcast

Resistance to change from those familiar and comfortable with traditional learning and teaching approaches is one of the main barriers to adopting E-Learning (Berge, 2002). A fairly common response from academics reluctant to adopt E-Learning is they do not have sufficient technological knowledge to create E-Learning materials. If they cannot convince themselves that they can create high quality E-Learning materials, they probably will keep to the original teaching method to which they are accustomed. The University developed and applied several E-Learning tools to enhance and support academic staff to use E-Learning. Xerte[34] and Podcast, two outstanding examples that are well used for E-Learning course development in the University, are introduced below:

- The Xerte Tool

The "Xerte", which is developed by the University itself, is a server-based suite of tools. Users can assemble content using simple wizards, and easily collaborate on projects. E-Learning materials can be authored quickly and easily using browser-based tools, with no programming required. The idea behind Xerte project is to create a rapid E-Learning authoring system which is easy to use even by those with limited technical knowledge. In addition, Xerte is open source software which is free to use, with powerful functions and a fairly easy user interface:

> *Xerte is a kill application to create E-Learning objectives (Head of teaching and learning, Dr. Wyn Morgan)*
>
> *Xerte is easy to use and reduces the barrier for creating E-Learning materials (a participator in the European E-Learning Summit 2008).*

Usually IS staff have a high pressure workload, with a certain numbers of projects running at a time and the number of new support enquiries increasing day by day. However, their working capability is limited. It is difficult to respond to every

[34] http://www.nottingham.ac.uk/xerte

E-Learning technical enquiry on time and, sometimes, the enquiries are very simple and repetitive, such as "how to create multiple choice quizzes":

> *.....I don't want to spend the rest of my life making multiple choice quizzes..... a way of being able to reuse tools for E-Learning (Xerte Project developer)*

The IS Learning team leader sensed this problem and discussed the idea of Xerte project in the eLeK Community in order to secure support from the University. In 2006, the eLeK Community formally encouraged the project. At the same time, the Xerte developer, Julian Tenney, also received advice, and was joined by another developer assigned by TechDis[35], funded by JISC[36]. Together, they improved some of the accessibility features and also took Xerte for further evaluation.

After announcing the Xerte website, they have madegood progress, widely applied to several University projects within, for example, the School of Geography, the Language School, Manuscripts and Special Collections. Nowadays, Xerte is popularly applied to E-Learning course development in each school, and the Xerte project team won ALT's "Learning Technologist of the Year Team Award 2009"[37]:

> *.....we've had that side there for about two months now and we've had over 260 learning objects created by all sorts of members of staff. Now a lot of them are very simple or just people trying things out, but some of them are, you know, a fully fledged piece of content well thought out and structured pieces of content..... (Xerte developer, Mr. Julian Tenney)*

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[35] TechDis: the TechDis Service aims to be the leading educational advisory service, working across the UK, in the fields of accessibility and inclusion

[36] JISC: Joint Information Systems Committee

[37] http://www.nottingham.ac.uk/public-affairs/press-releases/index.phtml?menu=pressreleases&code=ELE-241/09&create_date=15-sep-2009

.....Since October 2006, Nottingham has freely made Xerte--an accessible E-Learning development tool--available to the world through U-Now[38]. Since then Xerte has been used in over 60 institutions worldwide and garnered international recognition, including promotion by Jisc TechDIS as the best of breed accessible E-Learning tool[39].....(Announcement of Xerte Online Toolkits Launch Event by email)

- The Podcast Tool

The use of Podcast (downloadable audio files) is becoming more common in higher education, as introduced in Chapter 2. At the University of Nottingham, increased numbers of staff use Podcast to make their teaching audio material available to students via WebCT. As summarised below by Andy Beggan, Podcast:

- *Enable students to come to a better understanding of complex and important concepts than is normally possible in our courses*
- *Foster greater engagement with pedagogical principles due to the "fun" nature of the Podcast and their ready availability when each student most needs them*
- *Free up classroom time for tutor input, student presentation and discussion*
- *Provide a useful and interesting source of listening practice for our international students (who make up almost of all our student intake)*
- *Strengthen bonds between students and the tutors responsible for developing and acting in the Podcast (created at least partly in response to particular difficulties expressed by students during the course).*

The Central IS Department provides several ways of supporting the application of Podcast, including training and Podcast kits which can be booked by staff. The Podcast kits include microphones and headphones with a simple manual, to record

[38] http://unow.nottingham.ac.uk/resources.aspx
[39] http://www.techdis.ac.uk/getxerte

lectures, discussions and interviews and to convert recordings automatically for playing on the Internet.

However, the application of Podcast has some disadvantages. For example, due to fears that attendance will decline if too much material is made available online, staff in the School of Humanities have not yet adopted the use of Podcast. The IS team carried out a student survey in 2009, similar to that conducted by Brittain et al. (2006), and found that the majority of students focused on particular lecture topics among the range of Podcast files, that is, those topics that they had missed or topics that were seen as particularly important, especially in the week before the examination. Although all respondents viewed the availability of the Podcast very positively, it is notable that PowerPoint files of lectures saw far greater use. Few students accessed all the lecture audio files.

4.4.4 Five Initial E-Learning Projects

Before 2000, there are no official records of E-Learning projects in the University of Nottingham, although there are some E-Learning related activities based on the interests of individual members of staff. In response to the prevailing lack of knowledge and experience of E-Learning, the official E-Learning strategy group set up five initial E-Learning projects in 2000 within five schools (shown in Table 4.1). They were fully supported by the University and involved all E-Learning activities, including organization, technology and E-Learning project development, and especially financial expertise.

It was reported that the heads of Schools (in the E-Learning focus group) were in favour of supporting "bottom-up" developments rather than working towards centrally imposed targets. There were questions over the exact meaning of "bottom-up" because of concern that it may be implemented as *laissez-faire*. It was suggested that schools should be asked to partake in a centrally-led review of their current position and be requested to include the development of E-Learning in their relevant school plans. Centrally-controlled E-Learning development has set a

precedent for future policy. The E-Learning strategy group acquired a great deal of knowledge and experience from these five initial projects, although only the MELEES project succeeded in the end (Stephen Hibberd, Clair Chambers, and Christine Ennew).

No.	Project	School
1	*e*-Postgraduate Certificate in Molecular Biology	School of Clinical Laboratory Sciences
2	Mathematics Electronic Learning Environment in Engineering and Science (MELEES)	School of Mathematical Sciences
3	Integrated E-Learning for developing core conceptualisation skills in the engineering sciences. (INECSES)	School of Electrical and Electronic Engineering
4	Environmental Data Analysis and Modelling	School of Civil Engineering and School of Mathematical Sciences
5	Developing Virtual Engineering Laboratories	School of Chemical, Environmental and Mining Engineering (SChEME)

Table 4.3 Five Initial E-Learning Projects

> *……The E-Learning strategy group wanted to initial some E-Learning activities by providing a fund of money and asking people for ideas…… They provided sum of money and wanted to make it work, MELEES is the first E-Learning Project …… (MELEES Project Leader)*

Besides encouraging the schools to devote their efforts to E-Learning development, the E-Learning strategy group also held a series of events and seminars in order to initiate an E-Learning culture within the University. It was argued that this would help to reduce the barriers against adopting new technology.

From 2001 to 2004, the E-Learning strategy group has made considerable progress regarding initial E-Learning activities, including an extensive survey of opinions; staff development, not only among academic staff but also administrative and technical staff; and the building of foundation Internet infrastructures.

These five initial E-Learning projects helped to accumulate a great deal of knowledge and experience, and as a result the University, while retaining central control, handed over the development of E-Learning to the schools. An increasing number of projects were subsequently announced, and now almost every school has its own team for E-Learning development and embedment.

4.5 Conclusions

The researcher has undertaken a case study of E-Learning development at the University of Nottingham, which, it can be argued, is a pioneer in this field in the UK. As a starting point, the trend underlying the E-Learning development prior to the international E-Learning context and the competitors' pressure to organizational reactions describes as a background. The complexity of the E-Learning development process underpinning this approach became more apparent, suggesting that E-Learning development is based upon organizational and technological aspects. In order to facilitate the later analysis, this chapter examined the data by timeline. The next chapter will introduce three E-Learning projects within different schools.

CHAPTER 5 CASE STUDY OF E-LEARNING PROJECTS

5.1 Introduction

The researcher stated at the end of the literature review (Chapter 2) that E-Learning development in an organization is related to three aspects of development - organizational, technological and service. The previous chapter described E-Learning development within the University, and from the organizational and technological aspects. This chapter will present E-Learning service development in the University with reference to three selected case studies - the e-China project in the School of Education, MELES in the School of Mathematics, and the E-Learning project in the School of Geography.

5.2 Case Study of the School of Mathematics

5.2.1 Introduction

Mathematics has been taught and researched at the University of Nottingham since the University gained its Royal Charter in 1948. The School of Mathematical Sciences is one of the largest in the UK, with currently around sixty faculty members working in the fields of pure mathematics, applied mathematics and statistics. According to a recent analysis "Essential Science Indicators[40]", the University of Nottingham has entered the top 1% of institutions in the field of mathematics. Nottingham's current record in this field includes 422 papers cited a total of 1,500 times to date[41]. The School of Mathematical Sciences is a large, thriving centre with high standards of both undergraduate education and post-graduate research. External reviews rank it among the top universities in the UK to study mathematics. In the most recent Quality Assurance Agency Subject Review (2004/05, the latest result), the School of Mathematical Sciences scored 23 out of 24, while in the 2001 Research Assessment Exercise, the School earned a

[40] http://in-cites.com/rsg/esi/
[41] http://in-cites.com/institutions/UnivNottingham.htm

grade 5 ratings for Pure Mathematics, Applied Mathematics and Statistics. Undergraduate courses are offered in Mathematics and in Mathematics combined together with other subjects including Computer Science, Economics, Philosophy and Chinese Studies[42]. The School currently has over seventy postgraduate research students and is committed to expanding its portfolio of taught postgraduate (MSc) courses.

5.2.2 E-Learning Project overview – "MELEES Project"

Implementation and development of the initial project started in August 2002 with the delivery of a Mathematical Electronic Learning Environment in Engineering and Science (MELEES). There were four reasons for promoting this launch:

- Two projects funded by HEFCE which then became part of "Helping Engineers Learn Mathematics" (HELM) have provided many inspirational ideas for the academic community to follow.
- At that time, the E-Learning steering group at University was looking for innovative E-Learning ideas to be developed and incorporated into part of the teaching and learning practice.
- The project director realized that the School of Mathematics delivered compulsory Mathematics to the client schools (Engineering, Physics, Chemistry and the Built Environment) without sufficient support. MELEE could serve as an effective instrument to contact and support students more directly.
- Some of the teaching staff were interested in developing a new environment to deliver their professional knowledge.

It is necessary to mention "Helping Engineers Learn Mathematics" (HELM) if we wish to understand the inside story of MELEES. There were several reports in the 1990s that testified to the severity of the "mathematics problem" (Davis, et. al, 2005). For example, in 1995 there was a joint report entitled "Mathematics Matters in Engineering", which highlighted the difficulties encountered by engineers in learning Mathematics[43]. In the same period, the Engineering Council also published "The

[42] http://www.ceebd.co.uk/ceeed/un/uk/nottingham_university_mathematics.htm
[43] Appendix 3- Data source PD21

Changing Mathematical Background of Undergraduate Engineers", detailing the difficulties that undergraduate students met in learning mathematics. In 1998, the HEFCE established a joint project with a £250,000 grant aimed at forming the HELM project that aimed to enhance the mathematical education of engineering undergraduates by providing a range of flexible learning resources in the form of workbooks and web-delivered Computer-Aided Learning (CAL). The HELM project has some distinguishing features, such as computer-based assessment, which use "Question Mark Perception" (QMP) - predominantly multiple choice and providing instant feedback to students.

During the lifespan of the HELM project, the MELEES project leader was also a member of the HELM steering group:

> *I was a steering group member for that, and they produced workbooks, physical workbooks, but also additional materials. So they have online materials but they have predominantly PDFs*[44]*. (MELEES project leader Dr. Stephen Hibberd.)*

The project leader of MELEES acquired some useful experience from HELM, particularly the importance of applying the new concept to help students to learn mathematics. With this objective in mind, MELEES was initiated by the School of Mathematical Sciences. Specifically, the project is a web-based learning environment for students of engineering and science that supports mathematics learning and teaching, and offers information to students from client schools, such as the Departments of Engineering, Built Environment, Physics, Chemistry and Biochemistry (from the MELEES Initial Proposal). The birth of the MELEES project in 2002 marked one of the initial E-Learning projects under the "E-Learning

[44] PDF: Portable Document Format, a file format developed by the Adobe Systems. PDF captures formatting information from a variety of desktop publishing applications, making it possible to send formatted documents and have them appear on the recipient's monitor or printer as they were intended (http://www.webopedia.com/TERM/P/PDF.html).

Development Fund" (e-Pioneer project), the first official Nottingham University funding which supported E-Learning development:

> *A variety of resources ..... such as those funded by national initiatives (including HEFCE and HE Academy - Mathematics, Statistics and OR Subject Centre). Initial support for the initiative was provided within the University by the award of an "E-Learning Development Project" and additional support for special needs aspects from the "Learning and Teaching Development Fund". (MELEES project leader Dr. Stephen Hibberd)*

> *MELEES was certainly the first large scale, successful E-Learning project at the University, and I'm sure Stephen's told you that, as such, we got a lot of recognition for it, both here and elsewhere.*
>
> *(The School of Geography E-Learning coordinator)*

Lectures remain the central approach to mathematics teaching, an area enhanced by support from an E-Learning environment, based on an E-Learning platform (WebCT) which is linked to the University's student portal. This environment provides module-specific support and specialises in e-based materials, e.g. video tutorials, foundation level mathematics, etc. In addition to materials that are sourced locally, MELEES also incorporates HEFCE initiatives, through which some national and international sources have been selectively included. The initial two-year development, starting from September 2002, focused on the provision of E-Learning for first year students and a pilot provision for second year students. The aim is to improve students motivation towards a subject that constitutes a small but critical

part of their studies. Its usefulness is threefold. Firstly, it helps to ease the learning transition to university level mathematics. Secondly, it provides an embedded framework to enhance learning. Thirdly, it facilitates the provision of feedback on their progress to the students, their lecturers, postgraduate tutors, personal tutors and course directors in the client schools. This project also took into account the need to foster academic motivation for engaging in developing and using E-Learning tools. For example, there are small grants available at the University for the development of E-Learning material. Externally, several forms of support are available to universities in the UK. For example, funding for developing E-Learning tools and materials are available from HEFCE and the Joint Information Systems Committee (JISC). In addition, the HELM project developed by the HEFCE provided an inspiration to other universities.

5.2.2.1 Staff Involvement

There were two core members at the start of MELEES: the project leader, who leads negotiations with the central E-Learning Community of the University, and the project co-ordinator who is the director of teaching and learning in the School of Mathematics and who helps to secure funding and support. In addition, he also contributes to the development of the project by representing the valuable viewpoints of administrative and academic staff. More importantly, he plays a vital role in reducing staff anxiety over adopting a new technology into their school. After the initial project had been set up, a graduate student from the School of Mathematics showed a keen interest in multimedia development. He was contracted as the first project technologist to develop the web-based structure of the learning environment, establish the first version of template and assemble the initial project materials. After his departure, the project team took the strategic decision to appoint a professional technologist, Claire Chambers, as the technology developer to put from staff into E-Learning reality. She is not only technically competent, with remarkable software development experience, but also has excellent interpersonal skills. The MELEES project team is now firmly established, as follows:

The MELEES Project Team

- **Project Leader**

Dr. Stephen Hibberd is an Associate Professor and Director of Service Teaching within the School of Mathematical Sciences at the University of Nottingham. He holds a five-year joint appointment as a Teaching Enhancement Adviser, and was presented with a Lord Dearing Award for Teaching and Learning for his outstanding contribution in this area. His particular enthusiasm is the mathematical education of engineering and science students:

> ..... *Dr. Hibberd was the first to initiate E-Learning activities into the School of Mathematics... (Project coordinator: Dr. Cliff Litton)*
>
> .....*Dr. Hibberd is the main driver for the project.....(Project technologist: Mr. Peter r Rowlett)*

Dr Hibberd showed an interest in the E-Learning field in the mid-1990s. Prior to the MELEES project, he was already engaged in the development, promotion and use of Computer Assistance Learning (CAL) for mathematics. CAL is a standalone teaching method which was popular before the interactive learning environment was established. He was also a member of the HELM project steering group. In 2002, at the time that he wished to introduce E-Learning courses into the school, the University of Nottingham was about to initiate E-Learning projects across the University. Taking advantage of this timing, together with his personal passion and background knowledge of E-Learning, Dr Stephen was appointed to lead MELEES, the first project to be approved by the University's E-Learning steering group.

- **Project Co-ordinator**

Dr. Cliff Litton is one of the most senior staff in the School of Mathematics. He constantly provides input and suggestions to assist the project director in reducing barriers, and with Dr Hibberd also delivers the project report at the School's board

meetings. Due to the various roles he has played in the School, he has become a crucial champion of the development of E-Learning. As noted by the project leader:

> *.....helping greatly on the sort of strategic side, he is a key person who sits on the strategy board of the School, and it's been terrific to have somebody else to put a view that's slightly away from me, who has also tried to make every colleague feel that they're involved. (MELEES Project Leader)*

- **Project Technologist**

At the beginning of the MELEES project, the project leader appointed one of his undergraduate students, Peter Rowlett, to develop a web-based interface and create templates for the project:

> *.....I was the staff basically for the first three months and we, the aim of that was to set up, and I think did we try to set up a pilot module or something..... mine was more exploring the technology and how we could use it and try to come up.....(Project Technologist, Peter Rowlett)*

He has devoted a lot of effort to writing up documentation that was not considered by the other team members. His main contribution to the technology has been to explore WebCT as a working platform. During the pilot phase, Peter also finished one of the modules taught by the project leader entitled Engineering Mathematics (Calculus for Engineers). Despite this being the first online course at Nottingham University, feedback from students was exceptionally positive. In late 2002 he also created a template which is still used for the current MELEES' website, as shown in the screenshot (Figure 5.1) below:

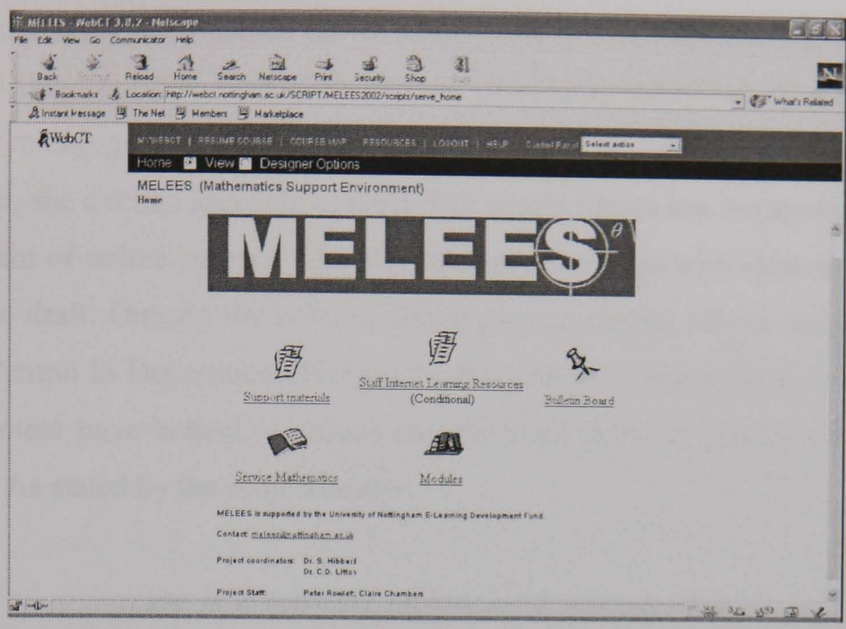

Figure 5.1 Screenshot of MELEES Website

Peter left the team after the project was piloted in late 2002, but before his departure he participated in the appointment of the next technology officer, Claire Chambers. His involvement was vital not only in identifying an individual with the required technological background, but also in passing on his experience to his successor to ensure a smooth handover. As he indicated:

> *……I was a little bit involved in the hiring process……I met Claire that way and I think I met her briefly before she started and I sort of went through what we were doing. I think I tried to leave a lot of notes on it so hopefully that helped. (Project Technologist, Peter Rowlett)*

Claire has extensive experience of E-Learning and obtained a distance learning degree course with the Open University. During her degree, she developed an interest and insight into a wide diversity of online learning systems. She joined the MELEES project in January 2003 and contributed to its continued development. However, although she has extensive knowledge in online learning in general, her previous experience of the adopted platform was limited. Nevertheless, her excellent

interpersonal skills have helped her to settle quickly into the team and fully utilise her E-Learning expertise. One of the actions praised by many faculty members was her ability to engage with and understand the needs of teaching staff. When she took up her post, she elicited ideas about what they would like to see incorporated into the development of online courses. She also arranged meetings with related faculties to discuss the draft. Outside the School, Claire plays a crucial role in communicating with the Central IS Department. Her good relationships with key members of Central IS Department have helped to reduce any potential delay in solving technological problems. As stated by the project leader:

> *.....she is a software technician I suppose, but she's rather more than that .... (MELEES Project Leader)*

- **The Academic Writer**

The definition of an academic writer is someone who is able to provide teaching theories, materials and notes. All teaching staff in the School of Mathematics are qualified to become academic writers if they participate in MELEES, and over 50% have done so. Most of the academic writers are also the course conveners responsible for the day-to-day running of their modules.

5.2.2.2 E-Learning Course Overview

The first two-year project was proposed, involving a first-year provision for non-specialist students of mathematics to engineering and the built environment (5 modules; over 500 students); science (5 modules; over 300 students) and foundation (4 modules; 50 students). In addition, the School delivers the engineering and foundation elements of this provision (5 modules) to the University's campus in Malaysia (UNiM). For all courses in engineering, as well as those in chemistry and physics, a qualification in mathematics is a course pre-requisite but a flexible first-year mathematics provision is crucial for enabling schools to recruit and retain students from a wide range of backgrounds. The range of mathematics modules provides the seven main client schools with the capability to consider students with

prior qualifications in mathematics, ranging from GCSE[45], A/S or, as in most cases, differing A-level grades. This requires significant liaison with the client schools to match the learning outcomes of their students with the course requirements, to provide a range of support mechanisms for their students and to exchange feedback. This provision is continued within engineering into the second year (6 modules; over 400 students) and is optional for third/fourth year students (5 modules; over 200 students).

Between 2002 and 2007, the development of the MELEES project was carried out in four phases - namely, the pilot, expansion, integration and upgrade. The current initiatives that started from 2007 up to the present are labelled by the researcher as the expansion phase. A brief illustration of these phases is given in Table 5.2.

Phase	Period	Major Achievements
Pilot	2002~2003	Autumn Semester: 1 module Spring Semester: 4 modules Feedback from web-logs and emailed student questionnaires
Expansion	2003~2004	The provision extended to 18 modules (all first and second year modules which have approximately 2000 students and 20 teaching staff); These modules were enabled by: ● A "generic" module template ● guidance on "good practice" ● informing and involving module teaching staff ● minimum core requirements for each module ● exemplar materials available to module staff ● project support to module conveners

[45] GCSE: General Certificate of Secondary Education

Integration	2004~2005	More students were using MELEES to develop their own learning strategies. Feedback from the teaching staff and students was exceptionally positive, and encouraged more efforts to: ● Extend student support , e.g. importing HELM Workbooks and mathcentre worksheets into the online support ● More E-Learning initiatives – trialling video tutorials ● Usage tracking ● Special needs
Upgrade	2005~2007	● All the courses have become stable. ● The tracking tools were able to obtain information related to the students' attendance, progress and performance, and, therefore, have gained popularity among the teaching staff ● Platform upgraded from WebCT4 to WebCT 6 Campus Edition. ● Secure linkage with the Central IS Department.
Expansion	2007~present	MELEES has been successful, and many institutions in the UK have learnt lessons from it. The teaching staff and students are used to and highly satisfied with MELEES. Some of the new functions, such as "Chat" and "Real-time Discussion" have been added. Spin out: ● MELEES was delivered to the Malaysian campus at the end of 2007. Currently, MELEES is preparing to deliver the first trial to Ningbo campus in China in the 2009-10 academic year.

Table 5.1 Summary of Phases of MELEES Project

5.3 Case study of the School of Geography

5.3.1 Introduction

In line with the overall philosophy of the University of Nottingham, the School of Geography is research-led and was awarded a rating of 5 in the latest Research Assessment Exercise (December 2001). The staff are, however, equally committed to teaching at both the undergraduate and postgraduate levels, and the School was awarded an Excellent rating in the most recent HEFCE assessment of teaching provision[46]. Moreover, in 2004, it was ranked among the top three geography departments in the UK by The Guardian, and in the top five by The Times.

The School currently has 39 academic staff members, more than 60 PhD students and 25 research Masters' students. There is also a range of taught Masters programmes on offer. Research is organised around five research themes (Cultural

[46] http://portal2.nottingham.ac.uk/about/departments/directory.php

and Historical Geography, New Economic Geographies, Environmental Management and Policy, Environmental and Geomorphological Sciences and Geographical Information Science). Each theme provides a focus for different aspects of the School's research community, although there is considerable overlap between them, reflecting the emphasis on trans-disciplinary and interdisciplinary research. Geography at Nottingham University provides a stimulating environment for students and staff alike, based on high standards of innovative teaching and research.

5.3.2 E-Learning Project Overview

Looking back to the mid-990s, there appears to have been little effort made to apply the new technology to assist classroom teaching (for example, producing teaching materials in digital format), albeit there is not much evidence for this:

> *In 1988, I got a grant from the University to produce geographic materials for web pages for my lectures. During that period, the School thought that (multimedia teaching material) is interesting and new so we will give you that grant. (Prof. Michelle Clarke)*

During the mid-1990s, the World Wide Web developed rapidly and the broadband infrastructure also made significant progress. The standalone computer-assisted learning materials were quite popular in language learning at that time. However, E-Learning development is far from maturity in terms of application diversification, platform competence, academic awareness and technological readiness.

- **Application Diversification**

The early E-Learning material development was known as "Computer-Assisted Instruction" (CAI), and it has been increasingly applied to language learning

(Computer Assisted Language Learning, CALL) since the 1960s (Delcloque, 2000). From the early 1990s, the application of computer-assisted instruction has still focused on language learning. There are few references in literature of the application of E-Learning to other disciplines.

- **Platform Competence**

There was no established Virtual-Learning Environment (VLE) in the market in the 1990s, although some institutions did initiate development in this area.

- **Academic Awareness**

In the late 1990s, the majority of staff in the School of Geography did not possess sufficient knowledge of HTML, and, needless to say, of E-Learning. However, once they had acquired information about the new technology, some staff showed considerable interest and sought to extend their knowledge:

> *.....one of the things I wanted to do in my first lectures is to have web pages as support information for my lectures. (Prof. Michèle Clark)*

> *.....And I was the first person in Geography to do that (web pages). The students love it or did love it then, still love it now, and after about three years other staff began to say "I'm interested; how do you do this?" (Prof. Michèle Clark)*

- **Technological Readiness:**

The multimedia technology has been widely applied since the 1990s. However, the multimedia file size was still too large to deliver via the Internet at that time and

"stream" technology had not yet been introduced. The re-use concept was still not popular with the end users.

The archive indicates that no member of the School of Geography participated in the first E-Learning Steering Community of the University. Nevertheless, some staff were familiar with the new technology as the means for encouraging the spread of E-Learning. The formal E-Learning project in the School of Geography started in 2004, and from then on the embedding of E-Learning into the daily traditional teaching and learning become common:

> *.....when I joined this School, um, I think there was already a realisation in the School that they needed some sort of strategy and they needed somebody to drive that strategy..... (Geography School E-Learning Project coordinator, Claire Chambers).*

5.3.2.1 Staff Involvement

The School of Geography is part the field of natural science. It can be argued that natural science scholars find it much easier than scholars of social science to embrace the new technology. However, this does not mean that the latter are more conservative - they may accept innovation as easily but it could be argued that natural science scholars may learn the new technology slightly faster. The Geography School E-Learning project is a fairly new project compared with some of the prestigious E-Learning projects at the University of Nottingham e.g. MELEES, eELT (part of the e-China project) and the TTRI E-Learning project[47] (Business School). Before 2000, some staff in the School of Geography showed an interest in adopting the new technology into their teaching yet few staff share their viewpoint when they experiment with a new way of delivering knowledge:

[47] TTRI: Tourism and Travel Research Institute in the Nottingham University Business School. (http://www.nottingham.ac.uk/ttri/)

I teach the teaching staff how to create a webpage which is a new way to share the knowledge (Prof. Michèle Clark).

Until 2004, there was no direct evidence to indicate that the School of Geography supported E-Learning activities although, there was a wide range of E-Learning supplementary materials, including online mini games and videos, produced by individual members of staff, and which received satisfactory feedback from students. Gradually, adopting E-Learning became common in the School of Geography. However, while the head of the School sensed the desire for E-Learning, there was no proper strategy for implementing it. In 2004, the School of Geography decided to appoint an E-Learning expert to drive the strategy:

...before I came to the School of Geography, there was already a realisation in the school that they needed some sort of strategy and they needed somebody to drive that... (E-Learning coordinator of the Geography School, Claire Chamber)

Since 2004 the implementation of E-Learning in the School of Geography has been a top-down process authorized by the head of School. There was already a desire to develop E-Learning and so to appoint an experienced and professional member of staff was crucial for the project. From the organizational point of view, this was a link between the implementation of E-Learning at the school level and all members of staff who were eager to adopt it.

5.3.2.2 E-Learning Course Overview

Unlike the E-Learning projects within other schools, the School of Geography produced 25 courses online up to 2005 and a further 72 online modules up to 2008.

Amazingly, almost all teaching staff in the School of Geography participate in E-Learning, which is a great achievement. This highly productive performance assumes that there is no significant pilot stage in their E-Learning project. Two reasons underpin this achievement: firstly, those who handle the project have appropriate experience, and secondly, they involved the E-Learning coordinator and academic writers in the development of the E-Learning materials:

> *……it's very important in the initial stage to discuss at length and for me to get an understanding of the module or the subject (E-Learning coordinator, School of Geography)*

> *……intensive meeting with Claire (E-Learning coordinator) to explain what the subject is and my ideas. She may suggest possible solutions for me. From then on, we can have deep discussions for a practical solution. (Dr. Nick Mount)*

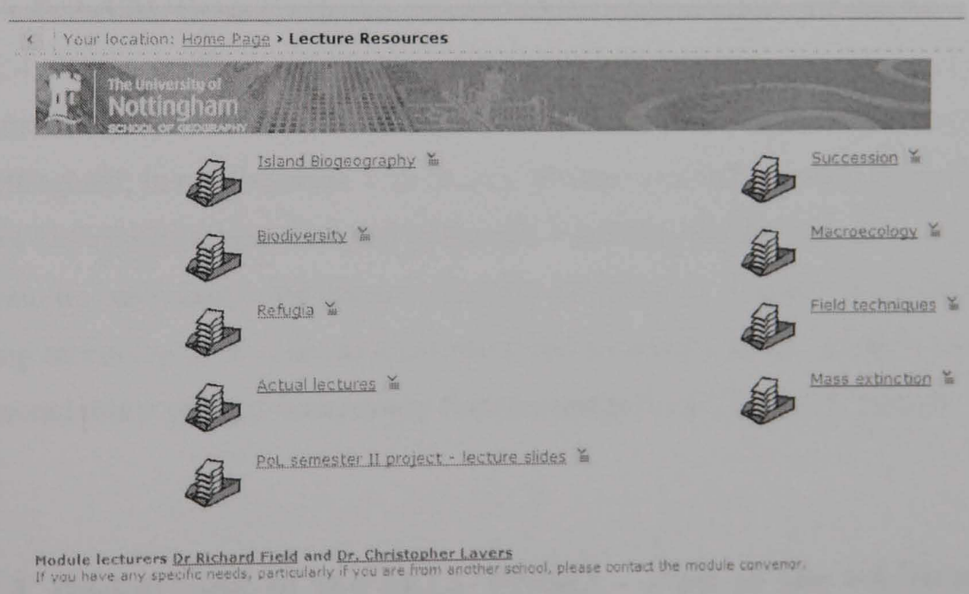

Figure 5.2 Screenshot of "Geography - Patterns of Life" Website

5.4 Case Study of the School of Education

5.4.1 Introduction

The School of Education at the University of Nottingham is a leading centre for educational research in, with a broad commitment to improving and investigating social justice and equality in education. In the 2008 Research Assessment Exercise (RAE) it was ranked 6th out of 82 education departments in the UK. There are many research projects carried out in the School for a number of external funding bodies, including research councils, charities, and local and central government bodies. As one of the largest and most respected education departments of any university in the UK, it leads the way in high quality research and teaching. Its particular strengths include: higher and lifelong education; the arts in education; technology and culture in learning; international and comparative education and development; mathematics education; special needs and counselling; teacher education and teacher development; educational leadership; and language and literacy in education[48].

5.4.2 E-Learning Project Overview - the eELT Project

The E-Learning for English Language Teacher Training (eELT) project is part of the e-China~UK project developed largely by the School of Education at the University of Nottingham, in collaboration with Beijing Normal University and Beijing Foreign Studies University, China. The aim of the eELT project is to develop online material for training secondary and tertiary English teachers in China which expanded existing technologies in order to meet identified pedagogic needs. In order to better understand this project, it is necessary first to explain the e-China~UK project.

5.4.2.1 Background of the eELT Project - Part of the e-China~UK Project

The development of E-Learning programmes is advancing internationally, promoted by the drive to seek more powerful, cost-effective means of supporting the expansion

[48] http://www.nottingham.ac.uk/Education/index.aspx

of mass education provision and enhancing the learning experiences of individuals. Over the past few years in China, the Ministry of Education has recognised 67 online institutions, each established by one of the 34 pilot universities[49]. This has initiated major development and investment in promoting technology-enhanced higher education for learners in China. As part of this development, the Chinese Ministry of Education has actively developed collaborative relationships with countries that are relatively experienced in E-Learning, including Japan, U.S.A. and the U.K. The partnership between the HECFE of the UK and the Chinese Ministry of Education has initiated a number of different programmes. Amongst these, the Sino-UK eLearning Programme, also termed eChina~UK, is the most important and ambitious in terms of its coverage and anticipated outcomes.

The aims of the eChina~UK programme are threefold. The first of these is to develop online learning material for staff in selected Chinese universities who will in the future be teaching their subjects in English. The second aim is to develop E-Learning material for senior high school teachers in China for studying a Master's degree in Education. Thirdly, the programme seeks to develop E-Learning materials in order to train English teachers in China who are currently teaching English at both the secondary and tertiary levels. A joint E-Learning working group was convened in September 2001 to set the parameters for co-operation. A Memorandum of Understanding and a framework for the programme were signed in May 2002[50].

Based on these three aims, the eChina~UK programme consists of four distinctive yet interrelated components which started in 2003. Table 5.3 below illustrates the core objectives of each component and the partners involved:

[49] The Pilot universities: In 1994, the Ministry of Education in China appointed four universities (Tsinghua University, Hunan University, Zhejiang University, and Beijing Post and Communications University) for piloting the E-Learning development of E-Learning. By the year 2000, 31pilot universities, established by the Chinese MoE were in existence. These universities set up their own online institutes and offered foundation, undergraduate and postgraduate levels of qualification.

[50] http://www.britishcouncil.org/china-education-highereducation-elearning.htm

Project		UK Partners	Chinese Partners
DEfT: Training in Generic Pedagogy (Methodology, Educational Psychology, E-Learning & educational technology) for Secondary School Teachers		World Universities Network (WUN) led by University of Manchester with involvement of Universities of Sheffield, Southampton & Bristol	Beijing Normal University
eELT Training (English Language Teache Training)	Secondary school teachers	University of Nottingham	Beijing Normal University
	Tertiary level teachers	University of Nottingham	Beijing Foreign Studies University
CUTE 1: English language for university teachers (non-specialists in English)		University of Cambridge with Open University providing consultancy advice	Tsinghua University, Beijing
Research into Education in China: Cross-cultural perspectives on educational practices and issues related to the regulatory environment, e.g. quality assurance and intellectual property		University of Nottingham	Beijing Foreign Studies University

Table 5.2 Project Objectives of eChina~UK Project

Each Project has its own research aims and objectives, as follows:

1. The Developing E-Learning for Teachers (DEfT) project was initiated to fulfil the aim of developing E-Learning materials for senior high school teachers in China to study for a Master's degree in Education. Specifically, this project covers several subjects, such as methodology, educational psychology, E-Learning and educational technology. The degree was designed to be delivered primarily in Mandarin, and was led by the University of Manchester, University of Sheffield, University of Southampton and University of Bristol, in conjunction with Beijing Normal University.

2. The Chinese University Teacher Training in English (CUTE) project aimed to design, develop and deliver two modules, including "academic listening and speaking skills" and "academic writing skills". The underlying intention of this project was to design a scalable training model that can be applied widely to Chinese Higher Education. The project was based on collaboration between the University of Cambridge and

Tsinghua University, while the Open University provided consultancy advice to the team.

3. **The E-Learning for English Language Teacher Training (eELT)** project sought to develop online material for training English teachers in China at both the secondary and tertiary levels which expanded existing technologies in order to meet identified pedagogic needs. The project was mainly developed by the School of Education, University of Nottingham, in collaboration with Beijing Normal University and Beijing Foreign Studies University, China.

4. Research into Education in China is an overarching research project funded by the HEFCE with the overall aim of investigating a variety of E-Learning issues in the Sino-UK context. Specifically, the project aimed to address two key themes:
   - Key issues in E-Learning which address the cross-national perspectives on effective teaching and learning for the practice of E-Learning.
   - Regulatory and institutional constraints for the exploitation of E-Learning. The theme aims to explore the implications of E-Learning for the related areas of quality assurance and intellectual property rights.

The programme has led to an increased understanding of the constraints and affordances of online learning, especially for teacher training; a deep mutual understanding and appreciation of different perspectives; and the potential for significant further innovation and change.

5.4.2.2 Staff Involvement

5.4.2.2.1 University Involvement

The staff involved in the eELT project came from three universities and one outsourcing company. The three universities were: the University of Nottingham,

UK (UoN), the Beijing Normal University (BNU), and Beijing Foreign Studies University (BFSU) in China.

The University of Nottingham (UoN)

From a micro-view, the eChina~UK project is hosted by the School of Education at the University of Nottingham. The School of Education plays a major role within the eChina~UK project. The School of Education is one of the largest in the UK, undertaking high quality research in the fields of education and continuing education. Research projects cover a wide spectrum of areas, with expertise in a number of specialist fields. A large number of Institutes and Centres make up the research base of the School, with University-wide links across different disciplines. E-Learning research in the School of Education is the mainstream research area that makes it possible for them to undertake the eChina~UK project.

Beijing Normal University (BNU)

Beijing Normal University[51] (BNU) has a history of over 100 years, almost as long as the history of Chinese modern education itself. The University has developed from the Faculty of Education, Capital Metropolitan University, established in 1902 with the aim of establishing a school and prioritizing teacher training in the field of Chinese higher education. After several mergers and reforms since 1949, especially in the 1980s, Beijing Normal University (BNU) entered a new age of rapid development. The University's history is the epitome of the development of modern teacher training and Chinese higher education.

Currently, BNU offers 19 schools plus 6 departments and enrols over 16,000 full-time students, including 8000 undergraduates and over 2000 overseas students. BNU is a symbol of an institution which nurtures qualified teachers for compulsory education, especially junior and senior high school high school students. The system of BNU represents the typical Easton Education system.

[51] http://www.bnu.edu.cn/

Beijing Foreign Studies University (BFSU)

Beijing Foreign Studies University[52] (BFSU) is the first institution of higher education in China specializing in foreign language studies. It has been one of the key universities directly under the Chinese Ministry of Education from 1941. In the early 1950s, the University started to enrol overseas students. Every year there are about 1,000 long-term and short-term students from more than 30 countries studying at BFSU. Over the years, the University teaching has gradually acquired many distinctive features. Meanwhile, the variety of languages taught offers a unique environment for both Chinese and overseas students to master their target languages.

By contrast, the traditional Chinese Universities, BNU and BFSU, emphasise international cooperation and exhibit a keen interest in innovative education. In order to achieve this, they are keen to promote cooperative research with other leading universities.

5.4.2.2.2 eELT Project Team

Taking a macro view of the eELT Training project, the UoN played a crucial role in the research team leading two sub-projects: one is focused on the secondary school level and the other targets tertiary-level tutor training materials. The development of the eELT project is complex. From the organizational perspective, the project team was set up as an international research team, with a diverse cultural range, including different philosophical approaches and varied experiences of E-Learning development.

It appears that British and Chinese universities differ in the way in which they handle E-Learning from an organizational point of view. In China, the Ministry of Education approved 68 universities to pilot distance E-Learning, and each of these universities set up their own online institute to handle distance E-Learning courses (e-China project report). However, the members of each online institute still belonged to other schools within their own university. By contrast, the UK

[52] http://www.bfsu.edu.cn/

universities also promote E-Learning activities but it is rare to see them establishing online institutes, instead intending to develop their E-Learning materials within the schools. Against this background, there was a significant difference between the Chinese teams and the UoN team during the initial team setup phase, as shown, for example, during meetings to discuss what they intended to achieve and to establish roles. The UoN team was unable to find their academic counterparts until their Chinese partners had finished a series of negotiation processes within their organizations. From the UoN team's viewpoint, it can be argued that there was no recognised Chinese research team before the negotiation process. However, from the Chinese partners considered that they needed to find the best solution before any response could be made.

Undertaking the eELT project could have significant implications for the participants' organizations, so in order to accommodate such a large-scale project, certain organizational changes have been made:

- Both BNU and BFSU have central online institutes: the Centre for Learning Technologies and BFSU Online respectively. These are involved in the identification of the courses; the engagement of academics to map out the curriculum and write the content; the development of the materials in their centrally developed and maintained platforms; and the engagement and support of tutors to deliver the materials, recruit students, and make evaluations. Initially the project had a development team but did not involve academics.

- At the University of Nottingham, all responsibility for the identification of courses, curriculum design and delivery rested with the academics within their schools. A small central support team of learning technologists and a wider team of technologists were available to work on the project and the University provided WebCT as a platform for the delivery of courses. The project therefore needed to establish a development team to work with the academics.

- From the research organizational structure viewpoint, managing a research team that represents a variety of international cultures is more challenging than handling a national cultural team (Hofstede, 1998). Initially, the UoN team and Chinese teams were confused about the roles in the opposite party's team, causing a barrier to understanding. However, the problem has been identified at an early stage.

5.4.2.2.3 Relationship with Central Support at the University of Nottingham

The project manager at the School of Education, University of Nottingham, had developed effective collaborative relationships with the learning team within Information Services over a number of years prior to the eChina~UK project, as well as with key members of senior management through his role as a university learning advisor. This, together with the fact that the manager was an established academic, was critical in ensuring effective and ongoing support throughout the project. However, because of the potential need for a wide range of technical and E-Learning support throughout the project, it was considered important to develop a new model of working aimed at meeting the needs of the University to develop expertise and capacity in developing E-Learning and ensuring that the needs of the project would be met by IS. To this end, the project funded a new member of the learning team to work on the eChina~UK project; this appointment created a much needed bridge between the central services and the School, and has been critical to the success of the project. This model has been successfully extended, with two further appointments to the learning team for school-based projects.

5.4.2.3 E-Learning Course Overview

The eELT project is a collaborative international project which, when considering instructional design and team collaboration, takes into account what are typically referred to as "culture differences". Holliday (1999) suggests the use of "large" and "small" to distinguish cultural differences between nationality groups, or more micro-scale differences, such as those between the different practising groups.

Within the context of the eELT project, it could be supposed that the differences between the UK and Chinese teams are large-scale, since the educational and political systems and the philosophy of the UK and Chinese partners may differ. Collaboration may produce some interesting stories.

The eELT team had planned to produce four modules, but in the end, due to delays caused by cultural, technological and communication issues, only one module was finished on time. However, despite this, the eELT project team made every effort to develop a better process of instructional design.

The module of "teaching grammar" is to enable participants to develop greater knowledge, understanding and experience of alternative ways of organizing the teaching and learning of English grammar. The course materials were to be primarily computer-based with online elements which cover the subject matter of the courses by a blend of rich media: video recordings, audio recordings, flash animation and interactive tasks. To support individualised learning, there are several student tools which provide a wide variety of opportunities for the participants to pursue and organise their own learning, including: "student workspace", "bulletin board", and "discussion groups". The "student workspace" provides the facility for the participants to store individual work, reflection, tasks, assessment results and learning progress on a database. It has several components: "notebook" - space for note taking; "reflective journal" - for directed and personal reflection; and "bibliography" - a repository for learning resources. There are also pedagogic tools for communication, for example, "bulletin board" — for posting outcomes, suggestions, materials for all participants to view; and "discussion groups" — to provide opportunities for sharing, interaction and to develop a learning community.

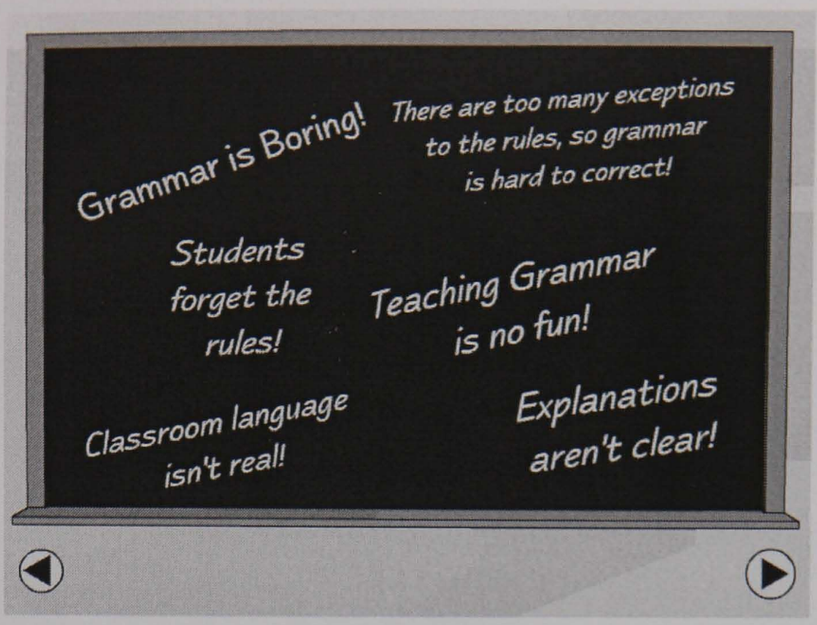

Figure 5.3 Screenshot of eELT Website

5.5 Conclusions

From the outset there have been many projects developed at the University of Nottingham, seeking to embed E-Learning, and there were more than eight hundred modules online by the end of 2005. It is therefore difficult to present all of these, so this research has chosen three representative case studies. In each case study, the researcher introduced the project background and development timeline with organizational, technological and service aspects. The next chapter will present the results of an analysis of these case studies, with the objective of exploring the dynamics of E-Learning development, taking into account the three aspects of innovation processes.