THE IMPACT OF COMPUTERISED INFORMATION SYSTEMS ON THE ROLE OF CLINICAL NURSES IN TAIWAN: A QUALITATIVE CASE STUDY

A thesis submitted to The University of Manchester for the degree of Doctor of Philosophy in the Faculty of Medical and Human Sciences

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Abstract

- Thesis entitled: The Impact of Computerised Information Systems on the Role of Clinical Nurses in Taiwan: A Qualitative Case Study
- Submitted by Feng-Tzu Huang to The University of Manchester for the degree of PhD
- Month and Year of submission: December 2011

Initiating the use of Computerised information systems (CISs) has become a global trend, including in Taiwan. Although CISs sound promising for improving clinical effectiveness and efficiency, evidence demonstrating their actual benefits is still limited. How CISs influence nursing practice and professionalism is not widely known, and the actual implementation process is not well understood. Hence, this study explores (1) the impact of CISs on the role of nurses and their practice, (2) the context of developing and implementing CISs, and (3) the practice politics underlying the use of information technologies in a Taiwanese hospital.

A single, embedded, qualitative case study was conducted. Data collection used multiple methods, combining elite interviews with nurse managers (n=13) and informatics staff (n=3), five focus groups with front-line registered nurses (n=25) and 47 hours of non-participant observation in six wards in the case-study hospital. Data analysis followed a thematic approach, comparing and contrasting patterns among multiple perspectives.

Four major themes emerged from the analysis. Firstly, the development of CISs was a result of negotiated order and relied upon interdisciplinary collaboration. Through interdisciplinary interactions of negotiations, covert negotiations and renegotiations, the exercise of power and power imbalances were recognised. Secondly, a top-down approach was adopted in the implementation process. In order to move computerisation forward, head nurses acted as change agents in gaining compliance from nurses. Front-line nurses showed generally positive attitudes towards computerisation. Being daily system users, front-line nurses were relatively powerless and were compliant with the top-down implementation; however, they grumbled at the same time. Thirdly, through system design strategies to structure clinical activities and increase information transparency, CISs became helpful tools in achieving standardised practice, tightening up managerial surveillance and control and clearly defining employees’ accountabilities. Finally, whilst convenience and efficiency were perceived as the results of computerisation, hardware problems and the burdens of the computerisation process created hidden work in nursing practice, which required nurses to care for computers whilst caring for patients.

Through the lens of several social theories, the study findings indicated that power in developing and implementing CISs was not in the hands of the nursing profession. The findings manifested the disciplinary power of computer technology and also suggest that computerisation may de-skill the nursing profession which may reignite the technology and skilling debate. Although generally believed to facilitate performance efficiency, this study found that computer technology created unfavourable consequences, for example hidden work, which seems to be unrecognised in the literature. Computers became the nurses ‘co-client’ and consequently took time away from patient care so computerisation may not be as efficient and effective as expected. Finally, a qualitative case study was found to be an appropriate methodology to explore this complex issue comprehensively and holistically. However, this small, single case study was conducted in one location in Taiwan. More research is needed to verify the findings which may have significant implications for management, policy and practice.
Declaration

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Chapter 1: Introduction and Overview

1.1 Introduction

Healthcare services are an information intensive industry (Hovenga, 1996). In 1986 the World Health Organisation (WHO) identified that health information systems would play a crucial role in achieving health for all by the year 2000 (Lippeveld et al., 2000). Information is significant at all levels of healthcare services from patient management to health unit management, and from policymakers and managers to healthcare providers (Lippeveld et al., 2000). Although beginning later than other industries, computer technology and information science have been widely integrated into healthcare institutes over the last ten years (Reep and Lohman, 1998; Patterson, 2004). Investment in health information systems has tended to increase, particularly in developing countries (Haux, 2006).

1.2 Overview of Health Information Systems

1.2.1 Definitions of Terms

The discipline of health informatics arose during the 1970s (Cesnik, 1996) as an umbrella term, which was previously known as medical informatics, covering medical, nursing, dental and pharmacy informatics. Currently, there are no universal definitions for health informatics. Generally speaking, it means that computer sciences are applied for using and sharing information to support healthcare delivery (Mandil, 1989; UK Health Informatics Society, 2004; Hannah et al., 2006). Only the work of Lippeveld et al. (2000), published by the WHO, clearly defined the term and the objectives of health information systems. Therefore, this definition is adopted in this study.

“Health information systems as a set of components and procedures organised with the objective of generating information which will improve health care management decisions at all levels of the health system ..... Health information systems integrate data collection, processing, reporting, and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services” (Lippeveld et al., 2000 ,P3).

Some terminologies in the health informatics literature need to be clarified. Lippeveld et al. (2000) pointed out that the widely used terms “health management information systems” and “hospital information systems” are misleading because they suggest different information systems for different functions. These systems are considered as a
“subsystem” of health information systems. Therefore, the term “health information system” is preferred (Lippeveld et al., 2000).

The development and progress of health information systems studied in the literature varies and terminologies were many at the outset of the study. Thus, it was not possible to predict what systems would be used by this study and the study sample. The focus of this PhD was on the information systems of which the end-users were front-line nurses applying them in their daily clinical practice. Therefore, the term ‘computerised information systems’ was adopted to generally indicate that the information systems would be used by front-line nurses in daily clinical practice, rather than the information systems producing electronic patient records only. Hence, computerised information systems refer to electronic patient records, computerised physician order entry, laboratory information systems, radiology information systems, nursing information systems and computerised nursing care plan systems.

1.2.2 The Application

Health information systems aim to contribute to high-quality and efficient patient care (Haux, 2006). Lippeveld et al. (2000) emphasised that the ultimate goal for health information systems is not “to gain information”, but “to improve action”. A variety of information systems are widely applied in supporting different clinical services. The common systems in the literature are described in Table 1.1.

<table>
<thead>
<tr>
<th>Table 1.1: Computing Application in Healthcare</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hospital Management Systems:</strong> A method of collecting, storing, retrieving and processing information that is used by managers in the performance of their duties (Hannah et al., 2006).</td>
</tr>
<tr>
<td><strong>Medical Patient Record Systems:</strong> Computer-based medical-record systems are the solution for the drawbacks of traditional paper medical records. Such a system can increase accessibility because it allows remote access. The system also provides more legible and better-organised medical reports (Shortliffe et al., 1990).</td>
</tr>
<tr>
<td><strong>Computerised Physician Order Entry Systems (CPOE)</strong> require doctors to enter all clinical service orders directly into the computer system without nurses’ or clerks’ assistance (Massaro, 2005).</td>
</tr>
<tr>
<td><strong>Nursing Information Systems:</strong> A computer-based information system assists nursing tasks in clinical practice, which include nursing diagnoses, nursing care plans, evaluation of the care provided, facilitating nursing administration and promoting nursing research and education (Shortliffe et al., 1990; Brittain and Abbott, 1993; Hannah et al., 2006).</td>
</tr>
<tr>
<td><strong>Point-of-Care Systems:</strong> A hospital information system containing bedside terminals and other technological devices allows health professionals to capture and enter data at the locations where patients receive care in order to enhance direct patient care (Shortliffe et al., 1990; Ball et al., 2000).</td>
</tr>
</tbody>
</table>
Table 1.1: Computing Application in Healthcare (Cont.)

- **Radiology Information Systems**: A computer-based radiology information system supports the operation of radiology departments in managing the film library, scheduling of patient examinations, reporting results and billing. Medical images such as X-ray, computerised tomography (CT), ultrasound imaging and magnetic resonance imaging (MRI) are recorded and stored in digital formats rather than on films (Shortliffe et al., 1990).

- **Clinical Decision-Support Systems** are any computer program designed to assist health professionals in clinical decision-making regarding patient care (Shortliffe et al., 1990).

- **Laboratory Information Systems**: A computer-based information system that supports laboratory functions such as collecting and reporting test results (Shortliffe et al., 1990).

- **Pharmacy Systems**: A computerised system to support pharmacy personnel for drug distribution accurately and efficiently, routine medication monitoring and screening for drug interactions (Shortliffe et al., 1990). The Physician Order Entry System is a subsystem of pharmacy systems.

1.2.3 World Trends

Facilitating the use of health information systems has become a global trend, including in Taiwan. The developed countries, including the UK, USA, Canada and Australia, have launched Electronic Patient Records since 2000 (See Table 1.2). In terms of availability, electronic patient records are becoming prevalent in the USA. Electronic patient records are greatly promoted by the developed countries (See Table 1.2). Furthermore, an American study surveying Veterans Health Administration (VHA) hospitals nationally (n=123) via stratified sampling showed that electronic patient records and electronic communication between healthcare providers are widespread in VHA hospitals (99%). Automation of decisions was claimed to reduce errors (84%). Computerised decision support systems are still not common (22%) (Doebbeling et al., 2006).

Table 1.2: The Countries that have Launched Programmes of Electronic Patient Records. (Adapted from Department of Health Taiwan, 2007c)

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2010</td>
<td>UK</td>
<td>National Programme for Information Technology (NPfIT)</td>
</tr>
<tr>
<td>2001-2010</td>
<td>Canada</td>
<td>Health Infoway</td>
</tr>
<tr>
<td>2004</td>
<td>USA</td>
<td>Health IT</td>
</tr>
<tr>
<td>2004-2007</td>
<td>Australia</td>
<td>Health Connect</td>
</tr>
<tr>
<td>2004</td>
<td>Singapore</td>
<td>Towards a Life-Time Health Record</td>
</tr>
<tr>
<td>2006-2010</td>
<td>Korea</td>
<td>Centre for Interoperable Electronic Health Record</td>
</tr>
</tbody>
</table>

The development of health information systems primarily focused on administrative and financial activities related to healthcare service delivery. It was not until the mid-1990s that
the development of healthcare information systems put the focus on clinical management functions (Hovenga, 1996). It is suggested that three factors facilitate the development of health information systems: (1) Economic and political influences, (2) Rapid changes in society and (3) Advanced technologies (Hovenga, 1996; Haux, 2006). Literature suggested that the increased emphasis and interest in the efficiency and effectiveness of healthcare services encourages the development of the clinical management functions of healthcare information systems (Hovenga, 1996). Furthermore, similar policy initiatives focusing on efficacy of care and budgeting in the USA, UK and Australia from the 1980s to the early 1990’s also had a great impact on health information system development (Hovenga, 1996). The tremendous progress in medicine and technology advances and the extended life expectancy also affect the development of health information systems (Hovenga, 1996; Haux, 2006). It is argued that economic constraints and competing pressures from the external environment appear to be the factors that drive the development and implementation of health information systems in healthcare service sectors (McCalman and Paton, 1992; Hovenga, 1996).

In terms of nursing information systems, the development of health information systems has been focused on medical rather than on nursing care (Staggers et al., 2001). Although the early computing systems were developed in the 1960s, their support for clinical care and nursing practice was limited in the 1970s and 1980s. In 1992, the American Nurses Association defined Nursing Informatics as a new speciality and published guidelines for nursing information systems to help the development of nursing-centred applications (Bowles, 1997; Staggers et al., 2001; Staggers and Thompson, 2002). In America, major vendors offered applications for nursing activities (Staggers et al., 2001). However, Staggers et al. (2001) pointed out that support of computing capacities for clinical nursing practice among healthcare organisations remains uneven. Additionally, there is little empirical data on the prevalence of nursing information systems in clinical nursing practice.

1.3 Healthcare in Taiwan

In this section, the country profile, healthcare systems and health financing in Taiwan are briefly outlined. For political reasons, Taiwan is not recognised as an independent country by the People’s Republic of China. Taiwan is not a member of World Health Organisation. Therefore, the latest official statistical data are from the Taiwanese government yearbooks (Department of Statistics, 2008; Directorate General of Budget, 2008).
1.3.1 Country Profile

Taiwan is an island lying to the southeast of China and is close to Hong Kong (See Figure 1.1). Table 1.3 shows the profile of Taiwan. Currently, there are more than 22 million people living in Taiwan. Because the land area is small, population density is high. Taiwan is also a rapidly ageing society. About 10.28% of the population are over the age of 65. The government estimates that the aged population will reach 14% in the year 2021 (Bureau of National Health Insurance, 2005). In 2006, GNP per capita is nearly 16,500 US dollars. The total national health expenditure in 2003 was 6.26% of GDP.

Figure 1.1: Map of Taiwan (Central Intelligence Agency, 2008)

Table 1.3: Profile of Taiwan

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Value (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land area</td>
<td>36,188 km(^2) (14,000 mile(^2))</td>
</tr>
<tr>
<td>Language</td>
<td>Mandarin Chinese (official), Taiwanese, and Hakka dialects</td>
</tr>
<tr>
<td>Ethnic groups</td>
<td>Taiwanese (including Hakka) 84%, Mainland Chinese 14%, Indigenous 2%</td>
</tr>
<tr>
<td>Population density</td>
<td>635 per km(^2) (2008)</td>
</tr>
<tr>
<td>Population aged over 65</td>
<td>10.28% (2008)</td>
</tr>
<tr>
<td>Literacy</td>
<td>99.4% Male (2007) 95.85% Female (2007)</td>
</tr>
<tr>
<td>Unemployment</td>
<td>3.91% (2007)</td>
</tr>
<tr>
<td>NHE as % of GDP</td>
<td>6.26% (2003)</td>
</tr>
</tbody>
</table>
The Taiwan health indices in Table 1.4 show that the mortality rate is decreasing and life expectancy is steadily catching up with OECD countries (Bureau of National Health Insurance, 2005). The leading causes of death are cancer and chronic diseases.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Value (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Birth Rate</td>
<td>9.1 ( \times ) 00 (2006)</td>
</tr>
<tr>
<td>Crude Death Rate</td>
<td>6.0 ( \times ) 00 (2006)</td>
</tr>
<tr>
<td>Natural Increase Rate</td>
<td>3.58 ( \times ) 00 (2007)</td>
</tr>
<tr>
<td>Infant Mortality Rate</td>
<td>4.7 ( \times ) 00 (2007)</td>
</tr>
<tr>
<td>Maternal Mortality Rate</td>
<td>6.8 ( \times ) 00 (2007)</td>
</tr>
<tr>
<td>Life Expectancy at birth</td>
<td>73.79 Male (2007)</td>
</tr>
<tr>
<td></td>
<td>79.63 Female (2007)</td>
</tr>
<tr>
<td>Leading causes of death</td>
<td>1 Cancer (2006)</td>
</tr>
<tr>
<td></td>
<td>2 Cerebral vascular disease</td>
</tr>
<tr>
<td></td>
<td>3. Heart diseases</td>
</tr>
<tr>
<td></td>
<td>4. Diabetes mellitus</td>
</tr>
<tr>
<td></td>
<td>5. Accidents</td>
</tr>
</tbody>
</table>

1.3.2 Healthcare Systems

According to the historical context, Fu (2005) discussed the phenomenon of colonial medicine in Taiwan in detail. The phenomenon of colonial medicine is that Western technologies and medicine are seen as enlightenment (Zhang, 2003). The development of Western medicine in Taiwan dated back to Taiwanese colonial history (See Table 1.5) which was organised from a sociological perspective into four major periods by Zhang (2003). In the modern age, the Taiwanese government and citizens are still greatly influenced by Western countries. According to Zhang (2003), such a phenomenon provides the basis of healthcare in modern Taiwan.

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1624-1683</td>
<td>Holland occupied Taiwan for 38 years (1630-1662). Zheng Chenggong, a military leader at the end of the Chinese Ming Dynasty, defeated Holland and then governed Taiwan from 1662 to 1683. During these two periods, Western medicine had spread to Taiwan but had no influence.</td>
</tr>
<tr>
<td>1683-1894</td>
<td>Taiwan was governed by the Qing Dynasty from 1683 to 1895. In order to spread the Christian Gospel, British and Canadian ministers brought contemporary western medicine into Taiwan by building hospitals and training nurses and assistants.</td>
</tr>
<tr>
<td>1895-1945</td>
<td>Japan colonised Taiwan. The Japanese government facilitated and managed the public health system based on the Western medicine paradigm and ignored traditional herbal medicine.</td>
</tr>
</tbody>
</table>
Table 1.5: The Establishment of Western Medicine in Taiwanese History (Zhang, 2003) (Cont.)

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1945-To Date</td>
<td>The political power was returned to the Republic of China which is the current Taiwanese government. The position of Western medicine in Taiwanese society has consolidated gradually.</td>
</tr>
</tbody>
</table>

The modern Taiwanese healthcare system is dominated by the private sector mainly providing Western medical services. In Taiwan, 85% of the hospitals and 97% of the clinics are private (See Table 1.6). Despite being fewer in number, public hospitals are crucial in public health programmes and provide services in remote areas. Public hospitals are run by the government. Some public hospitals are controlled by the Department of Health, Taiwan; some are run by local government, such as county or city hospitals and some are run by public medical schools or the Military. Although several hospitals were built by Westerners in the late 19th century, currently no overseas corporations are involved in hospital ownership. The private hospitals are run either on a non-profit proprietary basis or by individual doctors. However, there is a criticism that the concept of a non-profit organisation is misused. Although many hospitals claim themselves to be not-for-profit, the strategies of business achievement and a bonus system are applied in most hospitals, including the public hospitals (Koo Foundation Sun Yat-Sen Cancer Centre, 2007).

Table 1.6: Healthcare Providers in Taiwan in 2006

<table>
<thead>
<tr>
<th></th>
<th>Public</th>
<th>Private</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital</td>
<td>80 (14.63%)</td>
<td>467 (85.37%)</td>
<td>547 (100%)</td>
</tr>
<tr>
<td>Clinics</td>
<td>468 (2.45%)</td>
<td>18,667 (97.55%)</td>
<td>19,135 (100%)</td>
</tr>
</tbody>
</table>

The composition of the healthcare workforce is listed in Table 1.7. Unlike the western countries but like Japan, Taiwan's hospitals adopt a closed-staff system. In the closed-staff system, doctors are directly employed by healthcare institutions and doctors in clinics cannot use the equipment and human resources of hospitals. A gate-keeper system is not yet established in Taiwan. In other words, when patients need to see a doctor they can choose to go to any clinic or hospital. The general public believe that hospitals provide a better quality of service than clinics. Therefore, patients prefer to go to hospitals even with minor illnesses, which results in the extraordinarily high service volumes in hospital outpatient departments (Bureau of National Health Insurance, 2005).
Table 1.7: Numbers within the Healthcare Workforce in 2006 (Per 10,000 population)

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Number per 10,000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctors</td>
<td>15.26</td>
</tr>
<tr>
<td>Nurses</td>
<td>47.71</td>
</tr>
<tr>
<td>Midwives</td>
<td>0.16</td>
</tr>
<tr>
<td>Pharmacists</td>
<td>8.92</td>
</tr>
<tr>
<td>Dentists</td>
<td>4.55</td>
</tr>
</tbody>
</table>

1.3.3 Overview of National Health Insurance (NHI)

The National Health Insurance Programme was launched in 1995 and operated by the Bureau of National Health Insurance, a government agency under the Department of Health, Taiwan. Before the NHI, the health insurance coverage rate was 59% (See Table 1.8). NHI is a mandatory programme for all citizens and foreigners with residence permits. Currently, nearly 99% of the citizens are enrolled in the NHI programme. Nowadays, social insurance schemes still maintain their functions in pension payment, death benefits, disabled allowance, funeral allowance and occupational disease allowance (Bureau of National Health Insurance, 2005).

Table 1.8: Progress of Social Insurance in Taiwan (Adapted from Bureau of National Health Insurance, 2005)

<table>
<thead>
<tr>
<th>Year</th>
<th>Social Insurance</th>
<th>Population (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>Labour insurance</td>
<td>40.12%</td>
</tr>
<tr>
<td>1958</td>
<td>Government Employee insurance</td>
<td>8.06%</td>
</tr>
<tr>
<td>1985</td>
<td>Farmer insurance</td>
<td>8.21%</td>
</tr>
<tr>
<td>1990</td>
<td>Low-income household insurance</td>
<td>0.55%</td>
</tr>
<tr>
<td>1995</td>
<td>National Health Insurance</td>
<td>100%</td>
</tr>
</tbody>
</table>

The service provisions of NHI are very comprehensive including inpatient care, ambulatory care, laboratory tests, pharmaceuticals, dental services, traditional Chinese medicine, day-care for the mentally ill and home-care. The utilisation of NHI services is relatively high compared to that of Western countries. On average, each person visited outpatient services 14.3 times in 2003. For inpatient care, there were 12.4 admissions per hundred persons per year (Bureau of National Health Insurance, 2005).

In terms of payment, the Bureau of National Health Insurance collects insurance premiums from the insured and reimburses medical payments to healthcare providers (See Figure 1.2). The insurance premiums are paid by both employees and employers. Most employees pay 30 to 40% and the employers pay 60% of the premiums. The NHI healthcare providers offer the patients healthcare services and claim medical expenses from the Bureau. National Health Insurance pays the healthcare providers on a global budget payment.
scheme. Meanwhile, patients need to pay 10% of medical expenditure as co-payment for health services. Several cases are exempted from the co-payment, including low-income households, people with catastrophic diseases such as cancer, child delivery, preventive health services and medical services offered in remote mountain areas and on offshore islands (Bureau of National Health Insurance, 2005). For example, in the case of low-income households, the government helps to pay 100% of the premiums.

Figure 1.2: The Flow of Healthcare Systems under National Health Insurance

1.3.4 Healthcare Financing
In 2003, total health expenditure was 6.26% of GDP. 3.59% was from the health insurance, 2.23% from out-of-pocket money and the remaining 0.44% was from government coffers. The premium revenue in 2004 was about US$10.91 billion. The sources of premium revenues are from the insured (38%), the employers (35%) and government subsidies (27%). The medical expenditure of the NHI in 2004 was NT$ 385 billion (US$11 billion), of which 65% went to ambulatory care and 35% to inpatient care (Bureau of National Health Insurance, 2005).

1.4 Healthcare Information Systems in Taiwan
In order to gain an in-depth understanding of the general context, the policy framework of health information systems in Taiwan will be presented.

1.4.1 Policy Framework
As Section 1.3.2 described, the Taiwanese government and medicine have been greatly influenced by the West. Due to the promotion by Western advanced countries, the Taiwanese government stated that health information systems are necessary because this is the world trend (Department of Investment Services Taiwan, 2007; Li and Kirkup, 2007;
The central government therefore launched a nationwide policy, *Challenge 2008: National Development Plan* (Executive Yuan Taiwan, 2003). *E-Taiwan Construction Plan* is one of 10 individual key plans in the National Plan. It aims to build Taiwan as the most digitized country in Asia (Executive Yuan Taiwan, 2003). The *E-Health Service Project* is one of the sub-projects which facilitates the application of health informatics and promotes electronic patient records in healthcare to enhance service quality and efficiency. Three objectives of the *E-Health Service Project* are to:

1. Enhance the infrastructure of health informatics to develop a comprehensive internet network for the e-health service.
2. Promote electronic patient records and standard health information to enhance healthcare quality and efficiency.
3. Promote the application of health informatics to ensure that people obtain correct health information (Executive Yuan Taiwan, 2003).

### 1.4.2 Electronic Patient Records

Implementing electronic patient records is seen as the solution to improve healthcare quality in several articles by the Department of Health, Taiwan and academia (Chu et al., 2001; Executive Yuan Taiwan, 2003; Department of Health Taiwan, 2007a; Department of Health Taiwan, 2007b; The Liberty Times, 2007b; Department of Health Taiwan, 2007c; Department of Health Taiwan, 2007d). Electronic patient records are strongly promoted by the central government. The progress of the electronic patient records project is summarised in Table 1.9.

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>Revising the medical law regarding the electronic and traditional patient records (Department of Health Taiwan, 2005).</td>
</tr>
<tr>
<td>2004-2007</td>
<td>Developing the software (Department of Health Taiwan, 2007a) and standardising formats of electronic patient records by the TMT Project Team (Taiwan Electronic Medical Record Template, 2007).</td>
</tr>
</tbody>
</table>
Table 1.9: The Progress of Electronic Patient Records in Taiwan. (Cont.)

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>Pilot testing the newly developed electronic patient record system in selected clinics.</td>
</tr>
<tr>
<td>2007</td>
<td>Expanding the pilot programme by recruiting the medical centres as participants.</td>
</tr>
<tr>
<td>2007, May 21</td>
<td>The 4th and the greatest computer crash occurred in the National Taiwan University Hospital (China Times, 2007; The Liberty Times, 2007a).</td>
</tr>
<tr>
<td>2007, Jun 5th</td>
<td>10 medical centres signed the contracts for participating in the pilot programme of electronic patient records. (The Liberty Times, 2007b).</td>
</tr>
<tr>
<td>2008, Jan.</td>
<td>10 medical centres start to use electronic patient records (Department of Health Taiwan, 2007a).</td>
</tr>
</tbody>
</table>

The Taiwanese central government revised the medical law for the use of electronic patient records in 2004 and announced new regulations in 2006. One of the regulations stated that if healthcare institutions produce and store electronic patient records, there is no need to produce traditional paper-based medical charts (Department of Health Taiwan, 2006). From the literal meaning of this regulation, it is not clearly stated whether electronic patient records are compulsory or optional for healthcare institutes.

Since 2007, the Department of Health, Taiwan has invested 2 billion New Taiwan Dollars (NTD) in electronic patient records each year (Department of Health Taiwan, 2007b). Since 2007, the government has had plans to invest 10 billion NTD. In 2007, the Department of Health announced that 10 medical centres had signed the contract as participants in the pilot programme of electronic patient records beginning in January 2008 (see Table 1.9). However, initiating electronic patient records is time-consuming and costly. As presented in Section 1.4.1 and Table 1.9, the project started in 2002. Up to January 2008, just ten medical centres had started the pilot programme (See Table 1.9).

Moreover, all documents found from government websites, medical informatics industries, academia to the press advocate the benefits of electronic patient records (Chu et al., 2001; Executive Yuan Taiwan, 2003; Department of Health Taiwan, 2005; Department of Investment Services Taiwan, 2007; Taiwan Electronic Medical Record Template, 2007; Department of Health Taiwan, 2007a; Department of Health Taiwan, 2007b; The Liberty Times, 2007b; Department of Health Taiwan, 2007c; Department of Health Taiwan, 2007d). A few articles were published in general magazines discussing the benefits of electronic patient records to the general public (Department of Health Taiwan, 2007a;
Department of Health Taiwan, 2007c). These can be regarded as the government’s dissemination strategy to facilitate the lay people’s acceptance of electronic patient records.

The National Development Plan reported that the prospective advantages of the E-Health Service Project can benefit the development of Taiwan in four dimensions: individual citizens, healthcare organisations, the government itself and industry.

Firstly, citizens can have a copy of their patient records themselves (Executive Yuan Taiwan, 2003). The government claimed that the pioneering work of electronic patient records is to return the right of having patient’s records from healthcare institutions to the citizens because service users can keep the latest copy of their patient records in an electronic version themselves (Department of Investment Services Taiwan, 2007).

Secondly, for healthcare industries, efficiency and quality can be enhanced by continuing healthcare provision after digitizing (Executive Yuan Taiwan, 2003). Moreover, both the government and academia (from international commerce and information engineering and management fields) claimed that electronic patient records are easy to manage, saving time and paper, enhancing healthcare quality, reducing medical errors and being convenient for health research (Chu et al., 2001; Department of Health Taiwan, 2007c).

Thirdly, for the government, medical resources can be saved by reducing repeated tests and medications (Executive Yuan Taiwan, 2003). The government also asserted that electronic patient records can save the expenditure of 10 billion NTD by the National Health Insurance (equal to £159 million) by reducing repeated medical tests and medications whilst creating 40 billion NTD output value (equal to £635 million) for the government and healthcare industries (Department of Investment Services Taiwan, 2007).

Finally, for industry, international trade can be promoted by facilitating the development of health informatics industries in Taiwan (Executive Yuan Taiwan, 2003). Meanwhile, the government believes that in the future a new market will create a ‘secure repository’ for electronic patient records where services users can safely deposit their personal health information (Department of Investment Services Taiwan, 2007).

By contrast, political or academic debate about the introduction of computerised health information systems in Taiwan is limited. Whilst electronic patient records have found favour with the government, industries and academia, the voice against such a policy is
rarely heard even after the computer crash events (China Times, 2007; The Liberty Times, 2007a). According to the Taiwanese press, the fourth and the most severe computer crash occurred on May 21, 2007 in a leading medical centre in North Taiwan. Eight thousand patients were affected by a severe time delay (China Times, 2007; The Liberty Times, 2007a) (See Table 1.9).

However, the claimed benefits of computerisation need an evidence base. It is argued that promoting the employment of electronic patient records is not an evidence-based policy. Black (2001) argued that the policies regarding service organisation often have a weak association with research evidence as compared to practice policies generally. One of the common reasons is that the policymakers have social or financial goals other than clinical effectiveness (Black, 2001).

1.5 The Issue

In the following paragraphs, the evidence regarding the benefits of health information systems are discussed in detail.

As Sections 1.2 and 1.4 described, implementing health information systems has become a worldwide trend to which Taiwan is no exception. Abundant literature promotes the application of health information systems and claims that they have the potential to enhance quality of care. Both the Taiwanese and international literature claim that adopting health information systems to manage professional, yet complex, data can effectively promote the quality of care and administration (Shih, 1993; Thede, 2003; Chuang and Hung, 2004). The other claimed benefits in the literature include:

1. *Time-saving*: Both saving time from paper-based, information-processing tasks and eliminating duplication of effort provide more time for the nursing process (Bowles, 1997; McCargar et al., 2001; Thede, 2003; Hannah et al., 2006);

2. *Completeness*: To produce more complete patient records for patient care, quality assurance and research (Bowles, 1997; Thede, 2003; Hannah et al., 2006);

3. *Accuracy*: To improve the accuracy of documentation and increase the speed of information transfer to facilitate nursing assessment (McCargar et al., 2001; Thede, 2003; Hannah et al., 2006)

4. *Accessibility*: To make storage and retrieval of the healthcare records easier (Thede, 2003); and
(5) **Real-time:** A well-planned electronic information system can provide real-time information through creating and using aggregated data, improve quality by preventing errors through computerised systems and create financial savings (Thede, 2003).

However, the evidence demonstrating the benefits of health information systems in improving nursing clinical performance and patient outcomes is still limited in both the number of studies and the level of evidence. For example, in the review article, Bowles (1997) claimed that nursing information systems improved efficiency by saving nurses’ time based on the limited evidence derived from five studies from 1987 to 1994. However, nursing informatics has been recognised as a new speciality by the American Nurses Association since 1992 and is now a rapidly developing area (Bowles, 1997; Hunter, 2001; Staggers and Thompson, 2002). Moreover, the benefits of nursing information systems with regard to patient safety and satisfaction were underpinned with little evidence in Bowles’ (1997) review.

Delpierre et al. (2004) systematically reviewed 26 studies published from 2000 to 2003. Delpierre et al. (2004) suggested that computerised patient record systems increase user and patient satisfaction, which might improve healthcare practice. No evidence was presented that electronic patient records can benefit patient outcomes and quality of care. However, the majority of system users in Delpierre et al.’s (2004) review were doctors. Only three out of 26 studies recruited nurses and analysed their satisfaction. Nurses were only involved in three studies and their sample sizes were very small (n=6~12).

Two studies comparing computerised and paper-based nursing care plan systems by randomised control trials showed that computerised systems increase time spent on documentation (Ammenwerth et al., 2001; Daly et al., 2002). In terms of documentation time, no significant difference was found in Ammernwerth et al.’s (2001) study. On the contrary, Daly et al.’s (2002) study showed that the numbers of nursing activities and time spent on documentation both increase in the group using an electronic nursing record. Daly et al.(2002) also measured the influences of electronic nursing records on patient outcomes. No significant difference is found between two groups. Although randomised control trials were adopted, the generalisability of both Ammernwerth et al.’s (2001) (n=60) and Daly et al.’s (2002) (n=20) studies was limited by the small number of patients included. Hence, in spite of these claims, the relevant studies examining the benefits of health information systems are inconclusive.
1.6 Overall Research Aim
The broad aim of the study was to explore the impact of computerised health information systems on the role of front-line nurses and practice in healthcare organisations in Taiwan.

1.7 Structure of the Thesis
This thesis consists of 11 chapters. A brief description of each chapter is given below.

- **Chapter 1: Introduction and Overview**, as the introductory chapter, has provided the research background including the overview of healthcare information systems and healthcare and healthcare information systems in Taiwan. The issue was overviewed and the rationale and significance of the study highlighted. The broad research aim was outlined.

- **Chapter 2: Literature Review** consists of two broad topics. The first one is nurses’ attitudes toward computers and perceptions of computer use which presents the literature that analysed the studies that examined front-line nurses’ attitudes toward computers and perceptions of computer use in clinical practice. The second topic is the design and implementation of health information systems in healthcare organisations. This review provides an overview of design and implementation approaches of information systems in the information systems literature. Using sociological perspectives as an alternative approach to study the influences of healthcare information systems on nursing role and practice is proposed.

- **Chapter 3: Methodology and Method** presents the methodological framework guiding the research design and how the study was conducted.

- **Chapter 4: Characteristics of the Case and Sub-cases** presents the demographic data of front-line nurses, nurse managers and software engineers who participated in the study. Additionally, the characteristics of computer technologies are described and graphically illustrated.

- **Chapter 5: Developing Nursing Information Systems: Inter-occupational interactions as negotiation**. This chapter explores how nursing information systems
were designed and how the decisions were arrived at by three parties: the top management and the informatics and nursing departments.

- **Chapter 6: Implementation** presents how computerised information systems were implemented in the case-study hospital and how front-line nurses viewed the top managers’ decisions.

- **Chapter 7: Digital Taylorism** examines how computerised information systems can be used for practice and hospital management. How nurses’ experiences of using information systems are presented.

- **Chapter 8: Hidden work** investigates the unexpected influences of the computerisation process and what coping strategies front-line nurses used to manage and cope with unintended consequences.

- **Chapter 9: Discussion.** This chapter discusses the former four chapters of findings in sequence. Theories illuminating the findings are outlined and explanations of the results are given. Current available evidence is compared and contrasted. It will argue that power imbalance and lack of resources increased the difficulty of developing the desired nursing information systems. It will argue the issue of oppression in nursing. It will debate whether computers up-skill or de-skill nursing as an occupation because of the duality of computer technology. It will argue that computers became co-clients of front-line clinical practice.

- **Chapter 10: Conclusions:** this final chapter reviews the thesis overall, considers the limitations of the research, examines the extent to which the research could contribute to knowledge and explores further research opportunities.

### 1.8 Summary

To unify the terms used to describe computer systems supporting different kinds of clinical functions, ‘health information systems’ was suggested as an umbrella term by the WHO. The functions of health information systems to support clinical care sound promising. Consequently, the use of health information systems has become a world trend. Nowadays, its application is widespread, in particular the use of electronic patient record systems.
Taiwan is a crowded island country. Since 1995, the government has launched the National Health Insurance system which provides convenient, affordable healthcare services to the public. The low mortality rate and increasing life expectancy of the population is steadily catching up with advanced countries. From past colonial history, it is known that the modern healthcare system is deeply affected by Western medicine and technologies. By recognising that implementing health information systems is a world trend, the government began to develop such systems in 2002 and expanded the pilot testing programmes in 2008. Electronic patient records are promoted by the government.

However, evidence demonstrating its benefits is lacking in the official reports. Furthermore, the evidence of the actual benefits of the health information system is inconclusive. Therefore, this study was intended to explore the impact of computerised health information systems on the role of front-line nurses and practice in healthcare organisations in Taiwan.
Chapter 2: Literature Review of User and Implementation Contexts

2.1 Introduction
In order to understand how computerised information systems are used by clinical nurses in their nursing practice and identify knowledge gaps, this chapter is a literature review covering two main topics: users and implementation contexts. Section 2.2 is the critical overview of nurses’ attitudes to computers. Section 2.3 explores nurses’ perceptions of the computerised information system used in their practice. Section 2.4 outlines the approaches used to develop a computerised information system. Section 2.5 presents the current implementation issues and examines them from two aspects: First, predominant theories for promoting and studying computer technology and information systems in the implementation literature are appraised. The empirical evidence reporting on the implementation process in healthcare organisations is examined. Section 2.6 synthesises the findings about nurses’ computer attitudes and user experiences from a sociological perspective. Finally, Section 2.7 presents the significance and rationale for this study.

In terms of literature search strategies, the approach used for obtaining the literature varied in each section of the literature review, according to the topics and availability of evidence. The details of literature searching strategy for each topic are presented in each section.

2.2 Overview of Nurses’ Attitudes toward Computers
In this section, empirical studies measuring nurses’ attitudes towards computers are appraised according to their theoretical dimensions, research design, instrument design, sample selection and data collection procedure. Demographic characteristics which may affect nurses’ attitudes are identified. The overall attitudes are summarised.

2.2.1 Review Strategy
Nurses’ attitudes toward computers were firstly searched and reviewed in late 2007. The review results informed the researcher and provided a general idea regarding nurses’ attitudes toward computers. The systematic review tool by CASP International Network (2010) was applied to guide the appraisal. This review was updated in 2011 using the same search strategy and database which will be presented in the following.
2.2.2 Literature Search

Three electronic databases were used, including CINAHL (from 1982 to December 2011), MEDLINE (from 1973 to December 2011) and ERIC (from 1966 to December 2011). The key terms employed to identify studies were nurses, attitudes and computer. These key terms were used in single and combined searches. Source type was limited to academic journals. In addition, publication year was not limited in order to identify relevant studies. Furthermore, any changes over time in nurses’ attitude towards computerised information systems can be examined.

In total, 244 studies were found and screened for relevance by reading the abstracts. Studies examining nurses’ attitudes toward computers or computerised information systems in hospital settings were selected. Studies which focused on administrative functions were excluded. Finally, 19 studies were selected.

Several studies were excluded because their samples and the computer technologies studied were not relevant to the research focus of the current study. Two studies were excluded because the sample studied were not front-line nurses working in hospital settings. One study surveyed registered nurses from community and internet groups (IM and Chee, 2006). The other study surveyed middle-level nurse managers (Kivuti and Chepchirchir, 2011). Two studies researching web-based patient support systems were excluded, because the information systems studied were not primarily for healthcare professionals (Nordqvist et al., 2009; Koivunen et al., 2010).

Due to the limited availability of full texts, several studies were excluded, including six PhD theses (Coover, 1992; Maher, 1992; Bradley, 1993; Maakestad, 1993; Cuyar, 1998; Hendrickx, 1998), four studies were inaccessible (Casas-Dades, 1997; Honey, 1998; Kiat, 2000; Al-Zahrani, 2003), one recent study was in the embargo period until November 2012 (Carayon et al., 2011). Due to the language barrier, some studies written in Portuguese were excluded (Santos, 2001; Ribeiro and Lopes, 2004).

2.2.3 Review of Selected Studies

All nineteen studies were survey research designed to use self-administered questionnaires and were carried out in the USA (Burkes, 1991; Scarpa et al., 1992; Murphy et al., 1994; Sleutel and Guinn, 1999; Moody et al., 2004; Dillon et al., 2005; McLane, 2005; Smith et al., 2005), Canada (McBride and Nagle, 1996), the UK (Lowry, 1993; Lowry, 1994; Simpson and Kenrick, 1997; Getty et al., 1999), Australia (Marasovic et al., 1997; Eley et
al., 2009), China (Liu et al., 2000), Kuwait (Alquraini et al., 2007), Hong Kong (Chan, 2007), Israel (Shoham and Gonen, 2008) and Turkey (Kaya, 2011) from 1992 to 2011.

The main purpose of these 19 studies was to assess nurses’ attitudes toward computers. Their motivations for carrying out the studies were unanimous. Based on a literature review, the investigators thought that staff acceptance is significant to the successful implementation of computer systems (Scarpa et al., 1992; Marasovic et al., 1997; Simpson and Kenrick, 1997; Sleutel and Guinn, 1999; Dillon et al., 2005; McLane, 2005). The problems encountered during the implementation stage of computerised information systems may be associated with the users’ attitudes toward the information technology or a failure to seek the users’ involvement (Moody et al., 2004; Dillon et al., 2005). Another key determinant of successful implementation is the level of end-user satisfaction which is affected by the system usability (Moody et al., 2004; McLane, 2005). Therefore, it was suggested that identifying feelings of resistance prior to the implementation of the information system (Lowry, 1993; Getty et al., 1999) in order to understand the staff’s attitudes and expectations in the early stage would help the successful implementation (Burkes, 1991; Dillon et al., 2005; McLane, 2005).

2.2.4 Backgrounds of the Investigators
Most investigators were from clinical nursing and academic nursing backgrounds; some were from informatics or management. Some investigators worked in clinical nursing and were responsible for clinical information systems informatics in their organisations (Burkes, 1991; Marasovic et al., 1997; Liu et al., 2000). Only Dillon et al. (2005) were from the Computer Information Systems discipline and Management Science whilst Murphy et al. (1994) were from a research centre.

2.2.5 Theoretical Dimensions
An attitude is a theoretical construct and abstraction (Oppenheim, 1992; Gilbert, 2001). The common definition of an attitude is a predisposition to behave in a particular way (Gilbert, 2001) whilst social psychology defines that an attitude represents a summary evaluation response toward an object (Bohner and Wänke, 2002). The components of this summary evaluation may be affective, behavioural and cognitive (Gilbert, 2001). Opinion and value are close synonyms to attitude (Gilbert, 2001). The study of attitudes has a long history in social psychology. Attitudes are reinforced by beliefs and attract strong feelings which may lead to a particular behavioural intent (Oppenheim, 1992). Accordingly, they
Influence behaviour (own and others’), information processing and social encounters (Bohner and Wänke, 2002).

In terms of theoretical dimensions, only a few studies presented their conceptual frameworks. Nearly half of the 19 studies did not report how nurses’ attitudes toward computers were defined (Lowry, 1993; Getty et al., 1999; Sleutel and Guinn, 1999; McLane, 2005; Smith et al., 2005; Alquraini et al., 2007; Chan, 2007; Eley et al., 2009; Kaya, 2011). In the studies where the definition of nurses’ computer attitudes was given, some investigators thought attitudes were constructed by particular situations, rather than as stable concept (Burkes, 1991; Murphy et al., 1994; McBride and Nagle, 1996). Only four studies presented the conceptual framework. Burkes (1991) adopted Vroom’s (1964) expectancy model as the framework which explained that there were three constructs of an attitude: an individual’s satisfaction (or preference), expectancy (or belief) and motivation. Liu et al. (2000) examine a self-developed framework, which presented the relationship between computer knowledge, attitudes, skills and computer practice. Two studies adopted Fishbein and Ajzen (1975)’s Theory of Reasoned Action as the conceptual framework (Murphy et al., 1994; Shoham and Gonen, 2008).

2.2.6 Research Design

In terms of research design, all nineteen studies included adopted the survey method using self-administered questionnaires. These designs studied nurses’ attitudes toward computers via direct attitude measurement, which asks respondents to report their beliefs or evaluation (Bohner and Wänke, 2002). These studies were categorised into five groups according to their contexts and time of measurement presented in Appendices 1 to 5.

The majority of studies were of a cross-sectional design measuring nurses’ attitudes prior to or after the implementation of computerised information systems. Five studies measured nurses’ attitudes toward computers prior to the introduction of computer projects (Scarpa et al., 1992; Lowry, 1993; Lowry, 1994; McBride and Nagle, 1996; Dillon et al., 2005; McLane, 2005) (See Appendix 1). Two of these studies were carried out at study sites which had no computers in the hospitals (Scarpa et al., 1992; McBride and Nagle, 1996). Seven studies conducted a survey after the implementation of the computerised information systems (Appendix 2). The durations of computer system usage were varied, from less than one year (Marasovic et al., 1997) to more than one year (Burkes, 1991; Liu et al., 2000). Some studies did not report the duration of using computerised information systems (Moody et al., 2004; Alquraini et al., 2007; Chan, 2007; Eley et al., 2009).
Seven studies were non-cross-sectional surveys. Three studies used a longitudinal, quasi-experimental design measuring nurses’ attitudes toward computers before and after using the implemented system (Murphy et al., 1994; Sleutel and Guinn, 1999; Smith et al., 2005) (See Appendix 3). One study surveyed at the computer training workshops and after using the systems for three months (Murphy et al., 1994). One study collected data before the computer training, one month after implementation and 12 months after implementation (Sleutel and Guinn, 1999). One study measured during the first month of implementation and one year after implementation (Smith et al., 2005). One study compared two groups of registered nurses’, both users and non-users, attitudes toward computers (Getty et al., 1999) (See Appendix 4). A small number of studies did not report the context of the survey in the published paper (Simpson and Kenrick, 1997; Shoham and Gonen, 2008; Kaya, 2011) (See Appendix 5).

2.2.7 Instrument Design

Self-administered questionnaires were the major data sources in all fourteen studies. However, no standard questionnaire to measure nurses’ attitudes towards computers was identified. The most common tool applied in the studies was the Stronge and Brodt (1985) questionnaire (Scarpa et al., 1992; McBride and Nagle, 1996; Simpson and Kenrick, 1997; Smith et al., 2005; Alquraini et al., 2007; Shoham and Gonen, 2008). The Stronge and Brodt (1985), consisting of 20 items with a 5-point Likert Scale, (1985) assumes that nurses’ attitudes and behaviours toward computers and their use are caused by a complex inner state. This tool was the first instrument to examine nurses’ attitudes toward computers in general. The content included five topics: (1) Institutional benefits, (2) Capabilities of computers, (3) Job security, (4) Legal ramifications and (5) Quality of patient care. The items were listed in Appendix 6. It had been tested by Stockton and Verhey (1995) and Stricklin, et al., (2003). The results demonstrated good reliability with Cronbach’s alpha of 0.90, 0.92 and 0.93. However, the results of factor analysis in McBride and Nagle (1996) did not meet the Stronge and Brodt (1985) conceptualisation of computer attitudes whilst those of the other studies were significantly correlated (Scarpa et al., 1992; Stockton and Verhey, 1995). Moreover, this tool has been criticized since it examined nurses’ computer attitudes in general, rather than to a specific computer system. Therefore, Murphy et al. (1994) claimed that the Stronge-Brodt (1985) tool approached nurses’ attitudes toward computers from a broad and multi-dimensional perspective. The results derived from the Stronge and Brodt (1985) instrument may be helpful in
educational planning. However, Murphy et al. (1994) suggested that focused assessment of nurses’ feelings regarding a specific system may be helpful in their on-going improvement.

Three studies employed Burkes’ questionnaire (Burkes, 1991; Marasovic et al., 1997; Liu et al., 2000). This Nurses’ Computer-Use Attitude Questionnaire was developed in 1991. The topics of this 5-point Likert-scale included knowledge, satisfaction, motivation and beliefs. The belief section adapted the Stronge and Brodt (1985) tool. Marasovic et al. (1997) believed that Burkes’ questionnaire was more advanced than Stronge-Brodt (1985) because it was developed based on Vroom’s expectancy model. However, its reliability (Cronbach’s Alpha .360-.912) and validity (95% of agreement of nursing experts) may be weak.

Two studies adopted Murphy et al.’s tool (Murphy et al., 1994; Sleutel and Guinn, 1999). Murphy et al.’s (1994) tool was developed based on the Theory of Reasoned Action by Fishbein and Ajzen (1975) who define attitudes as situation-specific and containing cognitive, behavioural and affective components. Based on this framework, 12 positive and 6 negative attitude statements were developed after analysing the patient computer system at the study site. The finalised tool contained 12 items with a 5-point Likert scale using positive wording. It measures general attitudes toward patient care information systems and was tested by varimax rotation (0.46-0.84) and Cronbach’s Alpha (0.92), which suggested good reliability.

The tools of both Burkes (1991) and Murphy (1994) were developed according to a conceptualisation based on attitude theories. However, none of them were designed according to interview results. Oppenheim (1992) states appropriate decisions about the content of scale are crucial. No amount of statistical manipulation or the most advanced scaling techniques can produce a good attitude scale unless the material of the instrument is correct. The ingredient of scale may be created by repeated thoughtful conceptualisation after studying the literature and in-depth interviews (Oppenheim, 1992). According to Oppenheim (1992), in-depth interviews may have significant purposes particularly in developing questionnaires. Their results can be helpful in deciding which part of the conceptualisation is to be measured. Through the verbal expressions of respondents’ attitudes, questions with suitable wording may be produced.

It is noted that three questionnaires common in the published papers were developed in the early ‘90’s. At that time, the development of computer science and the prevalence of
computers were not as great as at the present time. Nursing informatics has been recognised as a new speciality by the American Nurses Association since 1992 and was clearly defined in 1994 (American Nurses Association, 1994). The notion of applying a computer to provide nursing care was new. Therefore, in such a context, interviewing nursing staff who had used computers in their nursing practice may be the most direct method to obtain rich data on nurses’ opinions. Without doing so, the major limitation of these questionnaires may be their reliability and validity, despite the great amount of statistical analysis carried out.

2.2.8 Sample Selection
The representativeness of a sample is affected by the sampling strategy adopted, sample size and the response rate (Polit and Beck, 2004). The samples in the 19 studies included consisted mainly of registered nurses. Some studies recruited other nursing staff such as licensed practical nurses (LPN), nurse assistants and head nurses (HN) (Scarpa et al., 1992; Murphy et al., 1994; Moody et al., 2004; McLane, 2005; Eley et al., 2009) or nursing specialists (Marasovic et al., 1997; McLane, 2005). Few studies recruited nursing students (McBride and Nagle, 1996). Only McLane’s (2005) study recruited clerks (n=6).

The scale of studies varied from national, hospital-wide to one or two care units. Only one study was a national survey (n=4330) (Eley et al., 2009). 12 studies recruited the participants hospital-wide with bigger sample sizes (n=100 to 890) (Scarpa et al., 1992; Murphy et al., 1994; McBride and Nagle, 1996; Simpson and Kenrick, 1997; Sleutel and Guinn, 1999; Liu et al., 2000; Moody et al., 2004; Dillon et al., 2005; Alquraini et al., 2007; Chan, 2007; Shoham and Gonen, 2008; Kaya, 2011). The remaining six studies were relatively small (n=14 to 56) carried out with a few special care units such as an intensive care unit (ICU) (Burkes, 1991; Lowry, 1993; Lowry, 1994; Marasovic et al., 1997), a blood & bone marrow transplant unit (McLane, 2005), one orthopaedic & neuroscience unit and one pulmonary unit (Smith et al., 2005) and two wards (Getty et al., 1999).

The sampling strategies were varied depending on the scale of the studies. For example, six small-scale studies recruited the whole population working in the wards under study (Lowry, 1994; Marasovic et al., 1997; Simpson and Kenrick, 1997; Getty et al., 1999; Sleutel and Guinn, 1999; McLane, 2005). For probability sampling strategies, several studies employed stratified random sampling (Liu et al., 2000; Alquraini et al., 2007; Eley et al., 2009) and one adopted simple random sampling (Murphy et al., 1994). One study randomly selected the wards to distribute questionnaires rather than the participants.
(Shoham and Gonen, 2008). For non-probability sampling strategies, few studies used convenience sampling (Moody et al., 2004; Smith et al., 2005; Chan, 2007). One study adopted purposive sampling (Kaya, 2011). Finally, some studies did not state their sampling strategies in the published paper (Burkes, 1991; Scarpa et al., 1992; McBride and Nagle, 1996; Dillon et al., 2005).

In terms of response rate, Polit and Beck (2004) suggest that 65% is sufficient. Six out of fourteen studies reported that their response rates were greater than 65% (Lowry, 1994; Murphy et al., 1994; Marasovic et al., 1997; Getty et al., 1999; Liu et al., 2000; Moody et al., 2004; Alquraini et al., 2007; Shoham and Gonen, 2008). The response rates were particularly low in the studies by Dillon et al. (2005) (22.9%), McLane (2005) (33%) and Sleutel and Guinn (1999) (33%).

Generally, the scale of studies examining nurses’ attitudes toward computers varied from a small ward to large nation-wide survey. Because of the large size of sample drawn by probability sampling and good response rates, several studies demonstrated better representativeness than others (Murphy et al., 1994; Simpson and Kenrick, 1997; Liu et al., 2000; Alquraini et al., 2007; Shoham and Gonen, 2008; Eley et al., 2009). However, the findings from the remaining 13 studies were derived from either convenience or unstated sampling with low response rates. This may over-represent certain groups of registered nurses, such as those who were interested in the issue of computerisation.

2.2.9 Data Collection Methods and Procedures

As Section 2.2.6 described and Appendices 1 to 5 showed, most studies described the timing of the questionnaire distribution either prior to or after the computer implementation projects. The questionnaires were distributed by the face-to-face method in many studies. A few studies (Getty et al., 1999; Dillon et al., 2005; Eley et al., 2009) distributed by post or staff mailbox.

However, whether nurses received information regarding computerisation in these studies was little known. Moreover, no study mentioned the issue of social desirability in participants’ responses. Only two studies (Murphy et al., 1994; Sleutel and Guinn, 1999) described that questionnaires were distributed after the completion of computer training programmes. Only one study reported that nurses were aware of the implementation of a new electronic patient record through the dissemination of a project timetable, computer training sessions and hospital-wide newsletters (Dillon et al., 2005). The context of
measurement may influence respondents’ question-answering process and consequently affect their answers (Bohner and Wänke, 2002). Moreover, before reporting their answers to the attitude statement, the respondents may privately edit their formed judgements so as to make a favourable impression (Bohner and Wänke, 2002). Therefore, the possibility of social desirability cannot be ignored. Therefore, receiving the computer training programmes or working in environments promoting computerisation may likely stimulate the respondents to present favourable attitudes towards computers.

2.2.10 Findings

One study did not report the results of attitude measurement (Marasovic et al., 1997) and one study found that nurses’ attitudes were neutral (Liu et al., 2000). 17 out of 19 studies found that nurses’ attitudes toward computers were generally positive. Of these, two recent studies showed that nurses had very positive attitudes (Dillon et al., 2005; Eley et al., 2009). However, it needs to be pointed out that only the national survey result of Eley et al. (2009) is of sufficient size to be appropriately generalised to the Australian nursing population. The results of Dillon et al.’s (2005) study cannot be generalised to the whole population at the study site. Although, the sample size was medium (n=140), the sampling strategy was not stated in the published paper and its response rate (22.9%) was the lowest one in the nineteen studies included. As mentioned in the previous paragraph, nurses in Dillon et al.’s (2005) study were exposed to a great amount of information which promoted the use of electronic information systems. Hence, its results may only reflect this certain group of participants.

By contrast, few studies found that nurses only have slight positive or neutral attitudes toward computers. Simpson and Kendrick (1997) found that only half of respondents (n=118, 54.3%) held positive attitudes. Burkes (1991) found that nurses who applied computers in nursing practice had less favourable attitudes toward them. The investigator gave a post-hoc rationalisation suggesting that it might result from the staffing problems experienced at that time.

Getty et al.’s (1999) comparative study found that both users and non-users held positive attitudes and the attitude mean score of the user group was higher than that of the non-users. The investigators suggested that it may be because the nurses had a feeling of resistance or the non-users were unlikely to report positive attitudes due to being unfamiliar with computerised nursing care planning. However, their arguments were based
on descriptive statistics and lack the support of inferential statistical analysis. This suggests that the authors may have a bias regarding the issue of nurses’ attitudes toward computers.

Surprisingly, three longitudinal surveys showed that the mean attitude score decreased significantly, becoming less positive (Murphy et al., 1994; Sleutel and Guinn, 1999; Smith et al., 2005). Murphy et al. (1994) reported that the mean scores in both measurements were still in the positive range on the 5-point Likert scale (from 3.62 to 3.30). The remaining two studies did not report the mean score range in the published papers.

Murphy et al. (1994) and Smith et al. (2005) suggested that the decreased attitudes scores may result from the inefficiency of the computer systems at the study site. Murphy et al. (1994) reported that in the narrative comments, the most common responses from the respondent nurses were regarding the inefficiency of computer systems such as that they took time away from patients. Moreover, Smith et al. (2005) reported that a focus group was conducted in order to identify affected nurses’ satisfaction regarding the use of computer systems. Similar to the narrative comments by respondent nurses in Murphy et al. (1994), they found that nurses’ dissatisfaction was related to the efficiency of the computer system, such as poor system navigability, lack of automatic prompts and slow system responses. The results of the focus group corresponded with the findings of their attitude survey. The statements with the most significant decrease in scores were related to ‘patient care’ and ‘capabilities of computers’.

In terms of nurses’ demographic characteristics, 13 studies also examined the relationship between nurses’ demographic characteristics and their computer attitudes. The statistical results of these findings are presented in Table 2.1. The factors examined included nurses’ gender, age, education level, years of nursing experience, job titles, length of employment, work unit, shift and previous computer experiences and knowledge. However, not all the demographic variables were statistically significant in every study. There was no consistent significance between any of the demographic characteristics and the nurses’ positive attitudes towards computers. Therefore, the influence of demographic variable on nurses’ attitudes is inconclusive.
Table 2.1: The Relationships between Nurses’ Demographic Characteristics and Their Computer Attitudes

<table>
<thead>
<tr>
<th>Study</th>
<th>Variables</th>
<th>Gender</th>
<th>Job Title</th>
<th>Grade</th>
<th>Work unit</th>
<th>Shift</th>
<th>Age</th>
<th>Education level</th>
<th>Year of practice</th>
<th>Length of employment</th>
<th>Previous computer experiences</th>
<th>Computer knowledge</th>
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<td>Smith et al. (2005)</td>
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<td>Alquraini (2007)</td>
<td>Yes (3)*</td>
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<td>Chan (2007)</td>
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<td>Kaya (2011)</td>
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<td></td>
<td>Yes (-)</td>
<td>Yes (+)</td>
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</table>

(X): No significance.
(--): Negative significance.
(+): Positive significance.
(1)*: Part-time nurses had more positive attitudes than full-time nurses.
(2)*: Elderly care unit had significant negative attitudes.
(3)*: Female nurses had more positive attitudes than male nurses.
2.2.11 Summary
Generally, after the critical appraisal, the cross-sectional studies showed that nurses held favourable attitudes toward computers with medium strength of evidence. Whether nurses’ demographic characteristics correlate with their computer attitudes is inconclusive. Several research designs of these studies may limit the strength of evidence. Firstly, the sample representativeness varied in the recruited studies due to various sample sizes, sampling strategies and response rates. Secondly, the attitude scale instruments were constructed from the literature and investigators’ conceptualisations, rather than the results of interviewing nurses. Especially noteworthy is that these questionnaires were developed in the 90’s when computers were not as prevalent as at the present. This may restrict the possible answers and viewpoints and threaten the validity of the attitude scales. Thirdly, most studies collected only a single, cross-sectional data source which tended not to produce rich data. Nevertheless, similar findings drawn from these studies from different hospitals around the world cannot be ignored.

Additionally, in longitudinal studies the score of attitude measurement significantly decreased following exposure to computer use. This may suggest that nurses computer attitudes may be changed by the context. This finding was based on three studies only, which limited its generalisability.

2.3 Overview of Nurses’ Perceptions of Computer Use
In this section, empirical studies exploring nurses’ user experiences are appraised based on the key dimensions of research design. The study findings regarding nurses’ perceptions are organised into two categories: positive and negative experiences.

2.3.1 Literature Search
Two electronic databases, CINAHL from 1985 to 2008 and MEDLINE from 1964 to 2008, were used. The key terms employed to identify studies were nurses, experiences or perceptions combining information systems, electronic health record, electronic patient record, computerised physician order entry, computerised nursing care plan system and computerised nursing record system. Source type was limited to academic journals and in English. In total, 316 studies were found and screened for relevance by reading the abstract. Finally, nine studies exploring nurses’ experiences of using computerised information system in clinical practice were selected. Additionally, the initial search in 2008 was updated in 2011 to bring the literature up to date for the discussion.
2.3.2 Review of Selected Studies

Several studies explored nurses’ perceptions and experiences regarding the use of computerised information systems in clinical practice in the USA (Harris, 1990; Axford and Carter, 1996; Kossman, 2006), the UK (Timmons, 2003), Sweden (Tornvall et al., 2004), Australia (Darbyshire, 2004) and Taiwan (Lee et al., 2002; Lee, 2005; Lee, 2006). The study characteristics are listed in Appendices 7 and 8.

Computerised information systems studied in these nine studies include:
- Clinical information systems (Axford and Carter, 1996; Darbyshire, 2004),
- Computerised patient information systems (Timmons, 2003),
- Computerised nursing care plan (Harris, 1990; 2002; Lee, 2005; Lee, 2006) and
- Electronic patient records (Tornvall et al., 2004; Kossman, 2006).

2.3.3 Backgrounds of Investigators

The background of all the investigators in these nine studies was from nursing academia. Their motivation to study nurses’ experiences of computer use in most studies was because it was little known. Only Timmons (2003) reported that it was because the use of a computerised nursing care plan did not achieve the target 100% 2-3 years after its implementation. Therefore, the study aimed to identify the existence of resistance to using computers in practice.

2.3.4 Research Design

Because little is known about the experiences of applying computer systems in nursing, most studies adopted a qualitative research design to explore nurses’ perceptions. Except two quantitative studies (Axford and Carter, 1996; Tornvall et al., 2004), seven qualitative research studies interviewed a small sample recruited by non-probability sampling. Only two studies reported their theoretical framework (Harris, 1990; Timmons, 2003). Harris (1990) was based on symbolic interactionism whilst Timmons (2003) adopted social constructionism. For the two quantitative research studies, Axford and Carter (1996) adopted a survey research design using a self-developed questionnaire. Tornvall et al. (2004) combined a questionnaire survey and a nursing record audit.

2.3.5 Sample Selection

Except for one study that recruited some midwives (Darbyshire, 2004), the participants of most studies were staff nurses. They were selected by non-probability sampling strategies,
either purposive (Harris, 1990; Darbyshire, 2004; Lee, 2005; Lee, 2006) or convenience (Kossman, 2006). Only two studies did not report their sampling strategy in the published papers (Lee et al., 2002; Timmons, 2003). The sample sizes in qualitative studies were small (n=12-56). The quantitative studies had a moderate size of sample (n=154-291) (Axford and Carter, 1996; Tornvall et al., 2004). The inclusion criteria were staff nurses who had used the computer systems and had worked at the study site for at least 6 months.

2.3.6 Data Collection Method and Procedure
Most studies collected self-report data from one single source. Some qualitative studies employed semi-structured interviews (Harris, 1990; Lee et al., 2002; Timmons, 2003). Only one study conducted in-depth interviews (n=20) (Lee, 2006) whilst another study conducted 13 focus groups (n=53) (Darbyshire, 2004). One study examined the written comments (n=202) from a previous survey (Lee, 2005). Of 738 completed questionnaires in a cross-sectional study, 202 nurses gave written comments in the open-ended questions (Lee, 2005). Two studies collected data by more than two approaches, such as a questionnaire and observations or nursing record audit (Tornvall et al., 2004; Kossman, 2006).

2.3.7 Findings
Nurses experienced several changes brought about by the implementation of computerised information systems. The findings of the studies included are further categorised into positive and negative perceptions.

Some studies found positive changes. The findings demonstrated that nursing information systems act as a reference to aid memory (Lee, 2006) and a learning tool to increase knowledge of patient care (Lee, 2006). Time and paper are saved (Lee et al., 2002) and accessibility and efficiency of documentation are also enhanced (Tornvall et al., 2004; Kossman, 2006). Moreover, computerised nursing care plan systems are perceived to be helpful in understaffed units (Lee, 2005).

However, the negative influences of computerised information systems on patient care were noticed in the studies included. Only a few studies found that nurses perceive the time spent on documentation had increased, which reduced the time available for patient care (Lee, 2005; Kossman, 2006). One study found that nurses are away from patients in order to complete the documentation and evaluating care plans became difficult since computer terminals were arranged in nursing stations rather than at the bedside (Timmons, 2003).
Additionally, some studies found that nursing job performance was delayed because of time-consuming and poor system function (Axford and Carter, 1996; Lee et al., 2002; Timmons, 2003; Lee, 2005; Kossman, 2006). Particularly in the studies exploring computerised nursing care plan systems, nurses perceived that the computerised nursing care plan and nursing record were inflexible and inappropriate (Lee, 2005) and too general to provide individualised care (Harris, 1990; Lee et al., 2002; Timmons, 2003; Lee, 2005). Some nurses thought that using the computerised nursing care plan was paperwork-oriented rather than patient care-oriented and could not reflect patients’ conditions (Lee et al., 2002; Lee, 2005).

Furthermore, the impact of the standardisation of computerised information systems on nurses’ professional competence was also noticed in some studies (Harris, 1990; Lee et al., 2002; Timmons, 2002; Timmons, 2003; Darbyshire, 2004; Lee, 2005; Kossman, 2006). Nurses perceived that nursing information systems hindered the nursing professional judgements (Harris, 1990; Lee et al., 2002), impaired critical thinking ability (Kossman, 2006), lessened autonomy (Harris, 1990; Newton, 1995), undermined nursing speciality in caring (Lee, 2005) and were unable to reflect ‘real nursing’ (Darbyshire, 2004). Moreover, nurses also perceived that a computerised nursing care plan system facilitates management control rather than improved nursing care (Harris, 1990).

Some studies identified the influences of hardware and software issues in computer technology on clinical practice. Nurses expressed that the computer systems could not meet the patients’ needs, nurses’ user needs and reflect the practice of nursing in some studies, such as the lack of sufficient computer terminals (Timmons, 2003; Lee, 2005), user unfriendliness of interface design (Darbyshire, 2004; Lee, 2005; Kossman, 2006), systems’ unreliability (Timmons, 2003) and the system design carrying out the nursing process incorrectly (Timmons, 2003). The content of the system design implemented the nursing model incorrectly (Timmons, 2003) and lacked short-term nursing care goals for ICU patients (Lee, 2005).

However, in some studies, nurses’ dissatisfaction with nursing information systems are attributed to two reasons: ‘resistance to change’ (Timmons, 2003) or ‘re-education and training are needed’ (Lee et al., 2002; Lee, 2005; Lee and Chang, 2004; Tornvall et al., 2004). Nursing informatics literature suggests that the development of hospital information systems originated from historical financial and administrative needs, rather than the demands of professional nursing practice (Hannah et al., 2006). Darbyshire (2004)
criticised the development of current computerised information systems that fail to consider the needs of end-users. Therefore, Hannah et al. (2006) stated that it is predictable that information systems that have inadequate support for professional nursing practice may hinder the level of acceptance by nurses.

It is apparent that the perceived positive changes of computerised information systems were fewer than the negative influences. These findings were mainly drawn from qualitative studies with small-sized samples and self-reported data from one source. Therefore, their results may not be generalisable to all nurses. However, these findings also provide vivid accounts from the nurses’ perspectives regarding the use of computerised information systems in their practice. The perceived negative influences may have a profound impact on nurses themselves and nursing care. Furthermore, these studies were conducted in several countries worldwide and in different periods of time from the early 90’s to date. Thus, the similar conclusions drawn from these studies cannot be ignored. The findings of these studies suggest that it is possible that computerised information systems may have a negative impact on nursing care and the nursing profession.

2.3.8 Summary
Several qualitative and a few quantitative studies exploring nurses’ experiences and perceptions regarding the use of computerised information systems in practice were reviewed. According to these findings, the influences of computerised information systems on nursing activities and nursing professionalism were perceived. However, contradictory findings were noticed. Whilst some studies found positive changes, more findings showing negative influences were found. For example, some studies reported that time and paper are saved and accessibility and efficiency of documentation are also enhanced, whilst some reported that computerisation increases time for documentation and reduces the time for patient caring. Participants’ perceptions in the studies included showed that computerised information systems are likely to have a negative impact on patient care and the nursing profession. For example, nurses perceived that computerisation facilitated management control rather than improved nursing care. Some nurses thought that using a computerised nursing care plan was paperwork-oriented rather than patient care-oriented and could not reflect patients’ conditions. Furthermore, the impact of standardisation of information systems on nursing professionalism by hindering nursing professional judgements, impairing critical thinking ability, lessening autonomy and failing to reflect ‘real nursing’ was also noticed. These findings suggest an unexpected negative impact of computerised information systems on nursing care and the nursing profession is possible.
Whilst providing rich perspectives regarding the influences of computerisation on practice, these studies were limited to their research design in terms of single qualitative data sources, small size of sample and non-probability sampling strategies. Because perceived negative influences may cause a profound impact on nurses themselves and nursing care, the attention paid to these similar findings identified from different study contexts is justifiable.

Therefore, cross-hospital or nation-wide studies and longitudinal survey research are suggested when the resources are available. Most studies were carried out in the ’90’s. However, computer technology has advanced rapidly and access to personal computers has increased in the twenty first century. The concept of computerisation may now be clearer to nurses. Whether such a context affects nurses’ computer attitudes needs further study. Furthermore, research combining qualitative data, such as from interviews or focus groups, may be needed to facilitate an understanding of nurses’ opinions and values.

### 2.4 Development of Computerised Information Systems

In this section, the literature regarding information system development will be reviewed. Section 2.4.2 will give an overview of the methods for building computerised information systems and the system lifecycle approach in particular. Sections 2.4.3 will briefly overview the approaches to implement an information system.

#### 2.4.1 Literature Search

Although applying information technology to support clinical practice is promoted in the literature, little is written about the development and implementation approaches of computerised information systems. Two databases, CINAHL and MEDLINE, were searched. The keywords employed were: development, software design, clinical information system and computer programmes. These key terms were used in single and combined searches. However, empirical evidence regarding how the information system was developed in healthcare organisations was scarce.

Therefore, the wider literature about health informatics was searched. In some health informatics and nursing informatics textbooks, the discussions regarding the development and implementation of information technology are limited. Only Saba and McCormick’s (2006) book offered one chapter (Douglas and Celli, 2006) proposing eight phases in the development, implementation or upgrading of clinical information systems. Each phase has
a specific goal and includes several steps (Douglas and Celli, 2006). Their details are summarised in Appendix 9. The eight-phase guidance seems complex and the way in which this guidance was developed was not indicated (Douglas and Celli, 2006).

After the analysis, this guidance adopted the concepts of the system life cycle model, one of the system-building and activation approaches. Therefore, the following sections overview the development of computerised information systems, including the system-building and activation approach, across the general information system management literature. Moreover, the initial search in 2008 was updated in 2011 to bring the literature up to date for the discussion.

2.4.2 System-building Approaches

The general information system literature uses the term “system development process” to describe the activities to produce an information system as a solution to an organisational problem (Laudon and Laudon, 2002). There are several methods developed for building computerised information systems presented in Table 2.2. The strength and limitations of each approach can be found in Table 2.3.

<table>
<thead>
<tr>
<th>Methods</th>
<th>Definitions</th>
</tr>
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<tbody>
<tr>
<td>System lifecycle</td>
<td>A traditional system building method with clear, defined and sequential stages. It is still used today and usually for medium to large complex projects</td>
</tr>
<tr>
<td>Prototyping</td>
<td>An experimental information system is built quickly and inexpensively which allows end-users to interact with and evaluate it. Next, the preliminary version of an information system will be further refined to fit the users’ requirements until being finalised.</td>
</tr>
<tr>
<td>Application software package</td>
<td>Building information systems uses software from application software packages, which are a set of prewritten, pre-coded application software programmes for sale.</td>
</tr>
<tr>
<td>End-user development</td>
<td>Information systems are developed by end-users with limited formal assistance from technical specialists.</td>
</tr>
<tr>
<td>Outsourcing</td>
<td>Information systems are developed by the external vendors that specialise in providing these services.</td>
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</tbody>
</table>
Table 2.3: The Strength and Limitations of System-building Approaches  
(Adapted from Laudon and Laudon, 2002)

<table>
<thead>
<tr>
<th>Methods</th>
<th>Strength</th>
<th>Limitations</th>
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<tbody>
<tr>
<td>System lifecycle</td>
<td>Being useful for building large, complex systems that need rigorous, formal requirements analysis, predefined specifications and tight control over the system-building process.</td>
<td>Costly, time consuming and inflexible,</td>
</tr>
<tr>
<td>Prototyping</td>
<td>Being helpful in (1) uncertain information requirements or design solutions, (2) end-user interface design of an information system and (3) encouraging end-user participation in the system-building process and the possibility of fulfilling users’ system requirements.</td>
<td>Not easy to satisfy the needs for large amounts of data or a large number of users. The building process may be slowed in order to meet large numbers of end users.</td>
</tr>
<tr>
<td>End-user development</td>
<td>Permitting users to state their system requirements increases the extent of user involvement and satisfaction with the system.</td>
<td>Control and location of data may be difficult because the system developed outside of the traditional mechanism for information system management and control.</td>
</tr>
<tr>
<td>Application software package</td>
<td>The available software package programmes can save time and money for the organisation.</td>
<td>If the design of software package conflicts with the organisation’s needs and is unable to be modified, the organisation will need to change its products, in order to adapt to the package.</td>
</tr>
<tr>
<td>Outsourcing</td>
<td>A cost-effective way of maintaining the organisation’s own computer centre.</td>
<td>Loss of control over the information systems and depending on the external vendor’s technological direction.</td>
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</table>

- **System Lifecycle**

In the eight-phase guidance by Douglas and Celli (2006), the first four phases in the guidance from planning to testing are closely related to the system lifecycle (SLC). Because it is the only system-building method adopted in the nursing informatics literature, the detailed overview of a system lifecycle is given in the following paragraphs.

The system life cycle, or system development life cycle, is a model or methodology for developing computer systems (Henderson-Sellers and Edwards, 1990; Gangolly, 2000). It is regarded as the oldest method for building information systems (Laudon and Laudon, 2002). The system life cycle has three stages which are generally agreed: (1) analysis, (2) design and (3) implementation (Palvia and Nosek, 1993). The three phases and their major
goals are summarised in Table 2.4. The analysis phase includes the initiation of the project, user requirement analysis and feasibility study. The design phase covers the various concepts of system design and testing. The final phase of the system life cycle is implementation and system evaluation (Henderson-Sellers and Edwards, 1990; Palvia and Nosek, 1993; Gangolly, 2000).

Table 2.4: Stages and Goals of the System Life Cycle (Henderson-Sellers and Edwards, 1990; Palvia and Nosek, 1993; Gangolly, 2000)

<table>
<thead>
<tr>
<th>Stages</th>
<th>Goals</th>
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<tr>
<td>Analysis</td>
<td>• Problem identification</td>
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<td>• User-needs analysis</td>
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<td></td>
<td>• Feasibility study</td>
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<td></td>
<td>• System analysis</td>
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<tr>
<td>Design</td>
<td>• System design</td>
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<tr>
<td></td>
<td>• System testing</td>
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<tr>
<td>Implementation</td>
<td>• Installation</td>
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<tr>
<td></td>
<td>• System evaluation</td>
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</table>

According to general information system management literature (Laudon and Laudon, 2002), this methodology has two key features. Firstly, it divides system development processes into formal stages in sequence and each stage has specific activities that must be performed (Laudon and Laudon, 2002). Originating in software engineering, this model logically describes the detailed steps taken in the process of information system development as a linear series of actions (Henderson-Sellers and Edwards, 1990; Checkland and Holwell, 1998; Gangolly, 2000). Figure 2.1 graphically illustrates the system life cycle. Because of this figure, the model is also referred to as the “waterfall” model (Gangolly, 2000). The strength of this feature is to enable the users to customise their own modest system for accessing data in organisations to support their activities (Checkland and Holwell, 1998).

Figure 2.1: System Life cycle (Adopted from Gangolly, 2000)
Secondly, it has a formal division of labour between end-users and information system specialists (Laudon and Laudon, 2002). System Technical specialists are responsible for much of the system analysis work, design and implementation (Laudon and Laudon, 2002). By contrast, the participation of end-users in providing information requirements and reviewing the technical staff’s work is limited (Laudon and Laudon, 2002).

Some studies adopted the system life cycle model concept to implement or evaluate computerised information systems in healthcare settings (Snyder-Halpern and Hoyman, 2000; Weiner et al., 2004; Alexander et al., 2007). Alexander et al. (2007) also suggested that developing a system life cycle charter plan may be one part of a successful strategy. However, it must be noted that the system life cycle model is relatively technology-oriented.

2.4.3 Activation Approaches

Implementation strategies are sometimes referred to as activation approaches (Douglas and Celli, 2006). In the nursing informatics and general informatics literature, four implementation strategies are suggested: (1) Big bang (2) Parallel, (3) Phased (also called Staged or Stepped) and (4) Pilot implementation (Hunt et al., 2004; Douglas and Celli, 2006). Hunt et al. (2004) illustrated the differences of these implementation approaches graphically (See Figure 2.2).

The big bang approach is to shift all users from an original system to a new system at once. All units or departments will use the newly installed system at a set point in time (Hunt et al., 2004; Douglas and Celli, 2006). In the parallel approach, the new and the existing systems run simultaneously until users can adjust (Hunt et al., 2004; Douglas and Celli, 2006). The phased approach is to implement one system in one department or unit at a time (Douglas and Celli, 2006). The pilot approach is to test the new system in a few departments or units to see how it works and then help other departments to use it (Douglas and Celli, 2006). However, the evidence regarding the applications, strengths and limitations of these four activation approaches is limited. The information about how these approaches are implemented in reality is scarce. Moreover, these activation approaches are very information-systems-oriented.
2.5 Implementation of Computerised Information Systems

In this section, literature and empirical evidence regarding implementation of computerised information systems will be reviewed. Firstly, the definitions of implementation of a computerised information system in the literature will be provided. Secondly, the implementation issues will be examined. Thirdly, two predominant theories in the implementation literature for computer technology distribution in healthcare settings will be overviewed including their concepts, applications, strengths and limitations. Finally, the empirical studies researching the implementation of computerised information systems in healthcare will be appraised.

2.5.1 Definitions of Terms

In the information system literature, the definition of implementation is often omitted. Only Walsham (1993), a professor in information system management studies, clearly defined the meanings of implementing an information system. He identified that the term ‘implementation of information systems’ contains two different meanings. Firstly, \textit{technical implementation} means that an information system is fully developed and can function satisfactorily in a technological sense. Secondly, \textit{human and social aspects of implementation} refer to the process of integrating the new system into the organization and the changes it brings.
implementation mean that a system is often applied by targeted organisational individuals and valuable to their work activities and co-ordination with others (Walsham, 1993).

Currently, there is no consensus about how to define a successful information system implementation. Walsham (1993) stated that such a definition is problematic and proposed alternative measures. They are:

- Meeting of the strategic objectives.
- A high level of system use.
- Effective in use to support particular organisation activities.
- Expressed satisfaction of various stakeholder groups, including the IS users.

Lorenzi and Riley (2003) gave the criteria to define a successful computerised information systems implementation:

- The implementation project is done within the proposed time length and budget and
- Over 90% of end-users are satisfied.

Lorenzi and Riley (2003) considered that the completion of the implementation project within the proposed timeframe and budget is crucial to healthcare organisations. However, the alternative measures by Walsham (1993) cover the system efficiency, organisational goal and users’ satisfaction and appear to be a more comprehensive measurement.

2.5.2 Implementation Issues

Nursing informatics literature suggests that the improvement of clinical processes may be facilitated by technology. Introducing a computerised information system is considered to save cost, improve efficiency and enhance healthcare (Grissinger and Cohen, 2006). Successful implementation has become the ultimate goal in the health informatics literature.

The health informatics experts Webb and Will (1998) claimed that implementation of computerised information systems was simple since only the technology was new. Some health informatics experts suggested that the implementation of any form of technology into healthcare organisations can be a major task which needs sufficient, adequate planning and preparation in order to avoid errors or serious problems (Lorenzi and Riley, 2003; Grissinger and Cohen, 2006).

However, in reality, the implementation of a computerised information system seems more complex than senior management has expected. A large number of information system implementation projects failing or encountering difficulties has been reported in recent years (Aarts et al., 2004; Lorenzi et al., 2008). Many systems remained un-utilised or not
fully put into service even after successful implementation (Munir and Kay, 2003). However, statistical data of failed computerised information systems are rarely reported in the published literature. The actual number is not known because organisations or individuals may be reluctant to publicise these issues (Lorenzi et al., 2008). A UK survey estimates a 28% success rate (Lorenzi et al., 2008). Based on the literature review, Lorenzi et al. (2008) estimated that 53% of implementation projects are challenged during the implementation processes. Some reports estimate that 50-70% of computerised information system projects failed (Beynon-Davies and Lloyd-Williams, 1999; Lorenzi et al., 2004).

The implementation of healthcare information systems may not be straightforward. Both expert opinions and empirical studies suggest that the implementation of computerised information systems is unpredictable (Berg, 2001; Munir and Kay, 2003; Aarts et al., 2004; Lorenzi et al., 2008) and a complex, multi-dimensional issue (Ammenwerth et al., 2006). Berg (2001) has suggested that an increase in complex technology is likely to reduce implementation success, particularly in large institutions.

The consequences of implementation failures cause stress on clinical units, increasing risk to patients and cost a massive, non-recoverable expenditure (Lorenzi et al., 2008). The costs of information system implementation are high. For example, Hendy et al. (2005) showed that the British government invested £2.3 billion for electronic patient records to be installed in all acute NHS trusts by the end of 2007 in England. Ciotti and Schopp (2003) examined more than 400 proposals submitted by the information system vendors to over 100 hospitals that the authors’ organisation assisted in selecting information systems over the past 12 years. Traditionally, the major expenditures are the purchases of hardware equipment and software license fees (Ciotti and Schopp, 2003). In 1990, the hardware and software expenditures were the major costs. The implementation fees were less than 20% of the typical vendor bid (Ciotti and Schopp, 2003). However, Ciotti and Schopp (2003) pointed out that charges for system implementation have changed considerably over the years. Besides the expenditures on hardware and software systems, the costs of system implementation have grown alarmingly. By 2002, the implementation fees were the largest portion of the cost of a computerised information system, frequently equalling or exceeding software costs whilst hardware costs dropped to less than 20% of the total expenditure (Ciotti and Schopp, 2003). Free implementation was a thing of the past. In the 1960s, there were no charges for installing systems. Installation tasks were:

- Training hospital employees in the new system,
- Building master files and profiles,
Setting up hardware and testing the system,
Go-live assistance (Ciotti and Schopp, 2003).

In the 1980s, the vendors and consulting firms started charging high hourly billing rates for their consultants to perform many of the above installation tasks (Ciotti and Schopp, 2003).

Because the implementation fees are costly, a prolonged implementation process may increase the financial burden on hospitals, moreover, a failed implementation project also causes financial losses. The failures of a computerised physician order entry (CPOE) system may cost upwards of $30 million (Lorenzi et al., 2008). These results may appear to conflict with the original motivations for implementing computerised information systems. Therefore, there is an urgent need to develop and disseminate useful strategies for safe, efficient and productive implementation of computerised information systems (Lorenzi et al., 2008).

On the other hand, the significance of organisational issues in the implementation of computerised information systems has featured increasingly in the recent literature (Lorenzi and Riley, 2003). Aarts et al. (2004) also pointed out that many studies tend to see the implementation process as a “rollout” of technology, a technical matter without organisational dynamics. According to the definitions by Walsham (1993), the focus of the rollout of technology is likely to achieve technical implementation rather than the human and social aspects of implementation.

The literature review by van der Meijden et al. (2003) analysing 33 evaluation studies of computerised information systems published in English or Dutch between 1991 to 2001 for the determinants of success of a computerised information system shows that organisational culture and the implementation process were identified as contingent factors, mainly in the cases of failure. Based on the literature review, Lorenzi et al. (2008) suggested that the causes for implementation failures are lack of user involvement, poor communication, lack of attention to the people and organisational issues and poor project planning. Cost overruns and delays in project completion are additional problems (Lorenzi et al., 2008).

Socio-technical theory suggests that good design and implementation of information systems need to consider both technical and human aspects equally, because a technological system cannot be isolated from the social systems of users who are involved with it (Checkland and Holwell, 1998). Furthermore, nursing informatics experts suggested
that the two most important issues are organisational and people issues, rather than technology (Hannah et al., 2006).

There was a strong agreement that the most onerous barriers faced by leaders of healthcare delivery systems were organisational issues (Berg, 2001; Institute of Medicine, 2001; Weiner et al., 2004; Lorenzi et al., 2008). In order to succeed, the implementation of information systems will not only rely on technical capacity, but also on management of human issues (Walsham, 1993; Lorenzi and Riley, 2003; Aarts et al., 2004; Hendy et al., 2005). Currently, it is not clear what these organisational factors are (Aarts et al., 2004). They are generally referred to as the human-related issues (Lorenzi and Riley, 2003). Walsham (1993) suggests that the current organisational context, subgroup culture and the socio-economic context of organisations are all meaningful to the change caused by information system integration.

From the user role perspective, implementing computerised information systems naturally significantly changes the way people work and interact (Walsham, 1993). In the management literature, computer information systems are regarded as powerful tools to achieve organisational change through redesigning structures, scopes, workflows, products and services (Laudon and Laudon, 2002). The general information system management literature often proposes that new information technologies enable four forms of organisational changes: (1) automation, (2) rationalisation, (3) reengineering and (4) paradigm shift (Laudon and Laudon, 2002) as defined in Table 2.5. Therefore, introducing a new information system not only installs hardware and software, but also involves several changes in jobs, skills, management and organisations (Laudon and Laudon, 2002).

<table>
<thead>
<tr>
<th>Types</th>
<th>Definitions</th>
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<tbody>
<tr>
<td>Automation</td>
<td>Using computers to speed up the performance of existing tasks.</td>
</tr>
<tr>
<td>Rationalisation of procedures</td>
<td>The streamlining of standard operating procedures, eliminating obvious bottlenecks, so that automation makes operating procedures more efficient.</td>
</tr>
<tr>
<td>Business process reengineering</td>
<td>The radical redesign of business processes, combining steps to cut waste and eliminate repetitive, paper-intensive tasks in order to improve costs, quality and services and to maximise the benefits of information technology.</td>
</tr>
<tr>
<td>Paradigm shift</td>
<td>Radical reconceptualisation of the nature of business and the nature of the organisations.</td>
</tr>
</tbody>
</table>
Consequently, new technology brings changes in users’ roles and working practices. For example, when the physical order entry system was employed in a hospital, the system put doctors, as highly trained health professionals, into the data-entry role (Massaro, 2005). Conflict is often encountered in particular during the initial phase of implementation (Carr-Bains and de Lusignan, 2003). Carr-Bains and de Lusignan (2003) reported that not all doctors and staff members supported the new technology with the same enthusiasm because several functions of paper-based records such as a visual scan, adding notes and folding papers, simply cannot be done on the computer screen when the electronic patient records are employed. Significant resistance was met when implementing the electronic medical record system (Snyder-Halpern and Wagner, 2000; Winkelman and Halifax, 2007) or physician order entry systems (Aarts et al., 2004; Massaro, 2005). The resistance even led to the implementation of information systems being severely delayed (Snyder-Halpern and Wagner, 2000; Massaro, 2005) or even halted (Aarts et al., 2004). For example, in Aarts et al.’s (2004) study, when doctors saw that the new system increased workload and chaos, they changed their attitudes from support to opposition since the new system would cost them time.

2.5.3 Predominant Theories in the Implementation Literature

In the following paragraphs, overviews of the two predominant theories will be given. The strengths and limitations regarding applying two theories to promote and research the implementation of computerised information systems in healthcare settings will be appraised.

The Diffusion of Innovations Theory (Rogers, 1995) and Technology Acceptance Model (TAM) (Davis, 1989) are the principal theories in the information technology and information systems studies (Lyytinen and Damsggard, 2001; Ma and Liu, 2004; Jeyaraj et al., 2006). Rogers’ diffusion of innovation theory is most widely applied in organisational adoptions whilst the technology acceptance model (Davis, 1989) is the most widely used model for individual IT adoption (Jeyaraj et al., 2006). In healthcare settings, many studies applied the two theories to examine healthcare professionals’ acceptance of computerised information systems and technologies, in order to promote computerisation (Rawstorne et al., 2000; Liang et al., 2003; Lee, 2004; Yen and Gorma, 2005; Paré et al., 2006; Chen et al., 2007; Wainwright and Waring, 2007; Wu et al., 2007; Greenhalgh et al., 2008; Alkhateeb and Doucette, 2009; Rahimi et al., 2009; Tucker, 2009; de Veer and Francke, 2010).
• Diffusion of Innovations (Rogers, 1995)

Rogers’ diffusion of innovation is a theoretical framework seeking to describe or predict individuals’ adoption behaviours (Lyytinen and Damsgaard, 2001; Jeyaraj et al., 2006). His framework mainly concerns the diffusion of innovations at the individual level, which means individual-optimal innovation-decisions. The definitions of diffusion and innovations by Rogers (1995) are presented in Table 2.6.

Table 2.6: Rogers’ (1995) Definitions of Diffusion of Innovations

<table>
<thead>
<tr>
<th><strong>Diffusion</strong></th>
<th>The process by which an innovation is communicated through certain channels over time among the members of a social system, including both the planned and the spontaneous spread of new ideas.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Innovations</strong></td>
<td>An idea, practice or object is perceived as new by an individual or other unit of adoption.</td>
</tr>
</tbody>
</table>

Rate of Adoption

Rate of adoption is one of the key concepts of Rogers’ theory. There are three features in the concept of rate of adoption. Firstly, Rogers states that the rate of adoption is determined by five characteristics of an innovation perceived by individuals within a social system. Their details and definitions are presented in Table 2.7. The former four factors are positively correlated and the last one is negatively correlated with the rate of adoption. Moreover, in explaining the characteristic of relative advantage, Rogers emphasises that the importance is the relative advantages of the innovation perceived by individuals, rather than an abundance of object advantages of an innovation. Secondly, Rogers presents that the rate of adoption in most innovations follows an S-shaped curve the slope of which may vary between a steep s-curve in rapid diffusion and a gradual s-curve in a slow rate of adoption (Rogers, 1995). Thirdly, Rogers separates adopters into five adopter categories: (1) innovators, (2) early adopters, (3) early majority, (4) late majority and (5) laggards (Rogers, 1995).

Table 2.7: Five Characteristics of Innovations and Their Definitions (Rogers, 1995)

<table>
<thead>
<tr>
<th><strong>Relative advantage</strong></th>
<th>The degree to which individuals perceive an innovation is better than the situation it displaced.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compatibility</strong></td>
<td>The degree to which individuals perceive an innovation is consistent with their values, past experiences and needs.</td>
</tr>
<tr>
<td><strong>Complexity</strong></td>
<td>The degree to which individuals perceive an innovation is difficult to understand and use.</td>
</tr>
<tr>
<td><strong>Triallability</strong></td>
<td>The degree to which individuals have opportunities to try out an innovation on a limited basis.</td>
</tr>
<tr>
<td><strong>Observability</strong></td>
<td>The degree to which individuals observe the results of an innovation.</td>
</tr>
</tbody>
</table>
Innovation-decision process
Another key concept of Rogers’ theory is the innovation-decision process through which individuals obtain information about an innovation. He conceptualised the innovation-decision process into a time-ordered sequence of five steps (See Table 2.8) through which individuals pass and which leads them either to adopt or reject an innovation.

Table 2.8: The 5 Conceptual Steps of the Innovation-decision Process of an Individual (Rogers, 1995)

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Individuals understand how an innovation functions.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persuasion</td>
<td>Individuals form a favourable or unfavourable attitude toward an innovation.</td>
</tr>
<tr>
<td>Decision</td>
<td>Individuals choose to adopt or reject an innovation.</td>
</tr>
<tr>
<td>Implementation</td>
<td>Individuals use an innovation.</td>
</tr>
<tr>
<td>Confirmation</td>
<td>Individuals reinforce their innovation decisions or reverse previous decisions if exposed to conflicting messages about an innovation.</td>
</tr>
</tbody>
</table>

Innovation process in organisations
Compared with Rogers’ (1995) concepts of rate of adoption and innovation-decision process, his idea regarding the adoption of innovation in organisations received little attention in the literature. Due to the current study being conducted within the healthcare organisation context, Rogers’ framework of the decision process in organisations, termed the innovation process (Rogers, 1995), is briefly outlined. This process is defined into five stages, usually undertaken in sequence (Rogers, 1995). The five stages and their definitions are presented in Table 2.9.

Table 2.9: Five Stages in the Innovation Process in Organisations (Rogers, 1995)

<table>
<thead>
<tr>
<th>An innovation process in an organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>I. Initiation</td>
</tr>
<tr>
<td>#1</td>
</tr>
<tr>
<td>Agenda-setting</td>
</tr>
<tr>
<td>General organisational problems that may create a perceived need for innovations.</td>
</tr>
</tbody>
</table>
• Technology Acceptance Model (Davis, 1989)

Davis (1989) developed two theoretical constructs, *perceived usefulness* and *perceived ease of use* and hypothesised that these two variables are underlying determinants of the user acceptance behaviours of information technology (See Figure 2.3). The definitions of the two determinants are presented in Table 2.10.

![Figure 2.3: Illustration of the Technology Acceptance Model](image)

Table 2.10: Definitions of Two Determinants by Davis (1989)

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perceived usefulness</strong></td>
<td>The degree to which a person believes that using a particular information system would enhance his or her job performance. Davis (1989) proposed that high perceived usefulness of system utilisation means users believe positive job use-performance.</td>
</tr>
<tr>
<td><strong>Perceived ease of use</strong></td>
<td>The degree to which a person believes that using a particular system would be free of effort. Davis (1989) claimed that a system perceived to be easier to use than another is likely to be accepted by users.</td>
</tr>
<tr>
<td><strong>Behaviour Intention</strong></td>
<td>An individual’s intentions to use a new technology.</td>
</tr>
</tbody>
</table>

• Strengths and Limitations

Rogers’ theory and the Technology Acceptance Model appear to have different relations and structures. The innovation characteristics of the two theories are different (Jeyaraj *et al.*, 2006) as shown in Tables 2.7 and 2.10. However, their concepts are similar in focusing on the relationships between computer technology and individuals. Furthermore, both theories emphasized that people’s appraisal of innovations or applications in decision of adoption or acceptance is subjective, rather than a reflection of objective reality (Davis, 1989; Rogers, 1995). They regarded individuals’ beliefs as meaningful variables serving the function of behavioural determinants (Davis, 1989; Rogers, 1995).
Due to their similarity, the strengths and limitations of both theories will be presented together in the following paragraphs.

**Strengths**

Due to focusing on individuals’ perceptions of or belief in IT usage, Rogers’ diffusion of innovations and the Technology Acceptance Model may be appropriate frameworks for analysing personal adoption decision-making vis-à-vis adopting computer technology, particularly under an optional context. Therefore, it is argued that Roger’s diffusion of innovations is quite good at analysing personal decision making in terms of adoption or non-adoption of innovations, having fewer organisational factors and other social, cultural factors which are often discussed in change management and which are said to be crucial factors in implementation or change management.

**Limitations**

Two taken-for-granted viewpoints underlie the frameworks of the two theories: pro-innovation bias and individual-blame bias (Rogers, 1995). Rogers states that the two biases may limit the understanding of the diffusion process.

Pro-innovation bias implies the perspective that an innovation is required to be adopted by all organisational members and adopted rapidly, should be diffused more rapidly and should be neither re-invented nor rejected (Rogers, 1995). Rogers (1995) acknowledges that pro-innovation bias is one of the most serious defects of diffusion research and that it is seldom stated in the diffusion publication straightforwardly. Therefore, this stance may hamper an objective analysis and balanced perspective in the investigation into computerisation in healthcare organisations.

As described earlier, the two theories are similar in postulating that the usage behaviours of computer technology are significantly influenced by individuals’ perceptions of IT. By focusing on the individual, their research frameworks easily lead to individual-blame bias. The user factor is often regarded as one of the key determining factors for the successful implementation of computer technology or information systems. It is common to see the stance in the adoption literature claiming that successful implementation is based on the acceptance of individual members - the end-users of the innovation - and suggests that the adoption of the innovation also heavily depends on individuals’ interests, needs and skills (Leonard-Barton and Deschamps, 1988). Individual members’ rejection or underutilisation
can have negative influences on the diffusion progress (Leonard-Barton and Deschamps, 1988). It is likely that late adopters are blamed individually for not adopting or adopting later than the other members in an organisation (Rogers, 1995). This perception implies that individuals are responsible for their problems (Rogers, 1995) and that their decisions about adoption or non-adoption are responsible for the success or failure of a computerisation project.

It is identified that several studies applying the two predominant theories (Lee, 2004; Paré et al., 2006; Wu et al., 2007; de Veer and Francke, 2010) and many other studies examining nurses’ attitudes and acceptance towards computers have shown this individual-blame bias (IM and Chee, 2006; Lium et al., 2006; Chan, 2007; Hurley et al., 2007; Shoham and Gonen, 2008; Huang and Lee, 2011; Kaya, 2011). Being the largest group of computer technology users in healthcare organisations, nurses’ acceptance or attitudes towards computers are regarded as playing a crucial role in influencing the success of computerised information systems’ implementation. Additionally, this stance also corresponded to the nurses’ computer attitude studies in Section 2.2. The research motivations presented in Section 2.2.3 and research focus on the demographic data and computer skills of front-line nurses in relation to their attitudes to computers presented in Section 2.2.10 implied individual-blame bias in terms of promoting computerisation.

However, this viewpoint is unbalanced because it omits organisational and social factors, which may play equally crucial roles in implementation. In Chapter 10 of his book on innovation in organisations, Rogers (1995) states that the decisions, schedules and methods of innovation adoption are usually made by the most senior or powerful authority. As Section 2.5.2 reviewed, adopting new computer technology or systems may unavoidably result in changing end-users’ role and practice. Individual members, being system users, are required to incorporate computerised information systems into their activities.

Therefore, it is argued that individual-blame bias is a salient limitation in studying adoption of computer technology among front-line nurses in particular. It is also argued that the perspective of an individual being responsible for successful adoption seems (1) to simplify the development and implementation processes into a choice of adoption or non-adoption by systems users and (2) creates a possibility which allows powerful decision makers to shirk their responsibilities for decisions made and attribute the failure or success of a project to the user roles.
2.5.4 Appraising the Implementation Approach
As Section 2.5.2 examined, the issue of implementing computerised information systems in healthcare may be complex and unpredictable. Thus, within this section, the implementation approaches in empirical studies are reviewed and critiqued. The actual implementation processes in studies are examined according to several key elements of change management. The impact of organisational culture in the implementation of information technology is discussed.

• Literature Search
Four databases were searched including CINAHL, MEDLINE, EBM reviews and EMBASE. Several keywords were employed to identify empirical studies, including implementation OR adoption, AND combining clinical information systems, health information system, electronic health record, electronic patient record, nursing information system, computerisation, health informatics, nursing informatics, organisational change and change management. The publication year was limited to 2008. In total, 310 studies were found and screened for relevance by reading the abstracts. Finally, nine studies providing implementation and management contexts in published papers were included. As with Sections 2.3 and 2.4, the initial search in 2008 was updated in 2011 to bring the literature up to date for the discussion.

• Studies Selected
Several studies explored the implementation of computerised information systems in healthcare, including clinical information systems (Snyder-Halpern and Wagner, 2000; Carr-Bains and de Lusignan, 2003; Doolan et al., 2003; Munir and Kay, 2003; Weiner et al., 2004; Sicotte et al., 2006), computerised physician order entry systems (Aarts et al., 2004; Massaro, 2005) and national programmes for information technology (NPfIT) (Hendy et al., 2005).

Except for one qualitative study researching three intensive care units (Munir and Kay, 2003), most of the studies chose hospitals as their case-study sites, either multiple case study (Doolan et al., 2003; Weiner et al., 2004; Hendy et al., 2005; Sicotte et al., 2006) or single case study (Snyder-Halpern and Wagner, 2000; Aarts et al., 2004; Massaro, 2005). One case study explored general practice (Carr-Bains and de Lusignan, 2003).

Except that some studies did not state the data sources in the published paper (Snyder-Halpern and Wagner, 2000; Carr-Bains and de Lusignan, 2003; Massaro, 2005), the
The majority of studies collected qualitative data, such as interviews, observations and reviewing documentation. Only two studies combined a survey exploring nurses’ attitudes toward computers (Sicotte et al., 2006) or clinical information system experts (Weiner et al., 2004).

The interview subjects were mainly project leaders, administration and clinical managers, such as executives and directors of informatics and medicine (Doolan et al., 2003; Aarts et al., 2004; Weiner et al., 2004; Hendy et al., 2005; Sicotte et al., 2006). Only a small numbers of studies recruited doctors (Munir and Kay, 2003; Aarts et al., 2004; Weiner et al., 2004; Hendy et al., 2005) or nurses (Munir and Kay, 2003; Weiner et al., 2004) as interviewees.

**Assessment Tools**

Assessment or guidance tools for the implementation of computerised information systems are rare in the literature. One tool for assessing the key elements and best practices in integration projects of information systems was developed by All Kids Count, a programme of the Public Health Informatics Institute in America, in 2003 (Wild et al., 2004). This tool was developed to promote information technology integration in paediatric sectors. However, the key elements proposed cover general change management issues, not for paediatric practice only. Therefore, these key elements are adopted to examine the implementation approaches in the empirical studies. The critical elements and the examples of best practice for assessment and planning computerised information system integration project are listed in Table 2.11.

<table>
<thead>
<tr>
<th>Leadership: Project has an executive sponsor and a champion.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project governance: Project is guided by a steering committee representing all key stakeholders and uses outside facilitators.</td>
</tr>
<tr>
<td>Project management: Formalized management strategies and methodologies are used. Project has adequate and appropriate staffing.</td>
</tr>
<tr>
<td>Stakeholder involvement: There is frequent interaction and high quality communication with stakeholders.</td>
</tr>
<tr>
<td>Organizational and technical strategy: Strategy is based on local issues, aligned with national efforts, customer-focused, developed through a legitimate process and based on business processes.</td>
</tr>
<tr>
<td>Technical support and coordination: Centralised within the health department with technical staff working closely with program staff. Uses business analysts to coordinate between technical and program staff.</td>
</tr>
<tr>
<td>Financial support and management: Funding is adequate, derived from multiple sources and managed by an oversight committee.</td>
</tr>
<tr>
<td>Policy support: Legislation, regulation and policy foster, or are neutral to, the integration of information systems.</td>
</tr>
<tr>
<td>Evaluation: Regularly performs qualitative and/or quantitative monitoring or evaluation.</td>
</tr>
</tbody>
</table>

Table 2.11: The Assessment Tool by All Kids Count (Adapted from Wild et al., 2004).
The advantage of the All Kids Count tool (2003) is that the key elements proposed cover the issues of technology, people and organisations. The questionnaire format may be easy to apply to practice. However, some limitations of this tool are identified. Firstly, despite that Wild et al. (2004) reported that informal positive feedback was received; the major limitation is the lack of empirical study to support how this tool benefits the actual implementation projects. Moreover, the decision-making regarding the adoption and implementation of information systems which may affect the project management and implementation strategies is omitted in the tool. In addition, the wording and standpoint of this tool are developed based on the top-down style in which the CEO makes a decision and tells the organisation to carry it out (Lorenzi and Riley, 2003). From the change management perspective, it refers to the so-called power-coercive approach, whereby influence is gained through the application of power (Bennis et al., 1985).

Next, the implementation of computerised information systems in healthcare organisations is analysed according to key elements in change management and the All Kids Count tool (2003). These include decision making, project governance and management, leadership, stakeholder involvement, technical support and coordination and resources support and management.

• Decision Making

Motivation

It is noticed that implementing computerised information systems was often motivated by the budgeting and competing pressures. For example, in the Snyder-Halpern and Wagner (2000) study, the hospital executives recognised that other local hospital competitors who had implemented clinical information systems had advantages for their healthcare service delivery and decided on the installation of such a system in order to help them sustain their competitive edge. Weiner et al. (2004) reported that information transfer and cost saving were the major factors promoting the adoption of health information systems in the five hospitals under study. Aarts et al. (2004) reported that in 1988, the medical centre decided that the existing hospital information system was out of date. Since the centre under study planned to move toward a clinically-oriented system, the purchase of the computerised physician order entry system was decided to support doctors and was expected to require fewer clerical staff because of the decreased paperwork and a more efficient user interface. However, in the published papers, these empirical studies did not report that the decision making when implementing computerised information systems by the hospital executives
had evidence-based support (Snyder-Halpern and Wagner, 2000; Aarts et al., 2004; Weiner et al., 2004).

On the contrary, the idea of computerisation initiated by improvements in practice was rare. Only Carr-Bains and de Lusignan (2003) reported that the motivation for moving to a paper-free situation was intended to improve practice. The study site experienced the problems associated with moving paper medical records between surgeries, difficulties in finding paper records and with missing medical record envelopes.

**Organisational Planning Style**

The planning of the implementation of computerised information systems in healthcare organisations was inexplicit in these studies. However, according to the given contexts in the published papers (Munir and Kay, 2003; Aarts et al., 2004; Weiner et al., 2004; Hendy et al., 2005; Sicotte et al., 2006), it may be inferred that implementing a computerised information system often involved a top-down approach.

For example, Snyder-Halpern and Wagner (2000) described the top-down approach employed at the study site which was lacking clear communications and commitment to support the systems. No plan to support the change and to manage staff expectations was proposed at the study site. The researchers reported that doctors who were not involved in the system design process thought that they could be free to reject the clinical information system if they did not like the final product. The doctors became distressed when they went from being experienced clinicians to novice end-users. Hence, applying such an approach to implement information systems also implies that the individuals who have less power need to comply with those who have greater power in terms of the plans, directions and leadership (Bennis et al., 1985).

Compared with the top-down style, the bottom-up approach is a decentralised method (Lorenzi and Riley, 2003). Individuals decide what works best for them and take the initiative in the adoption and implementation of computerised information systems (Lorenzi and Riley, 2003). Based on Carr-Bains and de Lusignan’s (2003) report, the decision-making process was relatively decentralised. In the Carr-Bains and de Lusignan (2003) study, because there were no subgroups or practice managers able to manage the change, the GPs in the practice who were interested in using information technology effectively were the drivers to support the computerisation process. All the decisions were made during the routine practice meetings.
Project Governance and Management

According to the All Kids Count tool (Wild et al., 2004), the best practice of project governance is that the project is guided by a steering committee representing all key stakeholders and uses outside facilitators. Prior to the project initiation, the eight-phase guidance by Douglas and Celli (2006) (See Appendix 9) suggested the formation of a triple-tiered committee approach carrying out the implementation of a computerised information system. These tiers include a steering committee, a project team and departmental teams. The committee structure and the common representativeness are illustrated in Figure 2.4. The role of the steering committee provides guidance which monitors the selection and integration of a new computerised information system into the organisation. The committee may need to meet more frequently during the planning and the implementation phases and less frequently during the middle stages. The aims of the project team are to understand the information needs of departments and to gain full understanding of the software’s features and functions (Douglas and Celli, 2006).

It is noticed that in several studies the healthcare organisations adopting the top-down approach often formed triple-tiered committees to lead the implementation of computerised information systems (Snyder-Halpern and Wagner, 2000; Aarts et al., 2004; Weiner et al., 2004; Sicotte et al., 2006). The implementation plans may often be decided and the consensus regarding IT priorities was achieved among these committee members. Such a triple-tiered committee approach may reflect the healthcare organisational structure and facilitate the power-coercive implementation by centralising authority among managers.

Project management refers to the managerial framework applied for computerised information systems implementation (Lorenzi and Riley, 2003). The literature suggests that poor project management was one of the factors contributing to computerised information system failures. (Lorenzi and Riley, 2003; Lorenzi et al., 2008). Lorenzi et al.(2008) pointed out that most hospitals depend on the information technology vendors to recommend the implementation plan for the information systems. However, the knowledge of software vendors on organisational issues is limited. Lorenzi et al. (2008) suggested that the healthcare organisations should be responsible for these issues.
In terms of the actual implementation process, the information about the project management is limited in the published studies. Meanwhile, how these investigators viewed the term ‘implementation’ was also not delineated. For example, the activation approach applied to implement computerised information systems was not reported in the published papers. Only the study by Carr-Bains and de Lusignan (2003) described the project management at the study site. Because there was no subgroup able to manage the change, the General Practitioners in the practice who were interested in using information technology were the crucial drivers in the moving to a paperless process. The implementation plan covered two sub-plans: the technology and the people plans. In the people plan, the perceptions of the pros and cons of going paperless were also analysed.

**Leadership**

There is no universal consensus regarding the definition of leadership. Four textbooks on change management (Senior, 2002; Lorenzi and Riley, 2003; Cameron and Green, 2004; Hughes, 2006) had one chapter discussing leader’s roles and leadership in leading change. However, only Hughes (2006) gave a definition about what so-called leadership is. Hughes
(2006) employed the definition by Bowditch and Buono (2005, P195) “the process of influence, usually by one person, whereby another individual or group is oriented toward setting and achieving certain goals”.

Literature suggests that leadership is crucial in facilitating organisational change and management (Senior, 2002; All Kids Count, 2003; Lorenzi and Riley, 2003). Kotter (1996) asserted that successful transformation is led by 70-90% of leadership and only 30-10% of management. Hughes (2006) reported that one study by the American Management Association in 1994 surveyed senior executives in Fortune 500 companies (n=259). The results identified that leadership was the most important (92%) key to successful change. Additionally, according to personal experiences, Lorenzi and Riley (2003) pointed out that the leaders of informatics in our healthcare organisations often have different backgrounds, such as the computing, library and healthcare areas and informatics professionals. They suggested that since each background has a different philosophy, who the leaders are and their backgrounds will make an impact on the leadership process.

However, leadership support has not been recognised as a salient issue in these empirical studies. Doolan, Bates and James (2003) studied five American teaching hospitals awarded the Computer-Based Patient Record Institute Davies’ Award. These sectors varied in size from 246-bed to 716-bed and had advanced clinical information systems. Data were obtained from semi-structured interviews with clinicians, informatics personnel and managers (n=38) and non-participant observations at 5 hospitals (41 hours). The findings from the interview data showed that strong leadership, commitment and vision were one of five important factors contributing to successful computerised information system implementation. Leadership support was provided by the CEO and high-level clinicians and managers. However, which leadership characteristics are important to the success of implementations in these five hospitals were not reported in Doolan et al.’s (2003) study. Suggestions about successful leadership characteristics are many. Cameron and Green (2004) and Senior (2002) reviewed these traits. Leadership style is suggested as an important element of the social context in the information system implementations (Walsham, 1993). However, there is no consensus regarding the traits that are definitely necessary for successful change management (Lorenzi and Riley, 2003).

Moreover, the limitation is that these accounts of perceived strong leadership are provided by the hospital executives under study, rather than being the employees’ perceptions. In Hendy et al.’s (2005) study, the participants also reported a major concern that there was a
lack of communication between NPfIT managers and local Trusts. Additionally, the lack of perceived short-term benefits regarding the use of information technology also influenced morale among front-line clinical staff. It is suggested that a top-down style of information system implementation may create a context where leadership support to lower-level stakeholder groups may be problematic (Walsham, 1993).

- **Stakeholder Involvement**

In general change management textbooks, there is little information regarding stakeholder involvement (Senior, 2002; Cameron and Green, 2004; Hughes, 2006). Only Cameron and Green (2004) briefly mention it. Stakeholders are individuals, groups or organisations who will be influenced by or can influence the information system direction and plan (Lorenzi and Riley, 2003). Stakeholder involvement refers to stakeholders playing a role in decision making, providing input throughout the project, helping to build up mutual goals and providing meaningful feedback (All Kids Count, 2003).

According to the suggestions by Lorenzi and Riley (2003) and All Kids Count (2003), the extent of representation of all levels ideally needs to be maximised throughout the process of implementation. However, Lorenzi and Riley (Lorenzi and Riley, 2003) suggest that it is not possible to be completely participatory in reality. Therefore, it is suggested that all key individuals affected should be involved or represented in the implementation process (All Kids Count, 2003; Lorenzi and Riley, 2003).

It is noticed that the importance of user involvement was ignored in the studies included. The studies paying attention to the significance of stakeholder involvement were few (Snyder-Halpern and Wagner, 2000; Munir and Kay, 2003; Aarts et al., 2004). Only Aarts et al.’s study (2004) showed that both informatics personnel and representatives of the clinical staff were included in the implementation team. Nevertheless, these representatives tend to be located in a lower position in the committee structure. Hence, this may imply that, although clinical staff members participated in the implementation team and were able to make some decisions regarding the system uses, actually they were relatively powerless in the decision making about the adoption and implementation of computerised information systems.

Moreover, insufficient stakeholder involvement also affected the results of the implementation project. In Snyder-Halpern and Wagner’s (2000) study, insufficient doctor involvement in the design team during the planning phase led to the majority of doctors
resisting using the clinical information system in the later implementation phase. A doctor representative discontinued his participation in the implementation project prior to the project manager being hired. Repeated requests for a doctor representative by the project manager were unsuccessful. Therefore, the majority of end-user representatives were from nursing. Consequently, the doctors complained that the clinical information system was a nursing system which did not support their needs. Moreover, the researcher reported that, although successful, the process to achieve consensus across end-users during in the design process demanded a great amount of time and cost, which was unexpected. Accordingly, the implementation of the clinical information system was delayed. It is suggested that the frequent stakeholder involvement may contribute to the credibility and effectiveness in implementation projects (All Kids Count, 2003). However, such a process may require considerable efforts.

Since the scale of computerised information system implementation is usually hospital-based involving a wide range of clinical departments, user involvement in decision-making and implementation is a key issue for successful implementation by a top-down approach. However, in these empirical studies, few participatory opportunities were given to the clinical staff who were the end users in their daily clinical practice. In addition, those representative of stakeholders were located in the lowest hierarchy in terms of the decision-making process. This change management often left staff members at the lower end of the power scale, such as staff nurses, few choices, except to accept, reject or resist change, rather than playing a part with real, contributory influence (Winkelman and Halifax, 2007).

**Technical Support and Coordination**

Sufficient technical support means that the health departments work closely with technical and program staff (Wild et al., 2004). Sufficient technical support was reported by some studies (Aarts et al., 2004; Weiner et al., 2004; Massaro, 2005; Sicotte et al., 2006). However, delays in implementation resulting from the technical problems were reported. Snyder-Halpern and Wagner (2000) reported that the clinical information system vendor promised a two-month implementation from the purchase date which proved to be unrealistic. The system was purchased in 1993. The completion of customised design and several modifications of the software resulted in delays. Finally, the system was implemented in the critical care units across the hospital in 1996, three years after the initial purchase date. Carr-Bains and de Lusignan (2003) reported that they expected to complete the implementation of the clinical systems and network scanning system in one
year. However, in reality, they took 18 to 24 months. The delay resulted from the technical problems encountered and finding out the solutions. Hence, the provision of technical support and coordination is important in the implementation of health information systems.

- **Resource Support and Management**

Time and funding are crucial resource factors in the implementation process. In the public sector, information technology implementation may be affected by inadequate funding (Wild *et al.*, 2004). For example, Hendy *et al.*’s (2005) study in the UK showed that the financial deficits of NHS trusts slowed down the NPfIT project. In addition, the unrealistic timetable of the implementation resulting from an urgent need to replace the existing information systems also affected staff morale.

Time is another constraint in the computerised information system implementation (Lorenzi *et al.*, 2008). Implementation is time-consuming. Clinical implementation projects often need one year or more to complete (Lorenzi *et al.*, 2008). Two studies showed that the negotiation with end-users for design or integration took a great amount of time and led to the projects being delayed (Snyder-Halpern and Wagner, 2000; Massaro, 2005). Moreover, no study reported that the implementation was accomplished on time and within budget.

- **Impact of Organisational Culture on the Implementation Process**

In the following sections, the definitions of organisational culture will be overviewed. The discrepancy in concepts of organisational culture in the literature is briefly outlined. Organisational culture in the computerised information system literature is examined.

There is no consensus definition regarding the concept of organisational culture in the literature. Different schools of thought view organisational culture differently. For example, from a sociological perspective, Watson (2003) refers to organisational culture as “the set of meanings and values shared by members of an organisation that defines the appropriate way for people to think and behave with regard to the organisation” (p83). In the information systems and management literature, the definition of organisational culture by Schein (1985) (See Box 2.1) is the predominant conventional view of the cultural concept (Avison and Myers, 1995; Collins, 1998). It is often adopted into the research on information technology and organisational culture (Avison and Myers, 1995). Schein’s definition is similar to the culture concept of social psychology, viewing that culture is something which identifies and differentiates one social group from others and something
that can be managed and changed (Avison and Myers, 1995; Collins, 1998). On the contrary, anthropological perspectives have moved away from a static view of culture which sees culture as hard and fast boundaries as Schein does, to one which is more dynamic and emergent (Avison and Myers, 1995). Contemporary anthropologists view culture as constantly being interpreted and reinterpreted and produced and reproduced in social relations (Avison and Myers, 1995).

Box 2.1: Definitions of Organisational Culture by Schein (1985)

| To analyse why members behave the way they do, we often look for the values that govern behaviour, which is the second level.... But as the values are hard to observe directly, it is often necessary to infer them by interviewing key members of the organisation or to content analyse artefacts such as documents and charters. However, in identifying such values, we usually note that they represent accurately only the manifest or espoused values of a culture. That is, they focus on what people say is the reason for their behaviour, what they ideally would like those reasons to be and what are often their rationalisations for their behaviour. Yet, the underlying reasons for their behaviour remain concealed or unconscious. To really understand a culture and to ascertain more completely the groups’ values and overt behaviour, it is imperative to delve into the underlying assumptions, which are typically unconscious but which actually determine how group members perceive, think and feel (Schein, 1985)(p3). |

Both expert opinions (Ball et al., 2000; Lorenzi and Riley, 2003) and empirical studies (Ash et al., 2003; Munir and Kay, 2003; Caccia-Bava Mdo et al., 2006; Callen et al., 2007) suggested that organisational culture plays a crucial role in the implementation of computerised information systems in healthcare organisations. However, empirical evidence regarding the impact of organisational culture on the implementation of computerised information system is limited. The literature review by van der Meijden et al. (2003) showed that contextual information and organisational impact (communication/collaboration with other disciplines, impact on patient care) were often included in evaluation studies. However, organisational culture was seldom taken into account in evaluation research on computerised information systems (van der Meijden et al., 2003).

Three major limitations of the studies exploring the relationship between organisational culture and information technology implementation are identified. Firstly, the concept of organisational culture in the computerised information system literature is vague. However, it is used in a common-sense approach without defining or specifying the concept’s origin (Ball et al., 2000; Ash et al., 2003; Lorenzi and Riley, 2003; van der Meijden et al., 2003;
Mukama et al., 2005; Caccia-Bava Mdo et al., 2006; Callen et al., 2007; Nowinski et al., 2007). A lack of a clear definition may result in the findings of these studies being irrelevant to the problem under study.

Secondly, after analysing their definitions given in the text regarding organisational culture, a confusion between organisational culture and corporate culture is identified in both empirical studies (Ash et al., 2003; Caccia-Bava Mdo et al., 2006; Callen et al., 2007; Nowinski et al., 2007) and health informatics textbooks (Ball et al., 2000; Lorenzi and Riley, 2003). The expert opinions of Lorenzi and Riley (2003) and the study by Caccia-Bava et al. (2006) saw organisational culture as corporate culture. Both the study by Ash et al. (2003) and the literature review by van der Meijden et al. (2003) recognised leadership and top-manager support as organisational culture. Caccia-Bava et al. (2006) surveyed 192 senior hospital managers (response rate 20%) in America by postal questionnaires to clarify which specific characteristics of organisational culture enhance the organisational capacity for the integration of information technology and the implementation process. The sample strategy was simple random selection. The instrument was a 7-point Likert scale questionnaire which had been pilot tested (n=8) and showed good reliability (Cronbach’s Alpha 0.96). Ash et al. (2003) carried out a qualitative study exploring the perceptions of the diverse professionals involved in successfully implemented computerised physician order entry (CPOE) through multiple sources across three hospital settings in America. Data were collected by participant observations (n=19), informal (n=16) and formal (n=9) interviews and three focus groups. The span of implementation of the three study sites was different, from a short time, ten years, to over ten years. The subjects of observations, informal interviews and focus groups were doctors. Additionally, five clinical information officers, two administrators and four academic teachers were formally interviewed.

However, from the perspectives of anthropology and sociology, organisational culture and managerial ideology are in most cases not the same (Alvesson, 2002; Watson, 2003). Corporate culture is prescribed and manager-led by managers with managerial values and mission statements (Alvesson, 2002; Watson, 2003). Organisational “real” culture is more or less emergent from below (Alvesson, 2002). Although management ideology is not necessarily different from organisational culture, management ideology is one of several expressions of organisational cultures (Alvesson, 2002; Watson, 2003). Because these studies saw corporate culture as organisational culture, the findings tend to reflect the management ideology towards computerised information system implementation, rather than the perceptions of employees from the lower hierarchy of organisations.
In most studies examining the relationship between culture and performance, the researchers focused on the values of senior managers and the extent to which these values are shared by larger groups of healthcare professionals (Ash et al., 2003; Caccia-Bava et al., 2006; Callen et al., 2007; Nowinski et al., 2007). Meanwhile, another limitation was that many studies were carried out from a top-down perspective. For example, Caccia-Bava et al.’s study (2006) recruited top managers only because they were regarded as the most appropriate subjects having a broad view of an organisation in terms of the organisational environment, available sources, workflow patterns and values. The ideas and actions of managers were not examined from the point of view of employees (Wright, 1994). Thus, the findings derived from a top-down approach would be from a manager’s perspective rather than that of employees (Wright, 1994). Additionally, Lorenzi and Riley (2003) claimed that organisations are messy places and therefore understanding organisational structure and culture is needed in order to implement computerised information systems successfully. Planned and direct managerial intervention is needed to develop an organisational culture to fit business requirements. This has become the traditional belief among managers and consultants (Collins, 1998). These authors believe that paying attention to organisational culture is done in order to gain a greater understanding of how organisations function to create favourable environments to meet organisational aims (Wright, 1994). However, Collins (1998) pointed out that this assumption reveals little regarding how the formation of the culture arises and develops whilst the complexity and variety of culture are neglected (Alvesson, 2002).

2.5.5 Summary
This section reviewed the actual implementation processes in hospitals. Whilst implementing computerised information systems is a very challenging project, an evidence-based and effective implementation strategy is currently lacking. Based on the analysis derived from the empirical studies, leadership support, stakeholder involvement, technical coordination and resource support can be either facilitators or barriers in the implementation projects. In terms of managing technological change, this review identifies how the term ‘organisational culture’ is narrowly viewed in the field of health informatics.

According to the available studies reporting the actual implementation processes, it is identified that the implementation of computerised information systems in healthcare settings is often led by a top-down management style because the decisions were often made by hospital executives. Furthermore, the top-down style also affects the project
governance and management. Within the context created by the power-coercive approach, leadership support to the lower-level stakeholders may be problematic. The project planning process often lacked consideration and user involvement was often insufficient. Overall, the idea of computerisation was imposed on healthcare professionals by hospital managers. The implementation approaches adopted in practice are not likely to provide sufficient support in terms of the human and social aspects of implementation.

Additionally, the concept of organisational culture presented in the health informatics literature reflects corporate culture which is prescribed by hospital managers rather than the culture emergent from the lower hierarchy. Thus, all hints point to hospital managers aiming to achieve the organisational goal of computerisation coercively.

However, sufficient literature shows that the significance of human and organisational factors in the system implementation has been recognised in recent years. If the computerised information systems are to fulfil their promised functions to support healthcare services, the implementation needs to focus on the human and social aspects of implementation. Hence, it is suggested that a comprehensive change plan with appropriate analysis is urgent and necessary prior to implementing computerised information systems in hospitals.

2.6 Sociological Perspective

In this section, the implications of implementing computerised information systems are reviewed from a sociological perspective.

The traditional system analysis may not grasp the complexities of the implementation issues. Section 2.5.2 described the implementation issues and the Section 2.5.4 appraisal showed that the implementation processes are various and complex. As Section 2.5.3 showed, the focus of Diffusion of Innovations (Rogers, 1995) and the Technology Acceptance Model (Davis, 1989) are individual-oriented. Adopting these models to examine the implementation of computerised information systems in healthcare organisations is likely to be subject to pro-innovation bias and individual-blame bias, which consequently limits the understanding of the implementation process.

Literature suggests that a sociological approach may be helpful in examining the implementation issues (Timmons, 2002). Sociological perspectives may contribute to a
deeper understanding of participants’ perceptions and the contexts related to change as well as giving an insight into the computerisation change.

From the viewpoint of management, as Section 2.5.2 presented, information systems are regarded as powerful tools for organisational change. From a sociological perspective, information technology has been regarded as a tool to transform organisations to the degree that Taylorism once did in the early 1890s (Davenport and Short, 1990). Taylorism revolutionised the workplace with the idea of scientific management. F.W. Taylor (1856-1917), an American engineer and consultant, proposed an approach to increase organisational productivity via structuring the job performance of labourers by applying the principles of task decomposition and job measurement. The central aspect of Taylorism is work de-skilling. This approach is also called “scientific management” (Watson, 2003). Information technology has had an increasing impact on several aspects of work and administration (Watson, 2003). These aspects are listed in Box 2.2. For example, in medical care, the computerised information systems may help doctors to obtain an electronic bank of information and to make judgements and diagnoses (Watson, 2003).

<table>
<thead>
<tr>
<th>Box 2.2: The Impact of Information Technology on the Aspects of Work (Adapted from Watson, 2003)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The products people can buy.</td>
</tr>
<tr>
<td>• How goods are developed.</td>
</tr>
<tr>
<td>• How things are made.</td>
</tr>
<tr>
<td>• How goods and services are distributed.</td>
</tr>
</tbody>
</table>

Meanwhile, the feature of information technology is to record, rewind and play back to allow the processes behind the operations to become visible (Watson, 2003). There is a common, conventional perspective in the field of information systems (Checkland and Holwell, 1998). Organisations, which are regarded as social entities, seek to achieve goals. Management activity involves much decision making to engage in organisational goals. Information systems offer support for the decision making. As a result, information is regarded as a crucial corporate resource (Checkland and Holwell, 1998). Information technology can concurrently produce information about the underlying productive and administration processes. This information can help organisations to achieve their goals (Watson, 2003). Therefore, information technology can make partially or completely opaque activities become more transparent (Watson, 2003) which is also the main goal of Nursing Informatics: seeking professionalization through visibility.
As Section 2.5.4 sets out, empirical studies show that computerised information systems are often implemented by a top-down approach which implies that computerisation was imposed on healthcare professionals by hospital managers. However, information technology also has significant potential for job design. Whilst providing a deeper level of transparency to activities, information technology also allows managers to have direct and tight control over work design principles (Watson, 2003). The differences of direct and indirect management controls are listed in Table 2.12. Timmermans (1998, P148) describes that the “Potential and power of a technological device to shape an interaction is not pre-given but is realised in practice”.

<table>
<thead>
<tr>
<th>Direct control work design principles</th>
<th>Indirect control work design principles</th>
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<tbody>
<tr>
<td>De-skilled, fragmented jobs.</td>
<td>Whole, skilled, “rich” job.</td>
</tr>
<tr>
<td>Doing is split off “thinking”, the</td>
<td>Doing and thinking is combined in the</td>
</tr>
<tr>
<td>latter being done elsewhere.</td>
<td>job.</td>
</tr>
<tr>
<td>The worker has a single skill.</td>
<td>The worker has a range of skills.</td>
</tr>
<tr>
<td>The worker does the same task most of</td>
<td>The worker does different tasks at</td>
</tr>
<tr>
<td>the time.</td>
<td>different times.</td>
</tr>
<tr>
<td>The worker has little choice over pace</td>
<td>The workers has choice over the pace</td>
</tr>
<tr>
<td>or order of task completion.</td>
<td>and order of task completion.</td>
</tr>
<tr>
<td>The worker is closely supervised.</td>
<td>Workers supervise themselves.</td>
</tr>
<tr>
<td>The quality of work is checked by an</td>
<td>Workers are responsible for their</td>
</tr>
<tr>
<td>“inspector”.</td>
<td>quality.</td>
</tr>
<tr>
<td>If there is a group dimension to the</td>
<td>If there is a group dimension to the</td>
</tr>
<tr>
<td>work, the supervisor allocates roles</td>
<td>work, the workers operate as a team</td>
</tr>
<tr>
<td>and monitors the workgroup’s</td>
<td>with members allocating roles and</td>
</tr>
<tr>
<td>performance.</td>
<td>monitoring team performance.</td>
</tr>
</tbody>
</table>

From the nursing perspective, Sandelowski (2000) reviewed key moments in the history of nursing in relation to the nursing-technology relationship. She critically examined the development of Nursing Informatics, the aim of which is to establish visible differences for nursing. The purpose of seeking visibility is to try to obtain the professionalization of nursing. Sandelowski (2000) wrote that “the claim to diagnosis is a claim to professional status”. A large amount of effort was put into classifying nursing work and the taxonomy of nursing diagnosis which represents nursing observations and assessments as diagnosis work resembling that of doctors and yet unique to nursing (Sandelowski, 2000). Meanwhile, the classification system and taxonomy adopted the language of science and economics in order to show the contribution of nursing to quality care, cost control and evidence-based practice (Sandelowski, 2000).
However, as Section 2.3 analysed, the studies exploring nurses’ experiences of computerised information systems found that nurses claimed that the systems at that time could not support their needs in nursing care activities. Several studies showed that nurses, as users of computerised information systems, perceived the negative influences of computerised information systems not only in nursing activities but also in nursing autonomy. Computerisation may not enhance nursing professionalization as expected; on the contrary, it may lead staff nurses to be exposed to close supervision and change nursing care delivery.

From sociological perspectives, nursing practice involves a great deal of “articulation work” or called “hidden work” (Timmons, 2002). That is, informal work which preserves good working relationships and maintains the organisation’s ability to work in a coordinated way for patients (Williams et al., 1998; Timmons, 2002). However, empirical evidence shows that the nature of the hidden work in nursing practice may not be reflected in or supported by computer systems. Broome and Adams (2005) conducted a 4-month longitudinal study in an A&E department where the existing whiteboards were replaced by computer systems. Data sources were observations of whiteboard usage (10 hours) and in-depth interviews with all users (n=10), such as nursing managers, nurses, doctors, porters and agency staff. The results show that the technology supported simple information requirements. However, the important role of a pen-holder, an information coordinator, whose work engages in complex coordination, collaboration and awareness issues, was left unsupported.

2.7 Significance and Rationale of the Study

Nurses are the largest group of professionals in any healthcare organisation. Consequently, nurses are the majority of end users who access computerised information systems more often than any other group (Hannah et al., 2006). Meanwhile, Barnard (1997, 2000) pointed out that nurses cannot use technology without being influenced by it. Whilst governments worldwide have promoted the utilisation of computerised information systems, adapting and applying such information technologies must be an issue confronted by every front-line nurse.

Moreover, several knowledge gaps in the literature were identified. Firstly, whilst many studies showed that nurses hold positive attitudes toward computers, some studies found that nurses’ attitudes become significantly less positive after the implementation. Delpierre et al. (2004) also suggested that alternative research approaches centred on social, cultural
and organisational factors are needed to examine the benefits and costs of computer-based patient record systems.

Secondly, several studies showed that computerisation has a perceived negative impact on nursing care and the nursing role. Although computerised information systems sound promising in clinical effectiveness and efficiency, their actual benefits in terms of patient outcomes are inconclusive. The negative perceptions among nurses in the varied, relevant studies cannot be overlooked.

Thirdly, whilst many studies have researched nurses’ computer attitudes and perceptions of using computer technology, nursing perceptions and organisational factors involved in adopting computerised information systems were often ignored. Little is known about how nurses respond to the trend towards computerisation.

Finally, the implementation process in introducing information technology also needed to be examined. Except for Timmons’s (2003) study, a common limitation of the studies exploring nurses’ perceptions and experiences of computerised information systems was noticed: descriptions of the information systems studied within units or organisations were lacking. Hence, little was known regarding the number and location of computer terminals, wireless networks, accessibility of computers and user interface design, such as tick-box or free-text formats. van der Meijden et al. (2003) suggested that the evaluation of any information systems needs to examine factors related to hardware, software, users and organisational culture.

Therefore, an exploration of the influences of computerised information systems on nurses is needed. Particularly, it was necessary to examine the impact of computerised information systems on the nursing role and practice through a whole context involving the dimensions of information technology, users and organisation. The results of this study may add to the knowledge regarding the impact of computerisation on healthcare systems. Meanwhile, it could enhance the understanding of the nursing role in the information age, the optimum utilisation of nursing information systems and improve the quality of healthcare. Finally, it was hoped that the overall findings would be beneficial to the development of healthcare information systems bringing the advantages of information technologies.
2.8 Summary of the Chapter

Computerised information systems are promoted worldwide. Nurses form the majority of end-users of information systems in hospitals. Nurses are recognised as having a key role in the implementation of computerised information systems. Barnard (1997; 2000) pointed out that nurses cannot use technology without being influenced by it. Consequently, adopting and applying information systems to enhance the quality of care are challenges that must be confronted by every nurse.

The former part of this chapter presented the literature review covering attitudes and perceptions of nurse users in relation to the use of computer technology in practice. The latter part of literature review presented development approaches and implementation issues. Several knowledge gaps were identified.

From a sociological perspective, the implications of computerisation were identified. Through information technology, the principles of Taylorism may be imposed on nursing. Because information technology has the potential for job redesign, computerised information systems may increase the managers’ tight control. Moreover, computerisation may be imposed on staff nurses coercively. Whilst managers’ ideology promotes computerisation to enhance the quality of healthcare, the efficiency of computerised information systems lacks empirical evidence. The application of computerised information systems may reinforce the issues of nursing status and hidden work. Meanwhile, whilst the development of nursing informatics aims to enhance the professionalization of nursing, some hidden tasks in nursing which are inherent to nursing care may not be acknowledged by current computer systems. Thus, it is suggested that further investigation was needed. In the next chapter, the research methodology and design are proposed.
Chapter 3: Methodology and Methods

3.1 Introduction
Chapter 2 identified the knowledge gaps in the literature and the rationale for this study. This chapter presents the research topic, theoretical perspectives underpinning the study, the selection of case study as research strategy and the conduct of the study. The detailed methods employed in this study are clarified, including sampling, data collection and analysis. How ethical principles were operationalised is described. How to enhance and evaluate the methodological rigour of the proposed study is presented in the last section.

3.2 Methodology
3.2.1 Research Aims and Objectives
The aim of this study is to explore the impact of computerised information systems on the role of nurses in healthcare organisation in order to facilitate the use of systems and to promote the quality of care.

• Objectives of the Study
To:
(1) investigate the impact of computerised information systems on the role and practice of nurse at the clinical interface at ward level.
(2) explore the implementation of computerised information systems in medical centres in Taiwan,
(3) explore the practice politics of information systems in healthcare organisations.

• Research Questions
Taking into account the conceptual framework and the research aims, research questions are then developed and presented following the conceptual framework.

Research Objective 1  To investigate the impact of computerised information systems on the role and practice of nurses at clinical interface of the ward level.
2. How computerised information systems affect the professional role of nursing.
3. How computerisation affects the quality of nursing care.
4. How nurses perceive the computerisation and the systems.
5. How nurses view the quality that HIS produced.
6. How computerisation shapes the care delivery.
Research Objective 2  To explore the implementation of computerised information systems on medical centres in Taiwan
   7. How the decision of computerisation is arrive at.
   8. How information systems are applied in order to support clinical practice now.
   9. How computerised information systems are developed.
  10. How computerised information systems are implemented and managed.
  11. How computerised information systems influence the future development of healthcare organisation.
  12. How computerised information systems affect the information delivery process between the departments, care units and individuals.

Research Objective 3  To explore the practice politics of information systems in healthcare organisations.
  13. How nurses view the decisions of computerisation in clinical practice.
  14. How the role of nurse is in the implementation process of computerised information systems.
  15. How computerisation influences the organisational management.
  16. What partnerships are there between system developers, informatics project team, nurses, and hospital managers in healthcare organisations?
  17. What power relations underlie the use of information technologies in the organisational context.

3.2.2 Theoretical Paradigm
A theoretical paradigm (Denzin and Lincoln, 2005) or worldview (Creswell, 2007), is an interpretive framework containing ontological, epistemological, and methodological propositions of researchers which is also a “basic set of beliefs that guide an action” (Denzin and Lincoln, 2005). Paradigms are “a set of general philosophical assumptions about the nature of the world (ontology) and how researchers understand it (epistemology)” (Maxwell, 2005, P36).

The significance of a clear paradigmatic stance is to guide researchers to establish a coherent approach to research and to justify these decisions, rather than having to construct these themselves (Maxwell, 2005). Worldviews, paradigms, or personal beliefs of researchers influence the conduct of qualitative and quantitative research (Bryman, 2004; Creswell, 2007). Therefore, it is suggested that researchers make these assumptions, paradigms and framework explicit in the research design and need to be aware of their influences on carrying out research (Maxwell, 2005; Creswell, 2007).
Choosing the paradigm is a critical decision in designing the study (Maxwell, 2005). Maxwell (2005) suggests that choosing paradigms is not a completely free choice because researchers have made assumptions regarding the world, the research topics, and how these can be understood. The selection process involves identifying which paradigms best fit the researchers’ assumptions and methodological preferences (Maxwell, 2005). Meanwhile, Mason (2002) suggests that the ontological or epistemological position of researchers is usually revealed through the research topic.

The theoretical paradigm of this study was realism. The theoretical perspectives shifted in the planning stage of the study, from positivism, to pragmatism then to critical approaches. Realism and the reflection process in identifying the theoretical perspectives for the study are discussed in the following section. The significance and influences of theoretical paradigms in carrying out research are outlined. An overview of realism is given covering the basics of realist explanations and realist view of science. How the realistic approach answers the research aims presented in the earlier section is discussed. How I shifted among the theoretical paradigms is discussed in the later part of this section.

*Realism*

Realism can provide a model of scientific explanation which avoids both traditional epistemology of positivism and relativism (Pawson and Tilley, 1997; Robson, 2002). The key characteristic of realism is “mechanics of explanation” (Pawson and Tilley, 1997). The aim of realists is to seek explanations of social phenomena (Robson, 2002). Realists develop and construct explanations regarding the *mechanism* which brings an action and causes *an outcome* in a particular *context* and which triggers the mechanism (Pawson and Tilley, 1997; Robson, 2002). In other words, *causal outcomes follow from mechanisms acting in contexts*, which is illustrated in Figure 3.1. Robson (2002) summarises the key characteristics of the realist view of science (See Box 3.1).

In realism, human actions can be comprehended with regard to their place in different layers of social reality. Therefore, in order to construct the explanation, visiting mechanisms at various levels, such as micro, macro, group or organisational, is needed (Robson, 2002). The research task is to collect evidence about the actual existence of the hypothesised mechanisms (Robson, 2002). By such a proposition of mechanisms, all realist explanations are built and scientific knowledge can be accumulated (Pawson and Tilley, 1997)
The aim of this research was to explore the impact of computerised information systems on the role and practice of clinical nurses in healthcare organisations in Taiwan. In this research, computerisation was regarded as an action. The influence of computerisation upon nurses was the outcomes of the action. The context was the healthcare organisations that implemented computerised information systems to support healthcare service provision. Therefore, realism was recognised as the epistemological position of the research.
The literature review identified that most studies sampled only one group of the population, such as decision-makers, managers, IT staff or nurses. Empirical studies that recruited different populations from multiple levels of organisations are rare in the literature. In order to gain in-depth comprehension of how computerised information systems influenced the role and practice of nurses, multiple perspectives from different levels of healthcare organisations are needed. Realism is seen as especially appropriate for studying practice and value-based professions such as social work (Robson, 2002). Furthermore, realists view the real world as complex and stratified into different layers (Robson, 2002) (See Point 5 in Box 3.1). Hence, through the realist approach, it was intended to construct explanations of how and why the role and practice of nurses were influenced following the computerisation process in healthcare settings. It was hoped that the findings would help in understanding how nursing roles and care are shaped by different layers of social systems.

- **Positivism**

Whilst trying to find a research design for the project, the use of randomised control trials (RCTs) for the study of the topic of computerised information systems was noted in a few studies (Ammenwerth et al., 2001; Daly et al., 2002). In terms of quantitative research strategy, RCTs can produce the highest level of evidence (Muir Gray, 2001). The epistemological orientation of quantitative research strategy is founded on positivism (Bryman, 2004). Positivism, as an epistemological position, denotes “the standard view of science” (Robson, 2002). It supports the natural sciences approach and quantitative practice in the study of social reality and beyond (Robson, 2002; Bryman, 2004). However, it was argued that constructing explanations through the positivism perspective may limit understanding of this research topic. Positivists search for a continual connection, so-called constant conjunction, existing between events or variables (Robson, 2002). Robson (2002) argues that constant conjunction is virtually non-existent when the research focus is people and particularly when the research context is the social real world. The systematic review of Delpierre et al. (2004) points out that the limitation of RCTs in studying the impact of computer-based patient record systems is that it is difficult to generalise positive results derived from narrow clinical areas to more complex clinical situations. Therefore, the findings of RCTs may not reflect the variety of medical practice and working conditions.
• **Pragmatism**
  At the outset of this study, case study research with a mix of quantitative and qualitative approaches was proposed, based on the considerations of “what works” and feasibility (Robson, 2002). The epistemological orientation of mixed-method design is pragmatism. The pragmatic approach supports the adoption of philosophical or methodological approaches as being appropriate for research problems under study (Robson, 2002). Finally, the mixed-method design underpinned by pragmatism was not employed because no appropriate quantitative data collection tool for this study topic, such as questionnaires, was identified. Nevertheless, it is noticed that the pragmatic perspective of considering what works best and feasibility still influenced the decision-making of the research design and fitted with realism.

• **Emancipation Approaches: Feminism and Critical Realism**
  During the literature review, the issue of gender and its power relationships in the application of computerised information systems was noticed. For example, hospital managers who are significant in decision-making about computerisation, and staff members of informatics departments are usually male. The daily system end-users who in this case are nurses, are mostly female. This observation drew me to ponder the critical approaches which might fulfil the emancipatory potential of social research.

  Both feminism and critical realism have emancipatory potential. Emancipatory approaches are close to the extreme limits of qualitative research. By contrast to these participatory approaches Robson (2002) criticises both post-positivist and constructivist research, as involving powerful experts researching comparatively powerless people. On the other hand the focus of feminist enquiry is gender imbalance (Robson, 2002) and it is intended to facilitate female emancipation and the understanding of the world views of women (Robson, 2002).

  Critical Realism is another form of realism (Robson, 2002; Bryman, 2004). In critical realism, not only generative mechanisms are identified, but also an impetus for change that transforms the status quo is provided (Robson, 2002; Bryman, 2004). Therefore, the critical realist approach is also helpful in attaining the emancipatory potential (Robson, 2002).

  Although it is expected that gender and change are important research aspects, gender and producing change were not the research focus and core theme running through this
research project. Meanwhile, realism has the potential of emancipatory approach (Robson, 2002). Therefore, emancipatory approaches were not employed.

3.2.3 Intellectual Puzzle

Mason (2002) suggests that all qualitative research should be based on an intellectual puzzle. According to Robson (1993), a conceptual framework or theoretical framework “covers the main features (aspects, dimensions, factors, variables) of a case study and their presumed relationships”. The focus of this study is about how computerised information systems influence nurses’ role and practice, particularly in the experiences of using information systems among front-line nurses. Computerisation is regarded as an action in this study. According to literature, the adoption, implementation, and application of computerised information system involves a variety of groups of people working in healthcare settings. As a result, a causal puzzle (Mason, 2002) is developed.

Figure 3.2: The Initial Conceptual Framework
The initial framework in relation to influences of computerised information systems on nurses’ role and practice in healthcare organisations is illustrated in Figure 3.2 and 3.3. Figure 3.2 was developed during the phase of clarifying the research aim and objectives. Figure 3.2 was a streamlined version of conceptual framework. In Figure 3.3, two groups of people delineated by dotted-lines, such as other health professionals and personnel and patients, are excluded as they are not the focus of this study. Meanwhile, this initial framework is not viewed as definitive. Alternative formulations and possible features or relationships remain open.

Figure 3.3: The Streamlined Version of Conceptual Framework
3.2.4 Case Study as Research Strategy

Research design (or methodology) is the overall logical plan for gaining evidence to answer research questions (De Vaus, 2001; Yin, 2003; Polit and Beck, 2004). According to Mason (2002), the purpose of methodology is the logic which strategically underpins the design of a research project and guides most decisions in the research. In this study, the methodology of case study research was employed. In the following section, the reasons for adopting case study as the research strategy for this study are explained. The strategy of case study as a means of research is outlined, including its definitions, types, and strengths and limitations.

• Rationale for Case Study Research

Implementation of computerised information systems is regarded as an action and change. Experiences of nurses regarding such a change to their role and practice are less easy to measure objectively. Moreover, the literature review identified that social and cultural factors in the studies examining computerised information systems are neglected. van der Meijden et al. (2003) suggested that the evaluation of any information system should examine factors related to hardware, software, users, and organisational culture. Alternative research approaches which centred on social, cultural and organisational factors to examine the benefits of computerised information systems are suggested (Delpierre et al., 2004). Therefore, it is intended to answer the intellectual puzzle of this research (See Figure 3.2 and 3.3) through the perspectives and experiences of a variety of groups of people who are involved in the implementation and usage of computerised information systems in healthcare organisations. The flexibility of the case study approach allows the investigator to explore different levels of social systems. Hence, in order to understand the complex phenomenon of the impact of information systems on nurses in healthcare organisations via different layers of social reality, the case study research design was employed.

• Definitions

In case study textbooks, only Yin (2003) gives a clear technical definition of case study (see Box 3.2) which covers the scope of study, data collection and data analysis strategies. The central focus of the case study approach is a case with clear boundaries (Creswell, 2007). The case may be a subject that interests researchers, such as the situation, individual, group, organisation (Robson, 2002). However, in case study research, the case is not regarded as a sample of one (Robson, 2002; Bryman, 2004).
Box 3.2: Technical Definitions of Case Study by Yin (2003)

1. A case study is an empirical inquiry that
   - investigates a contemporary phenomenon within its real-life context, especially when
   - the boundaries between phenomenon and context are not clearly evident.
2. The Case study inquiry
   - copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as a result
   - relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result
   - benefits from the prior development of theoretical propositions to guide data collection and analysis.

Case study research emanates from multiple disciplines, including psychology, medicine, law, and political science (Creswell, 2007) and is also widely applied in a range of disciplines, such as sociology and political science (Yin, 2003). According to Yin (2003), case study is a comprehensive research strategy. It is regarded as a flexible research design (Robson, 2002). Case study research may adopt a mixture of qualitative and quantitative methods (Robson, 2002; Yin, 2003) or qualitative methods only (Stake, 2005). Typically, data are drawn from multiple sources in order to provide the in-depth case picture (Robson, 2002; Creswell, 2007).

Yin (2003) argues that case study is preferable in some situations, when ‘a “how” or “why” question is being asked about a contemporary set of events over which the investigator has little or no control’ (P9). The most distinguishing need for case study is the aspiration to understand complex social phenomenon (Yin, 2003). Through the case study method, investigators are enabled to maintain focus on the holistic and meaningful features of real-life events (Yin, 2003). Most importantly, the unique strength of case studies is to deal with a variety of evidence, involving documents, artefacts, interviews, and observations (Yin, 2003).

However, there is debate about whether case study is a methodology or not. Stake (2005) views case study as a choice of what is to be investigated. However, Robson (1993) and Yin (2003) argue the components of case study design include a conceptual framework, a set of research questions, cases, a sampling strategy and data collection methods, the logic linking the data to the propositions and the criteria for interpreting the findings. These aspects demonstrate that case study is an all-encompassing research method (Yin, 2003). Therefore, it seems that considering case study research as a methodology, strategy of
inquiry, or a comprehensive research strategy is favoured (Robson, 1993; De Vaus, 2001; Yin, 2003; Jones and Lyons, 2004; Denzin and Lincoln, 2005; Creswell, 2007).

**Type of Case Study Research**

The terms and classifications of types of case studies vary in the literature. Generally, types of case studies are classified by the number of study cases and research purposes. These types and their definitions by Stake (1995) and Yin (2003) are presented in Table 3.1. Stake (2005) identifies three types of case study according to the research purpose: (1) intrinsic case study, (2) instrumental case study, and (3) multiple case study or collective case study. On the other hand, Yin’s (2003) classification is based on a 2x2 matrix which results in four types of case study.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Single Case</th>
<th>Multiples Cases</th>
</tr>
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</table>
| Stake (2005)  | **Intrinsic case study** interests in the case itself in either its particularity or ordinariness.  
**Instrumental case study** aims to gain insight into an issue or to change a generalisation. | **Multiple case study or collective case study**, which is seen as an extension of instrumental study to several cases, investigates a phenomenon, population, or general condition whilst a number of cases are studied together. |
| Yin (2003)     | **Single-case, holistic design** is when no logical subunits can be identified or the relevant theory underlying case study is of an holistic nature.  
**Single-case, embedded design** is the same case involving more than one subunit of analysis. | **Multiple-case, holistic design**: the same study contains more than a single case.  
**Multiple-case embedded design**: the same study involves more than one single case with more than one subunit of analysis. |

Several circumstances are appropriate for single-case design when the case is critical, extreme or unique, representative or typical, revelatory, or longitudinal (Robson, 2002; Yin, 2003). Single-case design is more manageable and less expensive than multiple-case. However, its limitations are the risk of vulnerability i.e. “put all your eggs in one basket” and the chance of misrepresentation (Yin, 2003).

In terms of multiple case studies, a common misconception involves the need to gather a sample of cases (Robson, 2002; Yin, 2003). The purpose of multiple case studies is not statistical generalisation, but is analytic generalisation which is the development of a theory in order to understand other cases or situations (Robson, 2002; Yin, 2003).
Therefore, multiple-case designs are likely be more powerful than single-case designs (Yin, 2003). Analytical conclusions derived from more cases may be more substantial than those from single study alone. It is also likely to have literal replication even when applying two-case design (Yin, 2003). However, multiple case studies can decrease the depth of the overall analysis (Creswell, 2007). In terms of number of cases for multiple case study, it is suggested that no more than 4 or 5 cases (Creswell, 2007) are used. Therefore, applying a two-case design is suggested as a worthy aim (Yin, 2003).

The differences between holistic or embedded case designs involve the type of phenomenon under study and research questions (Yin, 2003). Yin (2003) suggests the advantage of embedded design can increase the focus of study and avoid a shift of the entire nature of study which is one typical problem of holist design. However, the pitfall of embedded design is that the case study focuses on the subunit of analysis and ignores the holistic aspects of the case (Yin, 2003).

### 3.3 Methods: Case Study Research Design

The research design of this study was developed according to the guidance of Yin (2003) and Robson (1993), particularly Yin’s work. The research design for the qualitative, embedded case study was proposed to explore the impact of computerised information systems on nurses in Taiwanese healthcare organisations. Next, the detailed design is discussed including the sampling strategy, case and sub-cases selection, and data collection approaches.

#### 3.3.1 Qualitative Single Case study with Embedded Design

Currently, there is no comprehensive codification of case study research design (Yin, 2003). On the contrary, flexibility, either adopting pre-structured or loose emergent design, is one of the great strengths of case study (Robson, 1993). In terms of looseness and selectivity, Robson (1993) suggests that the looser original design would narrow the selectivity of data selection because anything might be important and attempting to cover everything is impossible (Yin, 2003). Conversely, if researchers begin with a strong conceptual framework, it might cause blindness of significant features of a case or misinterpretation of evidence (Robson, 1993). Generally, most case studies tend to fall between the two extremes, tight pre-structured or loose-emergent design (Robson, 1993).

A plan for data gathering is necessary. However, Stake (2005) suggests that it is necessary to identify and develop late-emerging matters for researchers. Based on experiences of
multiple case studies, McDonnell et al. (2000) suggest that whilst theoretical considerations may lead methodological decisions, practical issues in the field may affect research design. It is suggested that whilst careful planning is recommended, the flexibility to deal with unexpected issues during the fieldwork stage is also necessitated (Robson, 1993; McDonnell et al., 2000; Yin, 2003).

The significance of study propositions is highlighted in Yin’s work (2003) which can guide the research direction and help to clarify the relevant information needed. However, the research purposes and questions show that the nature of this study is exploratory. In this situation, study propositions may be legitimately absent (Yin, 2003). Hence, Yin (2003) suggests that the rationale and direction should be the foundation in exploratory studies.

Thus, the research design was constructed around the intellectual puzzle (See Figure 3.2 & 3.3). The conceptual framework is an important guide for defining research design, data collection, and for the generalisation of case study results (Yin, 2003). Furthermore, the proposed case study design is qualitative. The characteristics of qualitative research are exploratory, fluid and flexible, data-driven and context-sensitive (Mason, 2002). Mason’s (2002) difficult questions therefore were used to clarify the thoughts of the investigator in order to enhance the coherence and rigour of the research project.

It was intended to discover how computerised information systems were designed and implemented as well as the practice politics involved in design and implementation processes in healthcare settings. This research aim suggested that a qualitative approach with different stakeholders would be appropriate. The aim of a qualitative case study is to develop in-depth descriptions and analysis of a case or multiple cases (Creswell, 2007). In a qualitative case study data are often drawn from multiple sources, such as interviews, observations, documents, or artefacts in order to provide an in-depth case picture, (Creswell, 2007). Gaining the contextual materials, such as documents, to describe the setting of a case is important (Creswell, 2007). Therefore, a qualitative case study with embedded design based on realism to explore the impact of computerised information systems on nurses was proposed. Methodologically, realism was chosen as the theoretical paradigm and the principles of case study research were used to guide research design and data collection.

In summary, qualitative, multiple case studies with embedded design were proposed. The aspects of case study design of this project are outlined in Table 3.2. The advantages and
limitations of single and multiple designs are discussed. Yin (2003) suggests that multiple-case designs are preferred when investigators have choices and resources. Furthermore, ethical issues of anonymity were considered. This study, hence, aimed to conduct a qualitative, multiple-case, embedded design. According to the conceptual framework and research questions, several variables are involved in this study, for example nurses, managers, IT staff and computerised information systems. They were recognised as the subunits of a healthcare organisation; therefore, the embedded design was adopted. Consequently, different data collection methods were employed after the subunits were identified because multiple data collection methods are used to answer the research questions through a variety of angles (Mason, 2002). Because of the difficulty of negotiating access in the field, this study ended in a qualitative single case study rather than multiple-case study.

Table 3.2: The Components of Case Study Design in this Research Project

<table>
<thead>
<tr>
<th>Components</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of case study</td>
<td>Multiple-cases, embedded</td>
</tr>
<tr>
<td>Unit of analysis (cases)</td>
<td>Medical centres adopted computerised information systems in Taiwan</td>
</tr>
</tbody>
</table>
| Subunits of analysis & Data collection methods | ▪ Nurses with Focus groups  
▪ Managers with Elite interviews  
▪ IT team members with individual interviews or focus groups  
▪ Computer systems with observations and document reviews. |

3.3.2 Selection of Case and Sub-cases

- Purposive Sampling Strategy

The appropriateness, relevance and contexts of cases and subunits to the research questions are primary concerns. Purposive sampling strategy is the approach used to sample the study subjects based on whether they are relevant to the research questions and do not aim to seek representativeness of the sample (Robson, 2002; Bryman, 2004). Purposive sampling is commonly applied in flexible research designs (Robson, 2002). The selection principle in purposive sampling is the researchers’ judgements and interests (Robson, 2002). Therefore, purposive sampling strategy was employed to select hospitals as units of analysis and the nurses; IT staff members and managers as subunits of analysis on the basis of CIS implementation and usage.
• Case Selection & Rationale
Identification of cases is suggested as one of the challenges of qualitative case studies (Creswell, 2007). Creswell (2007) suggests considering the usefulness and potential of type of case studies in case selection. Meanwhile, Stake (2005) suggests that “Opportunity to learn” often is a superior criterion to representativeness, such as choosing the most accessible case or the one we can spend most time on. In other words, sampling of attributes may not necessarily be the highest priority in case selection compared with the potential for learning. Furthermore, accurate, specific primary research questions guide the selection of units of analysis (cases) appropriately (Yin, 2003).

According to the findings of the literature review, it is likely that the implementation of computerised information systems occurred in the medical centres which are also complex social systems. Therefore, medical centres that have implemented computerised information systems are the sample target of this case study. According to the current national hospital accreditation (Taiwan Joint Commission on Hospital Accreditation, 2008) results, 20 healthcare organisations were assessed as medical centres; 10 of which had signed the contract with the Taiwan Department of Health for the implementation of electronic patient record system in 2007. Therefore, these 10 medical centres became the blueprint of cases in this research project.

• Sub-case Selection & Rationale
Embedded subunits can be selected via sampling strategies (Yin, 2003). It was intended to answer the research aims through the perspectives and experiences of a variety of groups of people who were involved in the implementation and use of health information systems in healthcare organisations. Therefore, the embedded subunits were purposively selected from hospital employees who had been involved the computerisation process, including registered nurses, hospital managers and health informatics staff. Computer technology as physical artefacts was included. Accounts from different perspectives may construct a more comprehensive picture and an in-depth understanding of computerised information systems use. Moreover, the perspectives of participants at different levels may allow the investigator to compare the information obtained which may benefit the data analysis process.

Additionally, a small number of directors of nursing departments from other medical centres were recruited into this study. There were two reasons for this: the first was to protect the identities of hospital managers who participated in the study because they were
a small group of people. The second reason was that the accounts of directors of nursing from other medical centres may provide more information for comparing and contrasting in the data analysis process. The inclusion and exclusion criteria for each subunit are listed in Table 3.3.

<table>
<thead>
<tr>
<th>Subunit</th>
<th>Inclusion and exclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registered nurses</td>
<td>▪ Front-line registered nurses as daily system end-users.</td>
</tr>
</tbody>
</table>
| Hospital managers from different levels of hierarchy of the organisations | ▪ The inclusion criteria for Hospital managers involving decision making or in the implementation process of computerised information systems.  
▪ Managers of Nursing Departments involving computerised information system project,  
▪ Head nurses whose units had adopted computerised information systems. |
| Informatics staff | ▪ Information technology team members involving the HIS project process. |
| Computer technology | ▪ Computer systems located in the care units serving functions of clinical practice will be included.  
▪ Administration systems will be excluded. |

### 3.3.3 Choice of Data Collection Methods

Data for case study research usually is drawn from six sources: documents, archival records, interviews, direct observations, participant-observations, physical artefacts (Yin, 2003). In this case study, the major sources of data were participants’ accounts. It was proposed to carry out different forms of interviews: focus groups and elite interviews. Because the topic under study focuses on the experiences and perceptions of the nurses, hospital managers and IT teams, asking people directly is the best way of seeking answers (Robson, 2002). The face to face approach also offers opportunities for clarification and exploration, as well as non-verbal cues. Consequently, interviews have the potential to produce rich and highly illuminating materials (Robson, 2002). Moreover, physical artefacts, which are computer technology in this study, are the third source of data. Observations of computer technology at the ward levels may provide information about computer resources and allocations.

In the following paragraphs, an overview of three data collection methods is given. Their strengths and limitations and the rationale for each method are discussed. Finally, plans regarding data collection in the field were outlined.
Focus Groups with Registered Nurses

Overview

Focus groups have been applied in market research for many years and their use in social research is increasing (Bryman, 2004; Stewart et al., 2007). A focus group or focus group interview is a form of group interview on a specific topic (Robson, 2002; Bryman, 2004) which usually involves 8 to 12 people discussing a particular topic under the direction of moderator who promotes interactions and ensures that the discussions remain on track (Stewart et al., 2007). The group dynamics is a key feature (Bryman, 2004; Stewart et al., 2007) that distinguishes group from individual interviews which are discussed in the next paragraph. The participants are selected as they are involved in a particular situation or share some common identity and goals (Bryman, 2004; Stewart et al., 2007). Focus groups are particularly beneficial whilst the phenomenon under study is little known (Stewart et al., 2007). They are widely used in a wide range of circumstances (See Box 3.3).

Box 3.3: Use of Focus Groups (Stewart et al., 2007)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Obtaining general background information about a topic of interest.</td>
</tr>
<tr>
<td>2.</td>
<td>Generating research hypotheses that can be submitted for further research and testing using a more quantitative approach.</td>
</tr>
<tr>
<td>3.</td>
<td>Stimulating new ideas and creative concepts.</td>
</tr>
<tr>
<td>4.</td>
<td>Diagnosing the potential for problems with a new programme, service or product.</td>
</tr>
<tr>
<td>5.</td>
<td>Generating impressions of products, programmes, services, institutions, or other objects of interest.</td>
</tr>
<tr>
<td>6.</td>
<td>Learning how respondents talk about the phenomenon of interest. This may facilitate the design of questionnaires, survey instruments, or other research tools that might be employed in the quantitative research.</td>
</tr>
<tr>
<td>7.</td>
<td>Interpreting previously obtained quantitative results.</td>
</tr>
</tbody>
</table>

Strength & Limitations

The strengths and limitations of focus groups are summarised in Table 3.4. Generally speaking, the limitations are the negative side of their advantages (Stewart et al., 2007). For example, the synergistic effect of group interactions allows the group members to probe and react to each other’s views. In the group context the members may challenge each others’ view if there is any inconsistency or deficiency (Bryman, 2004). These possibilities may elicit a wide variety of viewpoints which may not have been uncovered in individual (Bryman, 2004; Stewart et al., 2007). However, group effect also has potential problems. For example, pre-existing style of interactions or status difference may restrict the generalisability of the results, whilst an opinionated group member can dominate the discussions, or reserved members may hesitate to talk (Stewart et al., 2007).
Table 3.4: Strengths and Limitations of Focus Groups.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Strengths</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaining data quickly, flexibly and with less cost (Stewart et al., 2007).</td>
<td>Focus groups are difficult to organise from participant recruitment, time arrangement to the preparation of small gifts (Bryman, 2004).</td>
<td></td>
</tr>
</tbody>
</table>

| Moderator | The moderators have opportunities to interact with group members in clarifying responses and asking follow-up or probing questions and can observe non-verbal expressions of the members (Stewart et al., 2007). | The moderator may bias the results by consciously or unconsciously reinforcing the expressions of viewpoints that agree with our own, which is so-called personal bias (Stewart et al., 2007). |

| Process | The members have opportunities to raise issues related to the topic of interest which are deemed to be significant (Bryman, 2004; Stewart et al., 2007). | Moderators have less control over the process compared with individual interviews (Bryman, 2004). |

| Process | Through synergistic effect, a wide range of viewpoints may be elicited (Bryman, 2004; Stewart et al., 2007). | Group effects are potential problems (Bryman, 2004; Stewart et al., 2007). |

| Data | Rich data expressed by the respondents’ language and context with a minimum of artificial responses (Stewart et al., 2007). | The data are difficult to analyse and the transcribing is more time-consuming than those in the individual interviews (Bryman, 2004; Stewart et al., 2007). |

**Rationale**

Alternative methods to collect data from registered nurses were questionnaire survey or one-to-one individual interviews. At the outset, using questionnaires to survey nurses was proposed. However, no appropriate questionnaires were identified in the literature review that were suitable for investigating the topic under study. Moreover, understanding the impact of the computerised information systems on nurses in the literature was insufficient to allow the investigator to construct a self-developed questionnaire with good reliability and validity. Furthermore, a questionnaire survey is constructed through the investigator’s perspectives which may restrict respondents’ answers to the questions. The responses are considered to be important to the investigator but not necessarily the salient issues to the respondents. Consequently, it is possible that some important aspects were omitted.

Additionally, the group dynamics and the moderator involvement in the focus groups bring out both the advantages and limitations as discussed earlier. Compared with individual interviews, the moderators have less control over the focus group process. However, focus
groups allow the researchers to study how group members make sense of a phenomenon and construct meanings around them. To a certain extent, such a process reflects how meaning is constructed in everyday life and can be regarded as more realistic than individual interviews (Bryman, 2004). Meanwhile, providing opportunities for group members to raise questions may fulfil the emancipatory purpose described in Section 3.2.2 and may help the investigator to understand what issues are significant to them. Therefore, considering the distinguishing features of focus groups and the research agenda in this study, focus groups were adopted.

_How many groups_

In terms of number of groups, currently, there is no rule to follow to decide the number of groups. It is suggested that the more complex the research will be, the larger groups are needed (Stewart _et al._, 2007). When investigators recruit participants trying to ensure groups with a wide range of features, such as demographic factors, a large number of groups are also required (Bryman, 2004). Conversely, while participants are homogeneous and research questions are simple, one or two groups may be sufficient (Stewart _et al._, 2007). However, Stewart _et al._ (2007) suggest that most focus groups be more than one group and seldom more than 3 or 4 groups.

_Size of Groups_

In terms of size of groups, Stewart _et al._ (2007) suggest 6 to 12 participants per group. Fewer people may produce limited discussions or may be dominated by one or two members (Stewart _et al._, 2007). Larger groups, more than 12 participants, may be difficult to manage and inhibit participation by all members of the group (Stewart _et al._, 2007). Stewart _et al._ (2007) suggest that slight over-recruitment is recommended because asking one or two people to leave is better than cancelling the group.

_Selection of Participants_

Group dynamics, one of focus group features, influence participants’ perceptions, the information process and decision making (Stewart _et al._, 2007). The nature and quality of group interactions among focus group participants are shaped by three research design elements: group compositions, interpersonal influences, and research environment factors (Stewart _et al._, 2007). In terms of group composition greater heterogeneous groups generally may yield fewer communications or even conflicts between the group members (Stewart _et al._, 2007). On the other hand, they can have greater perspectives and innovations (Stewart _et al._, 2007). In terms of interpersonal influences, natural groups or
pre-existing groups may have more natural discussions (Stewart et al., 2007). However, the
taken-for-granted assumptions may not be brought out (Bryman, 2004). Moreover, group
effects may have potential problems, which are discussed in the paragraph of strengths and
limitations of focus groups.

Therefore, in terms of participant selection it is suggested that a relatively homogenous
group who have never met before are more productive and work better (Stewart et al.,
2007). However, Steward et al. (2007) point out this suggestion is a rarely tested
assumption. Morgan and Krueger (1998) suggest that focus group participants may not
necessarily be strangers. Focus groups in organisational or community settings often
recruit participants who have acquaintanceships when investigators aim to hear from a
group of co-workers (Morgan and Krueger, 1998). On the other hand, group compositions
with half strangers and where half the people are acquainted are not desirable because such
a composition affects the group interactions (Stewart et al., 2007).

**Role of Moderator Involvement**

It is common to start with some general questions and then focus on more specific issues as
the discussion progresses (Stewart et al., 2007). The amount of direction given by the
moderators may influence the type and quality of data produced by the group (Stewart et
al., 2007). A balance between an active and a passive role is needed (Robson, 2002;
Stewart et al., 2007). The literature suggests that the most appropriate amount of moderator
structure and direction is determined by the research agenda (Stewart et al., 2007).
Generally, moderators adopt a nondirective approach with respect to the discussion,
allowing conversations to flow naturally as long as it remains on the topic of interest
(Bryman, 2004; Stewart et al., 2007). Less structured groups are appropriate for
researchers aiming to know what is important to the group, as the issues with greater
importance, relevance and interest to the groups tend to be discussed (Bryman, 2004;
Stewart et al., 2007). A more structured moderator approach may direct participants to
discuss issues relevant to the researchers’ specific information needs (Stewart et al., 2007).
Stewart et al. (2007) suggest that when this occurs, participants are discussing what is
important to the researchers rather than what the members consider significant.

- **Elite Interviews with Managers and Informatics Staff**

**Overview & Rationale**

Hospital managers including the decision makers and the middle-level managers were one
of the sub-cases in this project. They play powerful and influential roles as the expert
administrators in hospital management of healthcare organisations can be regarded as elites (Gillham, 2005). Elites can be defined as a group of people in close proximity to power or policymaking or hold a privileged position in society, and are more likely to be influential in political outcomes than general members of the public (Richards, 1996; Lilleker, 2003). Because Kvale (1996) suggests applying different interview approaches to different groups of subjects, elite interviews were employed for the group of hospital managers.

The identity and position of elites makes them different from the ordinary interviewees. Gillham (2005) suggests that the level of the expert administrators implies that this is a position concerned with policy, finance, public image, power and control. Consequently, they are more politically aware, alert to the implications of questions and pick their words carefully (Gillham, 2005). For example, they are aware of the problems that could result from the statements they make (Gillham, 2005). Hence, it is suggested that elite interviews are not carried out for the purpose of establishing the truth (Richards, 1996). The function of elite interviews, is to provide opportunities to gain an insight to the mindset of interviewees regarding their subject views about a particular situation (Richards, 1996). Additionally, Gillham (2005) suggests that the interpretation needs other sources of data as reference because expert administration elites are self-aware regarding how a given reality is constructed.

As described in Section 2.5.4, the implementation of computerised information systems often involves a great demand of human resources. The accounts from different perspectives may construct a more comprehensive picture and in-depth understandings. Moreover, participants from different levels allowed the investigator to cross-check information which may be helpful in data analysis.

**Strengths & Limitations**

In terms of strengths, elite subjects can provide several accompanying benefits which are the so-called *snowball effect*, such as helping the researchers to establish the networks or providing access to other interviewees (Richards, 1996). Through the face to face interactions, interpreting the personalities involved in the related decision-makings is helpful in explaining the outcome of events (Richards, 1996).

The literature shows that the accessibility of the elite sample is a potential issue and can be problematic (Kvale, 1996; Richards, 1996; Gillham, 2005). Inevitably, the sample sizes tend to be small (Richards, 1996). The interviewees may be deferential to high status
interviewees and that may cause the dominance and control of the interviewees over the interview discussions (Richards, 1996). A semi-structured approach is suggested for this situations (Richards, 1996).

- **Unobtrusive Measurement of Computer Technology**

  **Overview**

  Physical artefacts can be a technological device, instrument, or some physical evidence (Yin, 2003). Physical artefacts are less relevant to most case studies. However, if they are relevant, Yin (2003) suggests that they can be a significant component in the case study research.

  **Rationale**

  In this case, it was intended to understand some computer issues, such as the interface of computerised information systems as tick boxes or open spaces and how computers and the relevant equipment were allocated in the wards. Moreover, data from observations may enhance the understanding of participants’ accounts and the hospital context. Therefore, it was proposed to carry out unobtrusive measurement (Webb, 1966) of computer technology to understand the allocation at the level of ward units.

- **Integration of Data Collection Methods**

  In terms of sequence of these methods, it was proposed to understand the computerised information systems and organisational context prior to carrying out focus groups and elite interviews in order to have a good grasp of the conversations.

### 3.4 The Conduct of the Study

This section covers the issues in the field work, including gaining access, recruitment and data collection process, ethical considerations, data analysis and methodological rigour. The study setting was in Taiwan. All discussions of focus groups and elite interviews were carried out in Mandarin, the first language of the participants and the investigator.

#### 3.4.1 Gaining Access

Difficulties in negotiating and gaining access for conducting this study were encountered. Before approaching the potential individual participants, a considerable amount of time was spent on contacting and negotiating access with the gatekeepers who were hospital managers. The experiences of gaining access in this study had three stages, including negotiation with hospitals individually, approval from the Institutional Review Board and
layered permissions within the case study hospital. The details of each stage are stated in the following paragraphs.

- **Negotiation with Hospitals Individually**
Gaining the access from the chief executive of hospitals is necessary for two reasons. Firstly, as outlined in Chapter 1, the majority of hospitals are private in Taiwan. Secondly, there was no central process for gaining access and ethical approval in Taiwan. Because most hospitals are private, each hospital has its Institutional Review Board reviewing any research.

My first approach to Hospital A was refused. Because I had been an ex-employee of Hospital A for nearly three years, I wrote initial contact emails to the Institutional Review Board (IRB) of Hospital A. The Board refused my study. I requested further information regarding refusal reasons, but I received no further response.

In total, four medical centres, named Hospital A, B, C, and D in the following paragraphs, were approached for access to carry out the study. Except approaching Hospital A for the first time, the strategy of family networks was then used to gain access. Family friends, who were medical doctors, pharmacists and ex-chancellors of university, acted as referees for me. According to the selection criteria of the case (See Section 3.3.2), 10 medical centres were potential cases. The selection of hospitals approached for access was based on the family friends’ networks. In total, four out of ten hospitals were approached through their networks. The approach documents, including the approach letter, the abstract of research proposal and personal CV, were sent to them to familiarise with the study. The approach letter and abstract of study are presented in Appendix 10. The details of approaching process are presented in Table 3.5.

<table>
<thead>
<tr>
<th>Date</th>
<th>Approach details</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/2/2008</td>
<td>Approaching Hospital A (1st time) with the approach letter and personal CV by email.</td>
</tr>
<tr>
<td>25/2/2008</td>
<td>Hospital A refused the study by email</td>
</tr>
<tr>
<td>28/2/2008</td>
<td>Approaching Hospital B (1st time) by a family friend.</td>
</tr>
<tr>
<td>20/3/2008</td>
<td>Hospital B refused the study due to the workload.</td>
</tr>
</tbody>
</table>
Table 3.5: The Details of Approaching Process (Cont.)

<table>
<thead>
<tr>
<th>Date</th>
<th>Approach details</th>
</tr>
</thead>
<tbody>
<tr>
<td>28/3/2008</td>
<td>Gained permission of access from Hospital A</td>
</tr>
<tr>
<td>8/4/2008</td>
<td>Received feedback from a doctor working in Hospital C.</td>
</tr>
<tr>
<td>8/4/2008</td>
<td>Contacting a nursing supervisor of Hospital D by international phone call.</td>
</tr>
<tr>
<td>16/4/2008</td>
<td>Received email from a nursing supervisor in charge of nursing information system development in Hospital D. Receiving IRB procedure from her.</td>
</tr>
<tr>
<td>11/4/2008</td>
<td>Received the information of procedures for gaining access from the doctor working in Hospital C. (doctor said it is very complex)</td>
</tr>
<tr>
<td>14/4/2008</td>
<td>Approaching Hospital B (2nd time).</td>
</tr>
<tr>
<td>10/5/2008</td>
<td>Hospital B refused the study.</td>
</tr>
</tbody>
</table>

Through introductions and recommendations of these referees, the head of Hospital A verbally permitted the conduct of this study. He passed me to the director of the nursing department. The negotiating access with the nursing department is presented in next section.

Hospital B refused access for the study. The reason given was that the hospital was busy and had a heavy workload due to the upcoming hospital accreditation. This corresponded to Bryman’s opinion. In gaining access to organisational case studies, Bryman (1989) suggests that gatekeepers often are concerned about the amount of organisations’ and participants’ time that may be wasted by investigators.

A doctor working in Hospital C collected information regarding gaining access for me. He replied to me by email explaining that an official letter from the School was required and seeking the permissions of the departments involved in this study was needed. Once permissions were gained the researcher could start the ethical approval process within the IRB of Hospital C. If any one of the involved departments disagreed, the study was rejected. As the process seemed to be complex and the possibility of gaining the access successfully was uncertain, the researcher decided not to approach Hospital C further.

Through several emails, phone calls, and face to face contacts to introduce the study and the researcher herself, one nursing supervisor responsible for nursing informatics in the nursing department of Hospital D, was very supportive of the study. Because Hospital D
had started the trial of nursing information systems and portable computer trolleys, she expressed the findings of the study would be useful feedbacks for further computerisation process. Hospital D thus became the potential second case.

- Approval from the Institutional Review Board

However, these top managers were not the only gatekeepers to negotiate with for gaining access. Although the goal and aims for research ethics are the same, the ethical approval processes at the time of data collection in Taiwan varied from hospital to hospital, such as reviewing procedures, required document forms, regulations and fees. Consequently, the IRB in the case-study hospital was the other major gatekeeper requiring a considerable amount of time to negotiate with.

The Board of case-study hospital and Hospital D had a series of protocols to follow. Particularly, in the case-study hospital the criteria for researchers included receiving a certain hours of ethics principle training to be qualified for being the investigator, submitting the research proposal according to their policy, using their structured forms and wording for quantitative studies in my qualitative study, paying the request fees for the reviews, making amendments or corrections according to the members’ advice.

Before sending documents to the Board, the Nursing Department had reviewed the proposal. In total, the Board of the case-study hospital reviewed the research proposal twice (See Table 3.6). The Board did not request me to attend the meetings; however, 18 questions through a paper format were raised by nine reviewers which needed detailed answers in a structured feedback sheet. In the second time of review, the Board were concerned about access issues and requested a formal announcement from the head (Chief of Executive Officer) as a condition of the approval. Thus, the nursing department sent a request and explained that I was an ex-employee working as a registered nurse and also promised to share the authorships. Finally, after the head of hospital sent a formal domestic announcement showing that permission was gained, the study was approved by the Board of the case-study hospital (See Appendix 11).

<table>
<thead>
<tr>
<th>Date</th>
<th>Approach details</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/09/2008</td>
<td>Emailed the nursing director for the first meeting</td>
</tr>
<tr>
<td>30/9/2008</td>
<td>Received the reply from the nursing director.</td>
</tr>
</tbody>
</table>
Table 3.6: The Details of Ethics Review in the Case-Study Hospital (Cont.)

<table>
<thead>
<tr>
<th>Date</th>
<th>Approach details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct-Dec/2008</td>
<td>Preparing the documents required for IRB and reviewed by the Nursing Department.</td>
</tr>
<tr>
<td>17/12/2008</td>
<td>The Study was sent to the IRB for the 1st review.</td>
</tr>
<tr>
<td>14/1/2009</td>
<td>Received the feedbacks from the IRB. Second time of review was required.</td>
</tr>
<tr>
<td>19/2/2009</td>
<td>The Study was sent to the IRB for the 2nd review.</td>
</tr>
<tr>
<td>26/2/2009</td>
<td>Received the feedbacks from the IRB. The letter from the CEO of the hospital was required.</td>
</tr>
<tr>
<td>4/3/2009</td>
<td>The letter and announce from the CEO was made.</td>
</tr>
<tr>
<td>9/3/2009</td>
<td>IRB approved the study</td>
</tr>
</tbody>
</table>

The research committee of Hospital D was supportive and raised the issue of their internal policy that their IRB reviewed research proposals applied to their employees only which I had been discussed with the nursing supervisor. Under this condition the principal investigator of the application needed to be the nursing supervisor of Hospital D and the researcher would be the co-investigator. Considering some issues regarding confidentiality and ownership of raw data gained in the future, these issues made the researcher very hesitant and finally it was decided to give up attempting to gain access in Hospital D after starting the data collection in the case-study hospital.

Figure 3.4: Documents required for IRB (1)   Figure 3.5: Documents required for IRB (2)
Layered Permissions (Buchanan and Bryman, 2007) within the Case-study Hospital

Hospital A in the process of negotiation for hospital access subsequently became the case-study hospital. Before approaching the front-line nurses in the case-study hospital, a substantial amount of time was spent on negotiation with each level of nursing managers in the Nursing Department.

The levels included the nursing director, nursing supervisors and head nurses. I felt I was going through a series of ‘check points’ before recruiting front-line nurses. A lot of effort was put into maintaining and negotiating the way I wanted to conduct the study. The process I experienced corresponded to the concept of ‘layered permissions’ by Buchanan and Bryman (2007). According to Buchanan and Bryman (2007), this is one of political actions that researchers routinely engaged in the field of organisation research. The experiences of gaining layered permissions are presented in the following paragraphs.

In the first meeting, I introduced myself and discussed my study to the nursing director. During this meeting, agreements regarding who would be the co-investigators and sharing authorship of future publications were also made. Buchanan and Bryman (2007) describe politics of publishing. Getting the findings of study into prints is one of political properties of organisation research in the field (Buchanan and Bryman, 2007). This agreement infused ‘an element of reciprocity’ (Bryman, 1989) to the gatekeepers and the case-study hospital. However, this was one of big compromises I had to make in order to obtain the access.

In the second meeting, the nursing director introduced me to two nursing supervisors. One was responsible for activities of nursing information systems; the other was for empirical studies conducted in the nursing department. During this meeting, the main concerns of two nursing supervisors were how the study would be conducted, including focus groups, observations, elite interviews and my dress code. Which wards for observations and for focus groups were decided through the discussions. The nursing director expressed her concerns regarding the participation of front-line nurses. She tried to persuade me to directly designate front-line nurses as participants or recruit head nurses instead. In order to maintain the ethical principle of informed consent, voluntary participation and preventing potential social desirability bias (De Vaus, 2002) affecting data collected, I tried to reassure them that being flexible was part of my research design. Because recruitment and participation of focus groups with staff nurses was a new experience, it was worth trying
and seeing how front-line nurses responded. Buchanan and Bryman (2007) describe negotiating research objectives is one of political actions that researchers need to engage in.

In the third meeting, the nursing director introduced me and my study to all of head nurses in a nursing department monthly meeting during the lunch time. Because the nursing director only spared me five minutes, I prepared a one-page introduction and my business card for the head nurses to familiarise them with my study (See Appendix 12). After the introduction, I was required to leave the meeting venue immediately. Question time was not given in this meeting.

For the fourth meeting, individual head nurses were approached. I rang each head nurse and made appointments to introduce myself and the data collection process in their wards. Sufficient documents were prepared for the head nurses to let them familiarise themselves with the data collection method in their wards, including the abstract of research proposal, the plan and examples of recruitment approach, examples of consent forms, and the focus group interview guide or observation guide (See Appendixes 13 and 14). The durations of meetings varied from 30 minutes to one and half hours, depending on the availability of their schedules and their questions. A lot of self disclosure was made, including answering their questions regarding my personal life. The details of recruitment process are presented in Section 3.4.3.

In order to maintain good field relationship, reciprocity inevitably involved the building relationships (Bryman, 1989). Various requests were made. The nursing department requested my suggestions regarding their on-line education system and the nursing department homepages and invited me to write an introductory article on information systems in the UK. Some requests were for help with translating abstracts of papers into English for submitting to journals or a few pages of documents into English. The IRB secretary requested me to translate a book regarding the ethics policy for them. This request was unreasonable, but I felt I could not say no. So I replied strategically saying yes, but it will take a long time because it was a huge task and I also needed to work on my data collection. Some requests were finding research articles, either making photocopies or finding PDF files. Other requests were purchasing textbooks in English and talking about study abroad. However, the relationships with nursing managers involved much more reciprocity than relationships with front-line nurses.
As the above sections described, a lot of time and energies were spent on gaining access and paper work required by the Board, rather than the participants. Consequently, this process made me feel insecure and worried about conducting the study wrongly. The experiences of this study corresponded to Bryman’s (1989) work. According to Bryman (1989), the nature of organisation is an additional layer set between the researchers and their subjects. The researchers need to access both the individuals and the organisations themselves. To obtain the access to the organisations and their employees in organisation research, substantial negotiation is often needed. As a result, the problems of access take up the researchers’ attention a great deal (Bryman, 1989). Buchanan and Bryman (2007) point out this brings out at least two consequences: the delay of the start of data collection and compromise of research objectives (Buchanan and Bryman, 2007). My data collection was delayed indeed.

3.4.2 Unobtrusive Measure of Computer Technology
After gaining layered permission, six head nurses were individually visited for discussing the schedules for collecting data using unobtrusive measures regarding computer technology. The Case-study hospital had four main buildings. Six wards were chosen according to the floor plans of four buildings and characteristics of wards.

During the measurement, no discussion with their staff members was confirmed. A telephone reminder prior to the unobtrusive measure was made. Before the start and the end of unobtrusive measures of computer technology, I needed to report to the head nurses to make them aware of my data collection.

In the first day of unobtrusive measures of each ward, the maps of floor plans were drawn. After drawing the maps, the unobtrusive measures were carried out according to the schedule (See Appendix 15), including the information of wards, computer technology hardware equipments and accessories, software systems, and the technical support and maintenance. Field notes were recorded. In order to prevent researcher bias (Mason, 2002), six wards selected for unobtrusive measures were excluded for focus group recruitments.

3.4.3 Focus Groups
• Sampling and Recruiting Front-line Registered Nurses
Each head nurse was individually visited. The recruitment plan (See Appendix 13), was discussed. No need for head nurses to promote participation was clarified. A telephone reminder prior to the recruitment was made.
In the first day of recruitment of each ward, I attended on the designated date to introduce the study to each front-line nurse during the nursing hand over at day and evening shifts. Five minute oral explanations were given and prepared recruitment packages were distributed to front-line nurses (See Figure 3.6). Each recruitment package included one copy of information sheet, consent form and return slip (See Appendix 13). Several key issues were briefly outlined, including the purpose of focus groups, ethical considerations, how data would be used, how long the focus group would take, and the benefits of participations.

The means of return-slip method was adopted to identify potential participants. The potential participants filled the return slips and dropped it into the designated boxes (See Figure 3.7). The boxes also listed the study information as reminder, including (1) the purpose of box, (2) the research topic, (3) the schedules of 10-minute question time and (4) the box collection time as a reminder for prospective registered nurses.

The next day, I returned to the nursing station near the box for return-slips and for 10 minute question time during day and evening shifts in each ward for two days. Thus, it had four times of 10 minute question time in each ward. During the question time, I presented myself and waited for nurses raising any queries. Few nurses asked questions and none asked questions regarding the study or focus groups. Following the 10 minute question time, the fourth day, I collected box and the slips indicating interest in participation and made contact with front-line nurses individually.
Two recruitment techniques were amended soon after visiting few wards. The first issue was the information sheet. The Board had set a standardised consent form for research regardless the research design (See Appendix 13). Several sections in the consent forms had to adopt the wording set by the IRB exactly, despite the fact that I had negotiated the rephrasing of the consent forms. Consequently, the standardised wording and format of consent forms also led to one issue in the focus group recruitment process. Soon after starting to recruitment of focus group participants, I found out that the content of consent forms did not help the potential participants understand focus group. Four-page consent form took time to read and participating focus group was a new experience to front-line nurses. After visiting two wards and answering similar questions raised by potential participants, I added a one page Q&A in their recruitment package (See Appendix 16).

The second change was the wording in the return-slip. After visiting two wards, one head nurse stated that the wording for indicating the interest to participation would not work because I used “return your slip if you are interested in participation”. She suggested “indicate your willingness or not and return your slip” to increasing participation. After considering that this may protect the potential participant anonymously, the wording was changed as suggested.

13 wards were visited. 12 wards were recruited. Only one head nurse rejected the recruitment procedure and insisted on assigning participants to the focus group. This was similar to the offer of the nursing director presented in Section 3.4.1. As this procedure violated the informed consent and voluntary participation ethical principle this ward was abandoned. Larger wards with a higher number of staff nurses were recruited first because they have more potential participants to fit focus group requirements.

Through the return-slip indicating interest in participation, face to face contact individually to discuss willingness to participate answering any questions was made. I made face to face contact individually to discuss willingness to participate, to answer any questions they might have, to establish contact methods and preferred time, location for a focus group and to build up trusting relationships. Once the list of prospective participants was established, several possible dates were scheduled until the prospective participants reached an agreement on a particular date for a focus group

Recruitment results are listed in Table 3.7. In total, 359 nurses from 12 wards were approached. 212 nurses received my recruitment introduction and the packages. 35 nurses
listened to my verbal introduction only and did not take the packages. 112 nurses received recruitment packages only because they were off duty. 33 nurses indicated their willingness to participate via return-slips; 17 nurses considered participation. Through face-to-face approach, 41 nurses confirmed they would like to participate. Nine people declined participation after discussing their willingness. Seven people willing to participate could not fit the focus group schedules despite several discussions. Finally, five homogenous focus groups with front-line registered nurses were conducted in five ward units (n=25). Two participants did not turn up. In addition, because less than three people arrived and there were too few participants to form a group, four individual interviews were conducted with participants’ consent. One person canceled just before the interview. The participation rate was 8.07%.

Table 3.7: Recruitment Results of Focus Groups (n)

<table>
<thead>
<tr>
<th>Ward</th>
<th>Number of Staff</th>
<th>Recruitment Approaches</th>
<th>Return-slip Results</th>
<th>Data Collection Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>V &amp; P</td>
<td>Verbal only</td>
<td>Package only</td>
</tr>
<tr>
<td>ICU-1</td>
<td>59 4</td>
<td>22</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>ICU-2</td>
<td>54 3</td>
<td>33</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>Paediatric Ward -1 &amp; 2</td>
<td>32</td>
<td>16</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Medical Ward -1</td>
<td>27</td>
<td>15</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Medical Ward 2</td>
<td>32</td>
<td>23</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Medical Ward 3</td>
<td>26</td>
<td>13</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Medical Ward 4</td>
<td>29</td>
<td>21</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Medical Ward 5</td>
<td>22</td>
<td>17</td>
<td>0</td>
<td>4+1</td>
</tr>
<tr>
<td>Medical Ward 6</td>
<td>29</td>
<td>20</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Surgical Ward 1</td>
<td>23</td>
<td>17</td>
<td>0</td>
<td>5+1</td>
</tr>
<tr>
<td>Surgical Ward 2</td>
<td>26</td>
<td>15</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Surgical Ward 3</td>
<td>35</td>
<td>Head nurse rejected the recruitment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>359</td>
<td>212</td>
<td>35</td>
<td>112</td>
</tr>
</tbody>
</table>

*1: Nurses who only listened to my verbal introduction but did not take the recruitment packages.

*2: Although recruiting in the morning and evening allowed me to meet three shifts of nurses in one day, the nurses off day were not recruited. I distributed recruitment packages to them instead.

*3: AHNs were excluded according to my research proposal. The rest of wards were included because the head nurses persuaded me by AHN still involved in clinical practice everyday.

*4: Two participants were on duty during the scheduled date of focus group. They insisted to come because their friends attended. However, I suggested them not to participate as their patients were their first priority and the focus group may distract their time.

*5: One participant did not show up.

*6: Participants who were interested in participation could not fit each other’s schedules.
• Conduct of Focus Groups

After the dates for focus groups were set with the participants, the conference rooms at the ward booked in advance were visited. On the day prior to the focus group, mobile phone texts were sent to the participants as reminders. On the day of the focus group I arrived early to arrange the table, chairs and refreshments in the room (See Figure 3.8 and Figure 3.9) and posted the prepared ‘no disturbance’ sign on the door (See Figure 3.10 and Figure 3.11) to prevent interruptions. Many things needed to be prepared in advance (Figure 3.12)

Figure 3.8: Arranging the Table for Focus Group (1)

Figure 3.9: Arranging the Table for Focus Group (2)

Figure 3.10: “No Disturbance” Sign

Figure 3.11: Posting the Sign on the Door of the Conference Room

Figure 3.12 Preparations for Focus Groups

Figure 3.13: Gifts for Focus Group Participants
In the beginning of focus group, participants were free to choose their seats around a table; the observer sat outside the group. The group started with informal conversations as welcome. Information sheets and any concerns were discussed, such as tape-recording, the storage and usage of tapes. It was emphasized that I would be the only to listen to the tapes. Principles for group discussions were explained.

The discussions were conducted by the semi-structured interview guide (See Appendix 17). In terms of my role as a moderator, I adopted a less intrusive and directive approach (Stewart et al., 2007) as long as discussions were related to the topic under the study. Every group had one or two dominant persons who usually were senior nurses. Whilst noticing participants tended to talk to me rather than discussing with their colleagues, I encouraged other discussions by asking the quieter participants’ opinions more directly. I observed participants’ body language to identify any signs that they intended to speak in order to encourage wider participation in the discussions.

Two out of five focus groups were interrupted shortly by the hospital employees. At the end of focus groups, each participant filled the demography questionnaires (See Appendix 13). A pen bought from the Cancer Research UK (See Figure 3.13) as a small gift was given to the participants for their contribution.

3.4.4 Elite Interviews
Nursing executives and head nurses involved in the nursing informatics committee were approached. Two head nurses from the operation room and emergency room were not recruited because two wards were not the research focus in this study. Some head nurses were invited for interviews because focus groups were carried out in their wards. The director of Informatics Department and two software engineers responsible for computerisation information systems were approached. Through purposive sampling strategies, this group was small, despite that they were key informants in this study. Therefore, except the case-study hospital, nursing executives responsible for nursing informatics activities were recruited to enlarge the sample size. The semi-structured interview guide was sent via emails according to their requests.

All of interviews were conducted in their offices. Nurse managers and software engineers often asked questions about myself either in scheduling the interview dates or in the beginning of interviews. Information sheets and any concerns were discussed, such as tape-recording, the storage and usage of tapes. Two interviewees did not accept tape recording,
so after interviewing I made oral reports of the interview contents by a digital recorder. During the discussion, I also made brief notes of the discussion content. It was emphasized that I would be the only person listen to the tapes. The length of interviews varied from one to two and half hours. Similar to the focus group participants, a pen bought from the Cancer Research UK (See Figure 3.13) as a small gift was given to show my gratitude to them for their participation.

3.4.5 Ethical Considerations
As presented in Section 3.4.1, the approval of this study was gained from the IRB in the case-study hospital. Informed consent from interviewees and focus group participants were obtained in the research. Sufficient time for reading the information sheet was given, about 2 to 3 days at least. Confidentiality, anonymity and voluntary participation were assured. The detailed characteristics of healthcare organisations were removed and pseudonyms were used in the all quotes.

The nursing director and nursing supervisor were co-investigators in this study in order to gain the approval of the IRB. The agreement was reached that I was the only person who can listen to the tape recordings, in order to maintain the confidentiality. The digital records of data and transcriptions were kept on a computer only accessed to the investigator with a password system.

As presented in Section 3.4.4, the elite group was a small group of interviewees. Therefore, in order to maintain their anonymity, more nursing executives from the other hospitals had recruited.

Voluntary participation of focus groups in this study was assured. Firstly, as presented in Sections 3.4.1 and 3.4.3, I refused the offer of allocating staff members by the nursing director and head nurses. Secondly, the use of return-slip method was adopted to avoid pressure to participate. Thirdly, I discussed the issue of confidentiality with the group in particular that individuals are not obliged to disclose issues to other members of the group. They had right to withdraw their participations at any time.

Despite that all participants were informed that the details they provide were held in confidence, the nature of group discussions made me unable to promise or ensure strict confidentiality. I acknowledged this concern in the introduction of the focus group again and requested the participants not to share what the other group members had discussed
with the non-participants. I paid particular attention to any signs of stress or distress amongst members of the group. At the end of discussion the investigator allowed some time for the participants to discuss their feelings about the focus group process informally.

3.4.6 Data Analysis
The digital records were transcribed. The NVivo 7 computer programme and Excel spreadsheet were trialled as a means of organising the codes (Hahn, 2008). They were found to be of limited use because the screen size was too limited to view quotes in context. This also made it difficult to add marginal codes. Finally, manual methods were chosen as these gave more control over the work (Saldana, 2009), provided a greater degree of flexibility in keeping code memos, and allowed transcripts to be viewed holistically. Meanwhile, Riley’s (1990) suggestions were found practical in data management. Thus, Riley’s (1990) advice was followed in respect of data management. However, I used a Word Processor to do “cut and paste” transcripts and then printed out, rather the photocopy method suggested by Riley (1990).

Thematic analysis was adopted (Gibbs, 2007; Gibson and Brown, 2009). Thematic analysis is the process of searching for aggregated themes within data, according to their commonalities, relationships and differences (Gibson and Brown, 2009). Data were analysed manually using marginal codes and key phrases were highlighted. In the initial coding, Saldana’s (2009) suggestions for selecting appropriate coding methods were found useful. For example, in Section 7.4, versus codes were selected to present the perceptions of focus group participants.

After finishing the marginal codes, a coding frame was generated. These themes were categorised into four main themes, including the issues for development, implementation, management and influences on clinical practice. Then, further analysis was continued. The codes between elite interviews and focus groups were compared and contrasted.

The data were collected in Mandarin. Participants and the researcher spoke the same language. There was no language barrier between the researcher and participants in this study. Therefore, it was decided that the coding process in this study took place in Mandarin. The purpose of this approach in this study was to reduce the influences of translators and interpreters on the findings in the research process. Thus, the initial marginal codes were in Mandarin. In the level two and level three coding, these codes and quotes were translated into English. In the translation process, Lin Yutang's Chinese-
English dictionary (Lin, 1999) was used. Translation of quotations was relied on this dictionary in particular. Furthermore, two supervisors validated the accuracy of the translated quotations to enhance the rigour of study. The translated verbatim were proofread by English native speakers. Squires (2008; 2009) synthesised the literature and suggests that checking the technical and conceptual accuracy of translated results by a well-educated, native speaker is recommended to researchers conducting their own translations.

The researcher conducted all translations in this study. Currently, there is very limited literature on language issues and the use of translators during the qualitative research process in nursing or social science literature (Squires, 2008) and there is no methodological consensus for translation and interpretation in cross-language research (Squires, 2009). The methodological choice of translation approach in this study corresponded to the literature review findings (Squires, 2009). Squires (2009) found that investigators in case study research perform the majority of translations because conducting this research method requires investigators high levels of language competence, socio-cultural competence and significant background knowledge about the place of study.

Nevertheless, according to Squires (2008), translated presentation of the study findings is still a study limitation. Both advantages and disadvantages of this methodological choice that the researcher conducted all translations in this study were reflected on. In terms of advantages, my social-cultural competence and knowledge background about the hospitals in Taiwan were beneficial to the translation of participant’s quotations and trustworthiness in presenting translated data. Firstly, my four-year experiences in clinical nursing practice working as a front-line nurse and a nursing practitioner enabled me to understand nurses’ language easily. Secondly, being the role of the primary investigator collecting all data in the current study, I understood the conversations and discussions taking place in what contexts and circumstances. It allowed me to interpret participants’ data properly.

In terms of disadvantages, my level of English competence might affect the trustworthiness of the translated findings which needed to be acknowledged. Firstly, I was neither an English native speaker nor a professional translator. Secondly, it was found that modern spoken Chinese was challenging to tackle with in conducting translations. In spite of the fact that the Chinese-English dictionary was used as an assisting tool in the translation process, some modern spoken Chinese used by participating nurses and manager interviewees were difficult to translate in terms of selecting appropriate English
vocabularies. Despite that two supervisors and one proofreader validated the accuracy of the translated quotes which enhanced the rigour of study, the meanings of participants’ quotes could possibly have been lost in translation.

### 3.4.7 Methodological Rigour

As described in Section 3.3, this research design of this study relied on Yin’s (2003) guidance in particular. Yin suggests four tests, construct validity, internal validity, external validity and reliability to establish the quality of empirical social research (Yin, 2003). However, Yin positions himself in a positivist paradigm (Yin, 2003). Yin’s (2003) four tests may not appropriate for this qualitative case study.

In this study, the criteria of qualitative studies, trustworthiness, was adopted to ensure rigour. Trustworthiness of data is currently regarded as the gold standard for the evaluation of the quality of qualitative studies and presents the rigour of the qualitative inquiry (Polit and Beck, 2004; Burns and Grove, 2005). Four criteria are suggested to establish the trustworthiness of data: credibility, dependability, confirmability and transferability (Polit and Beck, 2004; Burns and Grove, 2005). The definitions of these four criteria are listed in Box 3.4.

In terms of confirmability, multiple sources of evidence were used. Detailed description of research methods and procedures were given. In terms of credibility, giving meaningful descriptions of themes was attempted and themes were supported by ample data. In terms of transferability, thick descriptions of findings were given allowing readers to judge potential transferability to their own settings. In terms of dependability, clear research questions and theoretical paradigm were employed which were congruent with the features of the study design.

### Box 3.4 The Definitions of the Four Criteria of Trustworthiness (Polit and Beck, 2004)

- **Credibility** means the confidence in the truth of the data and their interpretation.
- **Dependability** means the stability of the data over time.
- **Confirmability** means the potential for congruence about the accuracy, relevance and meaning of data between two or more individuals.
- **Transferability** means providing sufficient, rich and thorough descriptive data in the report regarding research settings, context, transactions, and processes observed during the inquiry so that readers can judge the contextual similarity and the extent to which findings can be transferred.
3.5 Summary

Based on the knowledge gaps identified in Chapter 2, this chapter presented the research aim and focus. According to the research questions, a single qualitative case study with embedded design was conducted. In order to have an in-depth understanding, multiple sources of qualitative data were collected with different stakeholders to explore the impact of computerisation on the role and practice of nurses. Difficulty in gaining access was encountered. The characteristics of the case and sub-cases will be presented in Chapter 4.
Chapter 4: Characteristics of the Case and Sub-cases

4.1 Introduction
This chapter presents the characteristics of the case and sub-cases in this study. The scale and organisational structures of the case study hospital are described and illustrated. The demographic data of front-line registered nurses are also presented using descriptive statistics analysis. The computer hardware equipment in terms of allocation, types, uses, and amount are also presented as both description and floor plans.

4.2 The Study Case
4.2.1 Scale of Case Study Site
The case study site was a 1700-bed private teaching hospital located in the middle urban area of Taiwan. It was accredited as one of Taiwan’s medical centres (Taiwan Joint Commission on Hospital Accreditation, 2008) (See Section 3.3.2) during the data collection period. The hospital provided general medical medicine, surgical medicine, intensive care, paediatrics, emergency, gynecology and psychiatry from hospitalization to outpatient. Its outpatient clinics provided more than 60 subspecialties and served about 5,000 people daily. Its emergency department provided 24 hour service and served about 8,000 patients monthly.

4.2.2 Organisational Structure
The organisational structure of case study hospital at the time of data collection is illustrated in Figure 4.1. The superintendent, a senior doctor, was elected by the board of directors. The position of superintendent was similar to the Chief Executive Officer in Western culture. Similarly, three vice superintendents and two chiefs of medicines also had medical backgrounds.

Figure 4.1: Organisational Structure of Case Study Hospital
The structure of the nursing department in the case study hospital is presented in Figure 4.2. The nursing department was the largest department in the case study hospital providing a variety of patient care services. The nursing department had one nursing director, one vice director and 10 nursing supervision officers (or called nursing supervisors). Each nursing supervision officer was responsible for several wards.

Figure 4.2: Structure of Nursing Department in the Case Study Hospital

The general structure of a ward in the case-study hospital is illustrated in Figure 4.3. Each ward consisted of one head nurse (HN) and one assistant head nurse (AHN), front-line registered nurses, one secretary and some nursing practitioners. The head nurses and assistant head nurses were senior registered nurses and been promoted by the nursing department. Among registered nurses, the senior nurses would be promoted as team leaders or called charge nurses. In the case study hospital, the nursing practitioners had two managers which were the nursing department and medical department.

Figure 4.3: General Structure of a Ward in the Case Study Hospital
4.2.3 Summary
The organisational structures illustrate that the case study hospital had its hierarchy and clear divisions. Because of being a large scale organisation and having a variety of service provisions, the hospital had multiple layers of management between the front-line employees and the manager roles.

4.3 Demography of Front-line Registered Nurses
This section presents the characteristics of participating registered nurses at the ward level. The data were provided by registered nurses through the anonymous demographic questionnaires after the focus group discussions. The demography data is presented in the following paragraphs and statistics figures.

4.3.1 Practice Settings
A total of 29 front-line registered nurses participated in the study. They are from medical wards (n=4, 14%), surgical wards (n=6, 21%), paediatric wards (n=6, 21%), medical intensive care units (n=8, 27%) and surgical intensive care units (n=5, 17%). Five focus groups included 25 participants in total. There were four nurses interviewed individually (See Figure 4.4).

Figure 4.4: Areas of Practice settings

4.3.2 Gender and Ethnic groups
The registered nurses participating in this study were predominantly female (n=28, 97%); only one was male (n=1, 3%). At the national level, female registered nurses were 98.85%. Male were 1.15% in December, 2010. The participating registered nurses reflected the national average of gender characteristic (See Figure 4.5).
In terms of ethnic groups, the participants were predominantly Taiwanese (n=28). Only one was from South Asia (n=1). At the national level, foreign nurses were 0.05% in the national level in December, 2010. The participant from ethnic groups was slightly over the national percentage.

### 4.3.3 Age

The range of ages of registered nurses participating in this study was from 24 to 38. The majority were in the 25-29 age group (n=16, 55%). Six were in the 30-34 age group. Three (10.5%) were in the 20-24 age group and three (10.5%) were in the 35-39 age group. One (3%) was missing data. The participants seemed to represent a younger group. Nearly two-third of participants (n=19, 66%) aged between 24 and 30. Ten (35%) aged between 30 and 40 (See Figure 4.6)
4.3.4 Yeas of practice
The 29 registered nurses participating in this study had a wide range of years in practice in the case study site from 13 months to 18 years. The majority of nurses (n=13, (45%)) had 3 to 5 years in practice. Over one-quarter of registered nurses (n=8, 28%) had 6 to 10 years in practice. Four (14%) had 1 to 2 years in practice. Four had 11 to 20 years experience. No participant had less than one year in practice. Because the participants represented a younger group of registered nurses, they (n=25, 86%) predominately had 1 to 10 years in practice (See Figure 4.7). Moreover, of the 29 nurses, over one-third of sample (n=11, 38%), had practice experiences in other hospitals from 1 month to 30 months. The remaining 18 had never been employed elsewhere.

Figure 4.7: Year of Practice of Focus Group Participants

4.3.5 Education
The registered nurses participating in this study predominantly had a Bachelor’s degree in Nursing (n=21, 73%) through either undergraduate 4-year programmes or RN to BSN programmes, (registered nurses with diplomas moving on to get their BSN degrees). Nearly one-quarter of nurses (n=7, 24%) had completed diploma level of education. Only one had Masters level degree (See Figure 4.8).

Figure 4.8: Education Background
In terms of continuing education for further degrees, no nurse was studying part-time programmes at the moment of data collection. This item had more missing data than the others (See Figure 4.9).

**Figure 4.9: Continuing Education**

![Continuing Education](image)

4.3.6 Nursing Grades

In Taiwan, a clinical ladder system is adopted for clinical nursing expertise. The system range is from N0 to N4. The proportion of participating registered nurses on the clinical ladder was distributed evenly in N1 (n=10, 35%), N2 (n=8, 28%) and N3 (n=9, 31%) (See Figure 4.10)

**Figure 4.10: Nursing grades of Focus Group Participants**

![Nursing grades of Focus Group Participants](image)

4.3.7 Computer Technologies in Daily Life

Regarding computer technologies used in their personal daily life, all participating registered nurses used at least one computer product in their off duty time. In terms of preference of products, desktop computers were predominantly used by the registered
nurses (n=25, 86%) participating in this study. Over half of the nurses used laptops (n=15, 52%). Other devices less commonly used in their daily life were GPS navigators (n=5, 17%), PDA or Smartphone (n=4, 14%), and IPods/ MP3 players (n=9, 31%) (See Figure 4.11)

![Figure 4.11: Computer Technologies Used in Focus Group Participants’ Personal Daily Life](image)

Furthermore, nearly half of participating registered nurses used desktop computers only (n=13, 45%). The next largest group used both desktop and laptop computers (n=12, 41%). Few nurses used laptop computers only (n=3, 10%). Only one participant (3.5%) used PDA instead of desktop or laptop computers (See Figure 4.12).

![Figure 4.12: Users of Desktops or Laptops in Daily Life](image)

In terms of number of devices used in daily life, every participating registered nurse used at least one computer device in their daily life. The majority of nurses used either one
product (n=10, 34%) or two products (n=11, 38%), whilst 6 nurses (21%) used three products and two nurses (7%) used four products in their daily life (See Figure 4.13)

![Figure 4.13: Number of Devices Used in Daily Life](image)

4.3.8 Summary of Registered Nurses Characteristics

The front-line registered nurses participating in this study represented a range of ages, areas of nursing practice, educational background, nursing grades, and years in clinical practice experiences at ward level. The participants constituted a reasonably mixed group of front-line nurses in terms of practice settings and nursing grades. However, in terms of age, years of experience, and educational background, the participants seemed to represent a younger group with Bachelor’s level of degrees and overall had used computers in their daily life.

There were some possible reasons for the participants’ characteristics. Firstly, conducting natural focus group discussions was one factor. The participants themselves had existing relationships. Furthermore, the topic of study regarding computer technologies seemed to have a tendency to recruit the participants who felt more comfortable with computer technologies and felt more confidence to share their personal opinions with group members. The former factor was expected before the data collection period. The latter one was unexpected.

4.4 Characteristics of Computerised Information Systems

Six wards were observed using an unobtrusive method for a total of 47 hours (See Table 4.1). The computer allocation and floor plan for each ward was presented in Appendices 18-23.
Table 4.1 Hours of Observations at Six Wards

<table>
<thead>
<tr>
<th></th>
<th>ICU-1</th>
<th>ICU-2</th>
<th>Ward-1</th>
<th>Ward-2</th>
<th>Ward-3</th>
<th>Ward-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours</td>
<td>8.5</td>
<td>13.5</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>6</td>
</tr>
</tbody>
</table>

4.4.1 The Settings

Six wards were purposively selected as they were located in different buildings with different floor plans. Two were intensive care units, three were general wards and one was paediatric ward. Bed numbers of Six wards varied from 24 to 73 (See Table 4.2). The occupancy rate was nearly 100%. In general medical and surgical wards, the nurse patient ratio varied 1:5-8 in day shift, 1: 8-12 in evening shift and 1: 11-16 in night shift. In intensive care units, the nurse patient ration was 1: 2-3 in three shifts.

Table 4.2: The Setting of Wards Observed

<table>
<thead>
<tr>
<th>Ward</th>
<th>ICU-1</th>
<th>ICU-2</th>
<th>Ward-1</th>
<th>Ward-2</th>
<th>Ward-3</th>
<th>Ward-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Building-3</td>
<td>Building-1</td>
<td>Building-1</td>
<td>Building-2</td>
<td>Building-3</td>
<td>Building-4</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Surgical</td>
<td>Medical</td>
<td>Surgical</td>
<td>Medical</td>
<td>Medical</td>
<td>Paediatric</td>
</tr>
<tr>
<td>Beds</td>
<td>24</td>
<td>28</td>
<td>57</td>
<td>48</td>
<td>73</td>
<td>29</td>
</tr>
<tr>
<td>Occupancy</td>
<td>24</td>
<td>28</td>
<td>48</td>
<td>48</td>
<td>60</td>
<td>25</td>
</tr>
<tr>
<td>Numbers</td>
<td>Day *</td>
<td>13</td>
<td>13</td>
<td>7</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>of Staff</td>
<td>Evening *</td>
<td>13</td>
<td>13</td>
<td>5</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Nurse</td>
<td>Night *</td>
<td>13</td>
<td>13</td>
<td>4</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Nurse</td>
<td>Day *</td>
<td>1: 2-3</td>
<td>1: 2-3</td>
<td>1: 8</td>
<td>1: 8</td>
<td>1: 6-7</td>
</tr>
<tr>
<td>Patient</td>
<td>Evening *</td>
<td>1: 2-3</td>
<td>1: 2-3</td>
<td>1: 11</td>
<td>1: 12</td>
<td>1: 8-9</td>
</tr>
<tr>
<td>Ratio</td>
<td>Night *</td>
<td>1: 2-3</td>
<td>1: 2-3</td>
<td>1: 11-12</td>
<td>1: 12</td>
<td>1: 12</td>
</tr>
<tr>
<td>Other Staff</td>
<td>Head Nurse</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Doctors</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Interns</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Nursing Practitioners</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Secretary</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Nurse Aid</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Day *: 8am-4pm. Evening *: 4pm-12 midnight. Night *: 12 midnight-8am.

4.4.2 The Progress of Computerisation

The case study hospital did not allow me to access its computerised information systems and the related documents and take any photos of computer devices. However, in the first ward I observed, after gaining the head nurse’s permission and her help with purposive selection of long stay hospitalised patient, I reviewed this patient’s chart, in order to check the progress of computerised clinical information systems according to patient chart’s contents.

The computerised information systems developed within the case-study hospital were mainly focusing on functions that supported doctors’ practice, including Computerised Physical Order Entry (CPOE), computerised progress notes, computerised laboratory requests and results, Picture Archiving and Communication System (PACS), discharge summary and computerised consultation sheet. It indicated that the clinical systems of case
study hospital served the functions of medication management, order entry, result reviewing and clinical documentation. Decision support capability had not been developed yet.

The computerised systems for nursing practice were relatively few, the systems included admission nursing assessments, nursing care plans and nursing transfer summary. In terms of operation record, pre-operation assessment sheet, anaesthesia record, and intra-operative nursing record were computerised.

These documents also showed that the interface of clinical system were mostly “tick box”. However, it was noticed that computerised progress notes combined both electronic and handwritten contents. It was noticed that electronic contents were produced by nursing practitioners but doctors still used handwriting. Meanwhile, when taking nursing admission assessment for patients admitted to wards, nurses are responsible for drawing patients’ family trees illustrating graphically on the nursing admission assessment form. Because of difficulties in the software development, the family tree on the electronic admission nursing assessment form required nurses’ hand-drawings as a backup. In computerised nursing care plans, the dates and signatures were completed by hand.

These clinical systems had been gradually implemented and used since 2000. Although these systems substituted some handwriting, they did not completely replace paper-based records at the time of the study. The contents of computerised information systems still needed to be printed-out and put into patients’ charts.

4.4.3 Computer Hardware Devices at Ward Level
The type of computer used throughout the case study hospital was stationary desktop personal computers (PCs). No computer on wheels (COW), tablet PCs or PDA were observed. Each ward was also equipped with two to four laser printers. The numbers of PCs and printers in each ward varied from 4 to 13 (See Table 4.3). There was a positive tendency that wards having more beds were equipped with more desktop computers. Each ward observed had one or two stationary PCs and display monitors especially only for Picture Archiving and Communication systems (PACS).
The allocation of desktop computers and printers were in areas accessible for healthcare professionals or cashiers. The location of desktop computers was mainly concentrated in the nursing station area. Head nurses had their own offices with their own computers and printers. The conference/lounge rooms were also equipped with one desktop computer. If the wards had a cashier area they also had their own computers and printers. The doctor on duty offices also had desktop computers.

The ratio of computers to healthcare professionals is shown in Table 4.4. Superficially, the distribution and supply of computers appeared to be sufficient for the numbers of employees across the whole institution. However, at ward level, there were problems of access to computers particular for staff nurses. In particular, certain groups of staff, such as doctors, appeared to have privileged access to ward-based computers. Each doctor and nursing practitioner has access to a designated desktop computer. By contrast, staff nurses had no designated or limited access to desktop computers.

Among registered nurses the computer ownership varied depending on the number of doctors, interns and nursing practitioners in the ward during the day time. Among the six wards observed, three wards (ICU-1, Ward-2 and Ward-3) had labelled the sign ‘nurse only’ on two or three computers (See Appendices 22, 19, and 20). Ward-2 also particularly labelled the sign ‘intern only’ on two computers. Except Ward-1, the average nurse-computer ratio observed was 2.5:1. Sometimes, if computer numbers were very limited the registered nurses needed to share computers with the ward secretary. For example, in Ward-2 and Ward-3, several nurses owned 2 to 3 computers and also shared with the secretary. In Ward-4, the nurses also used the computer for PACS to carry out their work.
Computer numbers seemed insufficient during the day shift. Once the doctors, interns and NPs off shift, for example after 5 pm during the observation, all computers were available to register nurses. Insufficiency amount of computers was noticed in the general wards observed, such as Ward-2, Ward3, and Ward-4. Only Ward-1 had sufficient computers. Ward-1 was a surgical ward. The doctors needed to go to surgeries for patients and entered operation rooms before 10pm. Because doctors were not fixed in the ward level, Ward-1 had sufficient computer amount.

Table 4.4: Healthcare Professionals/ Computer Ratio

<table>
<thead>
<tr>
<th></th>
<th>Nurse: PC</th>
<th>HN: PC</th>
<th>Dr: PC</th>
<th>Intern: PC</th>
<th>NP:PC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICU-1</td>
<td>13 RN: 4 PCs</td>
<td>1:1</td>
<td>1:1</td>
<td>--</td>
<td>4:4</td>
</tr>
<tr>
<td>ICU-2</td>
<td>13 RN: 5 PCs</td>
<td>1:1</td>
<td>1:1</td>
<td>--</td>
<td>3:3</td>
</tr>
<tr>
<td>Ward-1</td>
<td>7 RN: 6 PCs</td>
<td>1:1</td>
<td>--</td>
<td>--</td>
<td>4:4</td>
</tr>
<tr>
<td>Ward-2</td>
<td>6 RN &amp; 1 Secretary: 2-3 PCs</td>
<td>1:1</td>
<td>9:9</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Ward-3</td>
<td>9 RN &amp; 1 Secretary: 2-3 PCs</td>
<td>1:1</td>
<td>4:4</td>
<td>2:2</td>
<td>8:8</td>
</tr>
<tr>
<td>Ward-4</td>
<td>5 RN: 2 PCs &amp; 1 PACS monitor</td>
<td>1:1</td>
<td>1:1</td>
<td>1:1</td>
<td>1:1</td>
</tr>
</tbody>
</table>

Some computers were labelled stating its ownership. The computers also had the other signs for the last announcements regarding the computer manipulation or important message such as “save printing”. If the ownership belonged to doctors or nursing practitioners, the personal stationery put next to the computers was often observed.

During the observation, no computer or printer was out of order. Because I did not have username and password, I did not measure computer boot-up time. However, computer crashes were observed. Usually, the nurse requested help from a colleague or the secretary to shut down and restart. If this method did not work or after two or three attempts, they would change computers immediately if they were the middle of their work. Poor printing quality was observed in Ward-2.

Nurses' peak time to access computers was before and after handover. Nurses were observed using computers for checking routine and stat patient orders, medications, documenting non-administration medications, completing and printing out electronic administration nursing assessment, selecting and printing out nursing care plans, processing discharge procedures and completing discharge education. They also checked the hospital on-line education webpage. Whenever nurses logged into the system pop-up windows were observed. The screen also clearly displayed uncompleted tasks in highlighted colour.
During the observation period, nurses were busy and walked between patient bedside and the nursing station. Nurses rarely sat down unless they were completing nursing records or other documentation. Nurses frequently used computers for short periods and were called away to other duties. Therefore, they often manipulated the computers whilst they were standing. When computer tasks were finished, nurses left the computer immediately. Moreover, it was observed that nurses frequently left computers without logging out of the system. The hospital’s system had an automatic log-out design in two circumstances. The system would automatic log out users if the computer was left unused for 3 minutes or when the user attempted to login to more than one computer. However, if the computer was used very often and less than 3 minutes, it was observed that the next nurse logged out for their colleagues. By contrast, the doctors, interns and NPs worked on computers for a considerable amount of time, except at the time of medical ward rounds. They suffered fewer distractions and were able to logout in a timely fashion.

4.4.4 Summary
During the observation, two prominent issues were noted, including the rigidity of desktop computers to healthcare professionals’ work and the ownership of computers among healthcare professionals. The immobility of desktop computers limited the healthcare professionals’ work, including doctors, nursing practitioners and registered nurses. Because the development of clinical systems tended to focus on physicians’ practice, they had many tasks that needed to be completed using computers. The time they were fixed in front of computers was far greater than visiting bedside patients. On the contrary, the function of clinical systems for registered nurses was still developing. Nurses did not need to be static working in front of computers. Their practice was very patient-centred. Therefore, nurses walked between the nursing station and bedside. Consequently, nurses had the least ownership of computer in the day shifts. In the focus group discussions, the participating nurses discussed how to cope with the issue of inadequate computers.

4.5 Summary
Twenty nine front-line nurses participated in this study. Focus group participants seemed to represent a younger group of nurses with Bachelor’s level of degrees and using computer technology in their daily life. The unobtrusive measure of observing computer technology was conducted at six wards. Each ward had different floor plan. It seemed that nurses had the least ownership in terms of using computers compared with other healthcare professionals, such as doctors and nursing practitioners.
Chapter 5: Developing Computerised Information Systems: Inter-occupational Interactions as Negotiation

5.1 Introduction

This chapter will present the development experience of the case-study hospital and examine nurses’ roles in developing and implementing computerised information systems in the case-study hospital. In this findings chapter, the experiences of developing computerised information systems described by nurse managers and software engineers were for nursing practice and the needs of nursing department in particular. Therefore, computerised information systems mentioned in the following contents of this chapter specifically referred to systems for nursing purpose, including support of nursing practice and the needs of nursing department.

After initial coding, the hidden conflict among the top, informatics department and nursing department was identified regarding the developing computerised information systems for nursing work. In order to understand interactions among the top, software engineers and nursing managers and how they accomplished the computerisation tasks, Strauss’ (1978) Negotiated Order perspective was adopted. Strauss (1978) coined the term “negotiated order” to convey the concept that social order is negotiated order. Strauss (1978) defined negotiation as involving people who require dealing with each other in order to get things done. Moreover, Strauss (1978) proposed a theoretical paradigm to identify negotiations themselves and salient properties in the negotiation context within which negotiation took place. It is identified that some of Strauss’ (1978) concepts were helpful in clarifying the complex and linked interactions among the top informatics department and nursing department. The helpful concepts included identifying the negotiators, the issues negotiated, the respective stakes of each group and renegotiation for arriving at an agreement (Strauss, 1978).

Developing computerised information systems was identified as an interdependent task, which led to nursing managers perceiving themselves as having a dependent role during the development. The details will be presented in Section 5.2. How nursing manager interviewees perceived the top’s decision-making style towards computerised information systems will be presented in Section 5.3. Nurse managers’ perceptions regarding the collaboration of the informatics department will be presented in Section 5.4. Nurse
managers perceived themselves lacking power in negotiations, and how they attempted to renegotiate will be presented in Section 5.5.

5.2 Dependency on Interdisciplinary Collaborations

This section will present the crucial factors in the development of computerised information systems as perceived by nurse manager interviewees.

The same question, “What factors do you think are important when a hospital plans to carry out computerisation?” was asked at the end of manager interviews. Many managers described that developing computerised information systems for nursing purposes depended on an across-discipline collaboration, including commitment from the top, support of budget, collaborations with informatics departments and a steering group. These factors will be described in sequence.

The top managers in the case-study hospital were doctors in charge of medical administration and hospital administrators. The ranking order of the organisational hierarchy from high to low in Taiwanese hospitals is the top managers, who are doctors in charge of medical administration, hospital administrators, clinical doctors, managers of nursing department, head nurses and front-line nurses (Su et al., 2011).

Some nursing managers described the nursing role in developing computerised information systems for nursing purpose as dependent. For example, one nursing executive described that developing computerised information systems would be a hardship without the top managers’ support, the purchase of hardware equipment, and the collaboration of informatics department.

I think you will go through hardships. When you want to move, the top doesn’t support. Fundamentally, you need not talk about it, because the top doesn’t give you hardware equipment; you need to talk about it. Then the informatics department always arranges your requests as the least important in their priorities; you need not talk about it. You just can’t move on…(Case study/ UM Manager1, nursing).

Similarly, another nursing executive described the dependency of nursing in developing computerised information systems.

…Yeah, I think nursing informatics requires relying on other people. So it’s not easy, we can’t do it very well by ourselves. It relies on the informatics
department, relies on hardware equipment. If we don’t have these two things, we can’t (do it)…It (nursing informatics) is not independent. If it can be independent, I think it only needs possessing ambition and then we can do it well. There is no other way. Because of relying on other people, this is a thankless task (Hospital E/ UM Manager7, non-nursing, Ex UM Manager Nursing).

In addition, some manager-interviewees perceived the situation of dependency made developing computerised information systems a difficult task. During the interviews, they expressed their perceptions of computerisation as a hardship. Because of the situation of dependency, the roles of top managers and the informatics department shaped the subsequent negotiation which will be presented in detail in later sections.

As described in the section above, nursing’s role was a dependent position in developing computerised information systems for nursing work. The collaboration that nursing needed for computerised information systems will be presented in the following sections.

5.2.1 Commitment from the Top

Most nursing interviewees described that the top’s commitment to computerisation was regarded as the first and most crucial successful factor when developing computerised information systems for nursing work. They described the top’s viewpoints and priorities in relation to computerised information systems as having decisive influences on the progress of computerised information systems because it affected the decisions of executing computerisation projects and budget support. For example,

- It’s up to the top’s viewpoints and their priorities…For example, it can be done by handwriting and by computers…If the top thinks this is very important, they’ll do everything to promote it (Case study/ HN6, NI member).
- I think the first thing is for the top to support nursing informatics. Because of their support, the hardware equipment will be bought in…(Case study/ UM Manager1, Nursing).

In addition, some nursing interviewees said that the top managers not only decided to execute the computerisation project, but also controlled the budget. They stated that controlling the budget of computerisation was perceived as the biggest authority belonging to top managers. For example, one head nurse said that whoever decided the projects and budget are the key decision makers.

- Who can decide budgeting and if the project will carry out or not (Case study/ HN7, NI member).
For example, one nursing informatics practitioner stated

I think that the biggest power of a manager is to budget it or not. Yeah, if he 
thinks this is worth to invest, he’ll sign it… (Hospital C/ Nursing Informatics 
Practitioner 1).

Moreover, they stated the subsequent top-down power-command following their decisions 
mobilised informatics departments for software development and implementation efforts 
across multiple departments.

Software engineers will cooperate with you because this is the hospital’s goal. 
They won’t postpone your projects…I think the top’s support is really important 
(Case study/ UM Manager1, Nursing).

One head nurse maintained that top down power from the head of hospital facilitated the 
computerisation process.

…During the time of implementing computerised physical order entry stage, the 
ex-head of hospital…it was, he said, an order directly: no matter what happened, 
physical orders needed to be computerised. At that time it was like the entire 
personnel of every discipline cooperated with it. Yeah, therefore the 
computerised order entry could go on-line very soon, although many problems 
had happened…I think…any decisions need the top’s full support…(Case study/ 
HN3, NI member).

Similarly, another nursing executive described that the hospital goal and subsequent top-
down power were regarded as crucial facilitators in the computerisation process.

…The most important thing I think is that the top makes a public appeal saying 
this is our purpose, or saying we need to achieve the goal in the next few years. 
In this way, the bottom will follow it (Hospital F/ UM Manager8, Nursing).

5.2.2 Support of Budget

Most nursing manager interviewees indicated that money was another crucial factor during 
the computerisation process because computerised information systems and hardware 
equipment were costly.

For example,

…It needs money certainly. It needs money certainly. Money needs to pump 
in…Money is very important (Hospital F/ UM Manager8, Nursing).
...Information technology is very costly (Case study/ HN3, NI member).

5.2.3 Collaboration with Informatics Department

The interviewees’ accounts demonstrated that the method of developing an information system by the informatics department within healthcare organisations was often preferred. Their accounts showed that consequently the tasks of construction, modification and maintenance of information systems relied upon the support of informatics department. For example,

...We relied upon the informatics department to develop it (the system) ...How they allocate their tasks would influence our nursing practice (Case study/ UM Manager3, Nursing).

Some nurse managers indicated that collaboration with informatics departments influenced the progress of nursing informatics’ development. For example, one nursing executive asserted that after a new informatics director taking over and agreeing the collaboration with the nursing department, the speed of progress of computerisation information systems for nursing purposes was accelerated in her hospital.

Our current progress is because our informatics director had changed. (He) has a different style, very enthusiastic. So we can do it (computerisation) better and better now. In the past, our informatics department had not enough manpower, had not enough capability, had no training. Moreover, the ex-director didn’t think nursing informatics is important (Hospital E/ UM Manager7, non-nursing, Ex UM Manager Nursing).

5.2.4 A Steering Group

Most manager interviewees indicated that a steering group was necessary to facilitate the development of nursing informatics and to be the communication bridge between the informatics and nursing departments.

....You really need to team to facilitate it (nursing information systems)…(Case study/ UM Manager1, Nursing).

5.2.6 Summary

In summary, besides the efforts of the Nursing Informatics Committee acting as a steering group, developing computerised information systems for nursing purposes required support from a cross-discipline team, including the top managers’ support of initiating projects and budgeting hardware equipment, as well as software programme development by
informatics engineers. Nursing was reported as having little or no control over these crucial factors and consequently was perceived to be in a dependent position during computerised information systems development.

5.3 The Top

This section will examine the decision-making of the top toward computerisation in the case-study hospital. How nursing manager interviewees perceived the decision-making style of the top towards computerised information systems for nursing purposes will be presented in Section 5.3.1. Purchasing portable computer nursing trolleys will be drawn on as an example to illustrate the decision-making style of the top and will be presented in Section 5.3.2.

5.3.1 Wait-and-See Attitude

More than half the nursing manager and informatics staff interviewees in the case-study hospital indicated that the top had a wait-and-see approach to computerisation which prevented the progress of computerised information systems. They used the term “conservative”, “wait-and-see” to describe the hesitant “attitude of the top’s decision-making style. For example, the nursing executive of the case-study hospital described the top as taking a wait-and-see attitude because of the uncertainty regarding computerisation outcomes and costs of technologies.

...In the computerisation process, our hospital was relatively conservative in this informatics area. More (pause), not conservative. It’s waiting. Waiting and see what will happen when other hospitals have tried it out (Case study/ UM Manager3, Nursing).

Consequently, many nursing managers involved in the development of computerised information systems stated that the wait-and-see style of the top decelerated the progress of computerised information systems for nursing purposes. For example, one head nurse, also a member of the Nursing Informatics Committee, described the computerisation progress as slower than other hospitals in Taiwan.

...You’ll find out that the progress of computerisation from the other hospitals had done so fast and so many. You’ll see our hospital’s insufficiency. It’s too slow and too conservative…It’s a tradition…(Case study/ HN7, NI member).
5.3.2 Purchasing Portable Computer Trolleys

Most manager interviewees discussed purchasing portable computer trolleys. Therefore, it was a good example to illustrate the wait-and-see style of case-study hospital in terms of computerisation decision-making.

In terms of the progress of purchasing portable computer nursing trolleys, the nursing managers from the other six hospitals stated that the cost of portable computer nursing trolleys was huge. For example, Nursing Informatics Practitioner 1 described:

...Because it’s a very big cost to the hospital, they need to consider it (Hospital C/ Nursing Informatics Practitioner 1).

Despite this, these hospitals had made progress regarding portable computer nursing trolleys. For example, two out of six hospitals, Hospital A and E, had purchased the trolleys at the moment of data collection period. One hospital (Hospital C) had purchased laptops and set them up on the traditional nursing trolleys as substitutes for portable computer nursing trolleys. Three hospitals purchased small numbers of trolleys to carry out pilot tests in their wards.

By contrast, in the case-study hospital, many nursing managers said that they had tried out several types of trolleys and had not made the final decision to purchase which type of trolleys. Hope for computer trolleys was expressed by many nursing manager interviewees and focus group participants. For example, Group B participants described,

B1: Hopes that there will be one trolley for each staff nurse.
B2: Because it had been stated since last year or the year before that our hospital is going to have one trolley for each nurse, I always hope for it. But we still haven’t had it this year.

Most manager interviewees indicated that the top held back the purchase due to concern about the high cost of trolleys. For example, one nursing executive who was the head of nursing informatics committee described,

For four or five years we have kept requesting computer trolleys. Otherwise, we cannot work. But when we speak of computer trolleys, the top feels it is very expensive. They always think, are these trolleys needed urgently? We have kept trying computer trolleys since the second half of last year. But it has been held back by the top saying “wait-and-see”. We know technologies produce incessant changes and are very expensive when they are introduced to the market. But you see, from last year until now, many hospitals had made the purchases. When I
heard other hospitals had purchased, I replied “that’s fantastic. Your head is great. We are still wait-and-see”….I think the top’s primary concern is money…. (Case study/ UM Manager1, Nursing).

In addition, the accounts of manager-interviewees and focus group participants revealed that different positions held different concerns when discussing the purchase of computer trolleys. The details of their perspectives will be presented in Section 5.5.1.

5.3.3 Summary
As described in Section 5.2, developing computerised information systems for nursing purposes was an interdependent task and required the commitment from the top in particular. Due to the concerns about the vast costs and uncertain outcomes, the top of the case-study hospital took the wait-and-see style towards computerisation which slowed the progress of computerised information systems development.

Despite many nurse participants wanting computer trolley equipment, and nursing managers hoping for a faster computerisation progress, the accounts of nursing people revealed limited influence over the top’s decision makings. How nursing managers negotiated with the top for the purchase of computer trolleys will be presented in Section 5.5.

In addition, the consideration of the cost factor was also revealed in purchasing laser printers and toner cartridges. Printer problems and how the front-line nurse carried out troubleshooting will be presented in Chapter 8 Hidden work.

5.4 Informatics Department
This section will delineate how nursing manager interviewees perceived collaboration with the informatics department. Section 5.4.1 will present nurses’ general impressions of the informatics department. Section 5.4.2 presents nurses’ perceptions regarding work range of software engineers. Section 5.4.3 will present how informatics departments prioritised their work. The later part will present how nursing informatics’ needs subsequently were postponed. Section 5.4.4 presents how the informatics department turned down nursing requests for system modification.
5.4.1 Nurses’ Impressions of Informatics Department

Some nursing managers and one focus group participant described their impression of the informatics department, particularly regarding their capabilities in developing software programmes.

For example, one head nurse said that during collaboration with the informatics department they were really good at software programmes design.

I think that the informatics department is capable. They can manage most of our requests so far (Case study/ HN7, NI member).

Similarly, Focus Group E participants stated that they heard their informatics department was strong in system development.

E2: Our informatics department is very strong. During the time of Joint Commission International accreditation, one doctor, our deputy head, requested the computerised adverse drug record…Then it was done very fast. He said in public that our informatics department is very strong…

E4: I heard that they have talented men. The informatics department have the best capable men and they are really good at computing. I have heard about it.

Only few nursing managers who had collaborated with the informatics department indicated that informatics staff were different from nursing staff.

We had told the director of IT saying, because you are different, we need to learn how to communicate with you. But I always think they are strange. Maybe they are very good at talking to computers. But they don’t know how to talk to people…They are different, really different (Case study/ UM Manager3, Nursing).

How nursing managers communicated with the informatics department will be presented in Section 5.5.

5.4.2 Work Allocation

From the interviewees’ accounts, the case-study hospital and other five hospitals in this study developed their computerised information systems through their informatics departments. As described in Section 5.2.3, the method of developing a system through the informatics department within the healthcare organisations was preferred. This method was called the “in-house approach” as opposed to buying in an application software package or
outsourcing approach (See Section 2.4.2). Most manager interviewees described this approach as allowing a greater capacity and flexibility for further system development, maintenance and modification in the future, compared with the buy-in approach.

For example, one head nurse said that the in-house approach enabled the software engineers to do further system modification.

> If we buy ready-to-use systems, then it would be very difficult to modify….If we developed ourselves, our software engineers can do further modifications any time (Case study/ HN6).

Similarly, one nursing executive from another hospital implied that the in-house approach allowed a greater autonomy in managing the systems’ problems.

> Our software programmes are developed by our informatics staff. We didn’t adopt buy-in (systems). No buy-in means that all of the maintenance or other problems, can be solved by our own informatics staff ...The benefits and advantages of in-house method are if the system has any problems, the informatics department can solve them independently. I think this is very important (Hospital E/ UM Manager7, nursing).

Because of adopting the in-house approach, some nurse managers described the informatics department as being responsible for all computerisation tasks from all of departments in the case-study hospital and the branch hospitals. Consequently, they indicated their perception of the time software engineers gave to the nursing department was limited.

For example, one nursing executive described,

> Although all of software engineers are in the case-study hospital, they need to support the branch hospitals, too. Therefore, their energies were divided. What these people can do is limited…I think it really takes time (Case study/ UM Manager1, Nursing).

For example, one head nurse stated,

> …Their responsibilities are not only for the nursing department, but also other departments. Therefore, the time they give to the nursing department is relatively less. Their tasks are from the whole hospital, not a single department…(Case study/ HN7, NI member).
5.4.3 Prioritising Their Clients

As described in the Section 5.4.2, the informatics department was responsible for all the informatics’ needs of the whole hospital. Many nursing managers and one software engineer interviewee stated the informatics department had a principle to prioritise informatics’ needs requested from the whole hospital. They said that informatics needs related to health care insurance was the first priority and hospital accreditation was the second because of the concern for cost-effectiveness.

For example, the nursing executive intimated that informatics’ needs were costs, and hospital accreditations related were given priority and precedence over nursing requests.

…I think in our hospital, if do a prioritisation, actually we nursing are the third one! In other words, money definitely is precedent. The hospital accreditation is definitely a precedent. Then it is our turn (Case study/ UM Manager3, Nursing).

Similarly, one software engineer interviewee described the same prioritisation principle and therefore that most of their priority tasks were health insurance and hospital-accreditation related.

Now most numerous of requests computer systems are made by the health insurance department and the top managers’ requests regarding hospital accreditation…Because hospital accreditation and health insurance are closely related…About the prioritisation, the requests related to insurance are absolutely the first one. The second priority is about the top’s requests such as Joint Commission International Accreditation (Case study/ IT2, NI member).

Many managers from the other hospitals also said that their informatics departments used the same principle to prioritise their work. One nursing executive described a similar situation that when receiving many informatics requests from different departments of the whole hospital, the needs of doctors and health insurance were given priority because their requests related to a huge amount of cost and cost-effectiveness.

The director of the informatics department thinks that every department made their informatics requests. Where should he begin? The first thing he is looking at is cost-effectiveness and benefits. Can this bring cost-benefits to the hospital? Can this bring benefits by cutting down labour numbers? If it relates to these factors, then this system will be given priority. This is how the administrators consider. …So they prioritised doctors’ needs and administration managers’ needs first… Oh, it is about insurance payment. That’s very important because it’s related to several thousand millions or several millions. That is a big deal. It has to be done first (Hospital E/ UM Manager7, non-nursing, Ex UM Manager Nursing).
Many nurse managers described their perception that developing computerised information systems was the least important in the informatics departments’ agenda and consequently postponed.

For example,

Nursing informatics will never be given priority…I should say, its place is always the last one…It has been postponed because it is not the most important, just providing care based on what you have (Case study/ UM Manager1, Nursing).

Another nursing executive described how the informatics department responded to the informatics proposals made by the nursing department. She described how the informatics department postponed informatics’ requests of the nursing department based on their prioritisation and limited software engineers available described in Section 5.4.4.

…When we made requests to the informatics department, they would tell you, ‘oh, currently I got 100 tasks for health insurance and 50 tasks for hospital accreditation in my hand. I really know that you are very important. But I only got these software engineers (Case study/ UM Manager3, Nursing).

The other hospitals described a similar situation. For example, one nursing Informatics practitioner said,

Of course it’s about the priority. National health insurance payment issues definitely come first. The second priority is doctors’. Then it is nursing. The early stage was like this…When the nursing department made a request, They (IT) did not appear to put down the work at hand immediately and develop your requests... (Hospital C, Nursing Informatics Practitioner 1).

Not only did the nursing manager interviewees perceive that the requests of computerised information system were delayed, but the accounts of front-line nurse focus groups corresponded to the prioritisation by the Informatics department. In the focus group discussions the polarised accounts from two groups of front-line nurses reflected that the doctors’ requests were given precedence over nurses’ needs.

As described in Section 5.4.1, Group E participants felt the informatics department had strong capacity in software programme development in meeting the doctors’ request for

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1 Nursing informatics practitioner1 of Hospital C was the first person to take on this role in Taiwan. She was undertaking a part-time PhD study in informatics whilst working as full-time nursing informatics practitioner.
hospital accreditation purpose. On the contrary, Group D participants stated that because special fees on drawing blood from children under six years old were often missed, they had made several attempts for requesting an automatic function of charging fees. The informatics department refused them several times.

Actually we raised this issue before. But they (Informatics department) continuously said it cannot be done, there is no way…It was our head nurse who communicated with them. But when we found out the OPD system had this function, we could be self-confident on the strength that we are being right to request…[group dynamic stirring up and discussing who found out]. But it had been communicated this issue for several times. They kept saying it is without means (Nurse D4).

Not only did Group D participants experience the refusal of informatics department, but also many nursing managers described the issue that software engineers refused nursing’s requests for system modifications. This will be presented in the following section.

5.4.4 Refusal of Nursing’s Requests
As described in the earlier part of section one, the advantages of the in-house approach was the ease of system modification. However, in the case-study hospital more than half nursing managers described that sometimes software engineers refused to modify information systems to meet their user needs.

• Workload
Some manager interviewees having informatics background described the difficulty of modifying a system and the increasing workload of software engineers.

For example, one nursing informatics practitioner stated,

The modification process actually increased the informatics engineers’ workload…(Hospital C/ Nursing Informatics Practitioner 1).

One nursing executive described the considerable modification of an existing system was a difficult and time-consuming job for software engineers.

The informatics department often encounters a situation that…when a system is developed and needs a considerable modification because of hospital accreditation or other requests….They need to spend a lot of time to do the modification…(Hospital E/ UM Manager7, non-nursing, Ex UM Manager Nursing).
Similarly, one software engineer said,

Small modification is manageable. But if you want to overthrow the whole system, that will be very troublesome. When I made a computerised form for some people who are not nursing people and they need to add something else, they often say, this just amends it, doesn’t it? I often say this is not a form on a word process file which as easy as you only need to type it. I need to amend the data, programme and tabulation. It requires communications (Case study/ IT1, NI member).

Despite understanding increasing workload to software engineers, some head nurses described that sometimes system modification was unavoidable because clinical work or hospital accreditation changed frequently which subsequently changed their user needs of using information systems. For example, one head nurse reported,

…But the clinical work and clinical needs change frequently, or sometimes it changes because of hospital accreditation purposes… But the software engineers were like, I don’t care. I’d finished it…(Case study/ HN6, NI member).

**Difficulties of Modification**

Some nursing managers had similar experience as Group D participants (See Section 5.4.3) that the informatics department refused their requests by saying it cannot be done.

One nurse stated that the national health insurance payments for pulse oximeter monitoring were either by days or times. However, these two titles in the computerised physician order entry (CPOE) were misleading which caused many payment errors. She described nurses were required to do many procedures to claim fees back because doctors did not prescribe correctly in the first step. In order to solve the problem, she made the request of using highlighted colours to distinguish between the charge by days and by times in the system, she described the informatics department refused saying it cannot be done.

I wrote the informatics request of using highlighted colours to differentiate between by days and by times. Surprisingly, they said they cannot. I think why they cannot do it. It just used highlighted colours... (Case study/ HN4).

Another head nurse related that on the computerised consultation system, the table column of the statistics output was ranked according to the quantity of items rather than the items of contents. This produced different statistics tables every month and caused further statistics work using Excel file to do a table for their needs. After communicating this
problem for more than a year, the software engineer refused amendments because of the difficulty and workload. She described,

For the statistics part in the consultation system…We politely requested him, Can you modify? because this design causes us a big trouble doing statistics. One year later, he still does not want to do the amendment. Why? He says it is troublesome because you make me to re-develop software programme again. No, it is just modification. But he thinks this is very troublesome…Why? He said ‘It’s troublesome. You’ll cause me to write the software programme all over again’. Not at all, it’s just doing modification. But they think it’s very troublesome. …But the clinical work and clinical needs change frequently, or sometimes it’s the change for hospital accreditation purposes. But they engineers were like, I don’t care. I’d finished it (Case study/ HN6, NI member).

• Nursing Users’ Problems

Most head nurse interviewees described the interface problem of a newly launched administrative system called “work plan system”. They stated that poor interface design of this system wasted much their time on moving, dragging and clicking their mice. Moreover, they described that the save file function of the system was poorly designed, which made them unable to leave their seat before completely finishing the data entry and saving the changes they made. In spite of the fact that head nurses reported their opinions regarding user unfriendly issues and requested further modifications, the software engineer who developed this system refused and attributed these interface problems to nursing users. For example, one head nurse described,

…We think this system is very time-consuming. But the software engineer says it cannot be changed….He says the whole hospital is using it. Only your nursing department has problems…When I used this system, I felt it was annoying and not user friendly…I feel it is very inconvenient. That system was designed poorly. Many people complain about it. Almost every head nurse complains about it. But the nursing department is not the only user. The other departments did not complain about it….The conclusion is that nursing supervisor answered that the informatics department said it can’t be modified (Case study/ HN5).

5.4.5 Summary

The accounts of manager interviewees showed that when using the in-house approach, informatics departments were responsible for all of the informatics needs of the whole hospital. The informatics department prioritised their clients and often postponed the nursing departments’ requests. Nurse managers perceived that the priority principle of informatics department was health care insurance and hospital accreditation had high priority. Furthermore, many nursing managers and one focus group participant described
that sometimes the informatics staff refused system modification because of the workload, the infeasible requests, and user problems.

Their accounts revealed that in the domain of informatics, the informatics departments were relatively powerful in prioritising their clients and deciding modification requests. How nursing managers responded and negotiated with the informatics department for system priority and modification will be presented in Section 5.5.

5.5 Nursing Department

This section will analyse how nurse managers interacted with the top and the informatics department during the development of computerised information systems. When comparing and contrasting the interviewees’ accounts, only a small number of nurse manager interviewees interacting with the top and informatics departments provided their insights of the negotiation process. The following themes were identified from their descriptions. Section 5.5.1 will present how nursing managers perceived that they had insufficient power themselves to negotiate. Section 5.5.2 will present how nursing executive interviewees in the case-study hospital attempted to renegotiate with the top and informatics department using the authority of their positions and alternative strategies.

5.5.1 Insufficient Power to Negotiate

As described in Section 5.2, developing nursing informatics was an interdependent task because it required the top’s support and informatics department’s collaboration. As described in Section 5.3, in the case-study hospital, many nursing managers however perceived that the top had a wait-and-see towards computerisation and purchasing computer trolleys. As presented in Section 5.4, nurse managers perceived that the informatics department postponed nursing informatics requests and refused to modify systems to meet users’ needs.

When perceiving that developing computerised information systems for nursing purpose rested on the top and informatics department, some nursing manager interviewees felt that they lacked power in influencing the progress of nursing informatics development, lacked legitimate claims to persuade the top to buy computer trolleys, and lacked informatics knowledge to negotiate for system modification.
• Lack of Power
Some nurse manager interviewees perceived that nursing informatics requests were postponed. They explained that computerised information systems for nursing purpose was insignificant in the eyes of the top and informatics department because such information systems had no financial benefits from the perspective of hospital as a whole.

For example, one nursing executive indicated that the nursing informatics requests were postponed, because it was not important from the top’s and informatics department’s views.

The informatics requests proposing by the nursing department had been postponed. They felt it was not the most important things. So they said to us just kept doing your work based on the status quo (Case study/ UM Manager1, Nursing).

Another nursing executive said nursing care practice seldom related to insurance payments.

Nursing care practice related to money is little (Case study/ UM Manager3, Nursing).

One nursing executive from other hospital described a similar circumstance.

…We used to politely request a favour of the informatics department, to ask for help for developing computerised information systems for us …If they think your nursing request is too complex and has no benefits, you have to wait…The nursing department usually is the biggest department in the hospital. But it may not play the most important role….In the area of nursing informatics, the nursing department cannot earn money like doctors bringing many benefits and profits to the hospital. Nurses don’t. They just care for patients (Hospital E/ UM Manager7, non-nursing, Ex UM Manager Nursing).

Moreover, some nursing managers stated the nursing department had limited power in influencing the agenda of the informatics department. One head nurse indicated that compared to doctors’ needs and organisational goals, the nursing department was relatively powerless in proposing informatics requests and controlling the development of computerised information system.

I think the power of the nursing department is still not enough [smile]. I found out doctors’ needs are high on the list of priority in the informatics department…other people can jump the queue. But your nursing department’s systems absolutely can’t…The informatics department can postpone our systems for the hospital’s development. They can finish branch hospitals’ systems first. Of course, it’s about priorities. The things can be classified as the least, the
important, the slow and the hurry\textsuperscript{2}. But when you found out that you’ve been postponed every year, you would worry. I think the nursing department does have a lot of people, but the voice is very small…I felt that we haven’t been regarded seriously…So during the computerisation process, we can’t easily achieve what we want…What we can control at hand is limited…(Case study/ HN3, NI member).

Similarly, one nursing informatics practitioner from another hospital described insufficient power of nursing department in negotiation.

Usually, when the nursing department requests their needs, the effect is quite limited. This is very true (Hospital C/ Nursing Informatics Practitioner 1).

Moreover, my field notes recorded that during the discussion of arranging our interview schedule in the office, one nursing executive suddenly mentioned that \textit{once the computerisation stuff goes online, it just cannot be pulled back}. Her feelings of being trapped revealed that being a nursing executive, she felt it was difficult to have any influence on computerisation once these systems went online. Adopting passive resistance and acting a renegotiation strategy was revealed in her interviewee accounts. The details will be presented in Section 5.5.2. Moreover, most focus group participants had similar perceptions of being trapped whilst the computer crashed or printer was out of order, both of which interrupted their practice. The details will be presented in Chapter 7 Digital Taylorism.

Additionally, few interviewees with informatics’ background stated that nursing care practice was not affected without computerisation. For example,

I think the healthcare professionals’ practice doesn’t relate to computers (Case study/ IT1, NI member).

If the informatics department doesn’t develop this system for you, you still can provide services. You still care for patients and write nursing records. It’s alright without the support of information systems (Case study/ HN3, NI member).

- **Lack of Legitimate Claim**

In terms of decision making regarding computer trolley purchase, many nurse managers described the top and nurse managers as middle-level manager who held different perspectives. For example, one software engineer described,

\textsuperscript{2} Chinese slang, means things have order of priority.
When considering buying technology equipment, the front-line professionals are concerned with the user-friendly issue. The middle level are concerned whether it improves work efficiency. The top are concerned with cost-effectiveness or return of investment after purchase (Case study/ IT2, NI member).

As described in Section 5.3.2, nursing managers and front-line nurses hoped to purchase trolleys promptly. Nurse managers perceived that the top adopted the wait-and-see approach due to wanting to buy the trolleys as cheaply as possible. Many nursing managers said that the top managers kept asking them about the cost-effectiveness of computer trolleys. For example, one head nurse stated,

They kept asking us “why does your nursing department have to buy it? You need to tell us about its benefits…Because it’s a huge amount of money. Is it really better?” They are more concerned with the benefit aspects and we think about work efficiency…(Case study/ HN8, NI member).

The nurse managers involving in purchasing trolleys described that they lacked legitimate claims to persuade the top that purchasing computer trolleys was cost-effective. For example, one nurse interacting with the top for computer trolley purchase described their communications. When the top expected to know how much nursing work can be saved after spending an ample amount of money on computer trolleys, she explained that she cannot tell them.

…I can’t tell you surely if the nursing record system goes on-line today, I then can cut down one nurse. I can’t make sure such a thing. I know it will save nurses quite a lot of time. But can you say it can save one nurse? I can’t tell you. But the top wants to see this after spending several millions; can you cut down on several nurses? [Imitating the top’s tone of speech]…. The managers are all like this. They want to know the cost benefits. Even if you searched journal papers everywhere, no one can tell you that after adopting computer trolleys, how many nurses can be cut. We have too much hidden work. I still think that nursing informatics is very important. But its effectiveness is very invisible (Case study/ HN3, NI member).

Besides lack of cost-effectiveness claim, the issue of how to dispose of old conventional nursing trolleys influenced the purchase of computer trolleys. One nursing executive described that when the old nursing trolleys were still usable, it was difficult to persuade the top to buy new computer trolleys.

I think this is my inadequate attention…One nursing director told me she hasn’t updated nursing trolleys for almost 10 years…She thinks, if trolleys are not broken, the hospital would not allow her to buy new ones. When we reported to the top saying “we can’t wait any longer…We need computer trolleys now. Then
he asked me saying, “You’re going to buy 170 trolleys. Could I ask you how you are going to dispose of these old ones? To throw them away?” (Case study/ UM Manager3, Nursing).

As described in Section 5.3, the high cost was the top’s main concern in purchasing computer trolleys. Some nurse manager and software engineer interviewees stated that budget was not controllable by the nursing department. Subsequently, their accounts revealed that their negotiations were subtle. For example,

Talking about money…it is incontrollable, because it’s the cost (Case study/ HN7, NI member).

We know they are very expensive. So we dare not give pressure to the hospital saying you must give us (computer trolleys) immediately. We say we must have them. But the timing of purchase depends on the assessment of the price by the top (Case study/ UM Manager1, Nursing).

• Lack of Informatics Knowledge

Many nursing manager interviewees explained that they could not judge the feasibility of modifying information systems, which made them feel uncomfortable in negotiating with software engineers. Nursing managers attributed software engineers’ refusal to their lack of informatics knowledge.

For example, one nursing executive described the nursing department was in a disadvantaged position in negotiating with the informatics department because nurses do not understand informatics.

In the past when we hadn’t any idea, they (informatics staff) said this can’t be done. Later, we found out other hospitals had developed it and why do our informatics department always say no to us. So I talked this over with Dr. X. He said “They lie to you because they feel you are stupid. It’s not that your requests can’t be met. It is very difficult to do so”…(Case study/ UM Manager3, Nursing).

As described in Section 5.4.4, the software engineer refused to modify the computerised work plan system requested by the nursing department. Despite many nurse manager interviewees’ complaints, the interface problems of this system remained unchanged. They perceived that lack of informatics knowledge made them unable to carry on further negotiation. For example, one head nurse stated,

They say the software programme design is not as simple as we think. I don’t understand it. But I tried to convey our opinions to them…Sometimes they said it
can’t be done. Because we don’t understand whether it’s truly no ways, we still have to use the system…(Case study/ HN10).

5.5.2 Renegotiation

In order to accelerate the development of computerised information systems for nursing purposes in the case-study hospital, the accounts of nursing executive interviewees revealed that they attempted to renegotiate with the top and information department through several strategies, including passive resistance, recourse to hospital accreditation and gaining informatics knowledge.

• Passive Resistance

As described in Section 5.5.1, the nursing executive perceived that she had limited power after computerised information systems had gone on-line. She explained that previously she cooperated with the hospital’s computerisation goal until she noticed the computerisation process increased the front-line nurses’ workload and reduced the time of patient care.

In the early stage, we didn’t understand the informatics. As long as the informatics department said it is needed for health insurance or something, we always cooperated……But during the recent years, gradually I found out that we can’t cooperate anymore. Sometimes, the computerisation process… increased the nursing work. Because much work requires you sitting down in front of computers, then your time at bedside reduces…(Case study/ UM Manager3, Nursing).

She revealed her passive resistance when she described that she did not allow a computerised information system going online easily for several times throughout the interview.

…This is why I had changed my decision making. I think if we are not ready, I absolutely won’t go online rashly…. (Case study/ UM Manager3, Nursing)

Because of concern about the front-line nurses’ workload resulting from computerisation, she described several factors influencing her decision making regarding whether to implement a new computerised information system or not.

For example, the nurse executive described one of her concerns was the duration of parallel implementation which increased the workload of front-line nurses. The parallel approach was outlined in Section 2.4.3.
When a system goes online, there will be a transition period requiring both handwriting and computer entry work at the same time. If I plan to stop the paper format and can’t do so. The computer system can’t stop; because once it went online it’s there. Then the front-line will be so miserable….Now I have to make sure the handwriting part will be cancelled in the future. If both parts exist, I’ll hold back. I won’t allow it to go online, because I don’t want to increase nurses’ workload (Case study/ UM Manager3, Nursing).

She explained another concern about activating a ready computerised information system which had sufficient hardware equipment, such as computer trolleys.

…Such as portable computer trolleys…If the hospital doesn’t purchase these trolleys, I won’t let it go online easily…Otherwise, some systems had been designed for a while. But because the equipment is not ready, we won’t go online (Case study/ UM Manager3, Nursing).

She described considering the workload of front-line nurses, the amount of computer typing tasks in an information system was also a concern.

If the computer system requires a lot of typing work…In the beginning, we are not familiar with typing. I worries once going online, I don’t how my staff would cope…(Case study/ UM Manager3, Nursing).

She explained that upcoming hospital accreditation may make her postpone a ready information system to go online. Because from her experience it took at least half a year to get used to a new system, the transitional stage of going online may affect the results of hospital accreditations.

My readiness also concerns me…such as the upcoming hospital accreditation. Before the accreditation, it’s better not to change, because a new system only becomes stable after six months or a year’s time (Case study/ UM Manager3, Nursing).

The nurse executive’s decision regarding passive resistance was also cross checked with other interviewees. A few described how the nursing department held back the development of computerised information systems. For example, one head nurse described how the nursing executive postponed the computerised discharge planning system going online.

Like our discharge planning system, it had been developed two years ago…But our director was concerned with the workload of front-line nurses…It’s been
more than one year, it still hasn’t gone online (Case study/ HN6, NI member).

One software engineer described their perceptions that the nursing executive had held back the development of computerised nursing record system.

It’s a part of electronic patient record. Many hospitals have developed this area. But we haven’t…They (nursing department) considered front-line nurses’ workload (Case study/ IT1, NI member).

Moreover, the nursing executive’s concerns regarding the workload increased by computerisation corresponded to focus group participants’ accounts. Most focus group nurses described that their work was duplicated because of the parallel implementation period and immobile desktop computers. The details will be presented in Chapter 8 Hidden work.

**Recourse to Hospital Accreditations**

As described in Section 5.4.3, informatics requests related to hospital accreditations were given priority. Some nurse managers described that after discovering the priority of informatics department, they found a way of circumventing the prioritising principle in order to accelerate the computerisation progress. They stated that they attempted to package and present their nursing informatics requests as for hospital accreditation purpose.

For example, one nursing executive said,

…It depends how we propose our informatics needs. The hospital accreditation purpose will be given high priority. We only need to relate our needs with hospital accreditations purpose…It depends on how we package our needs. The informatics department doesn’t understand this. You only need to tell them this is for hospital accreditation purposes… (Case study/ UM Manager3, Nursing).

Another nursing executive described that the informatics department completed many nursing informatics requests because of Joint Commission International (JCI) accreditation.

Because of hospital accreditations, we are given priority…We don’t need to worry our requests were omitted…For example, the informatics department completed many of our requests, because of JCI accreditation…(Case study/ UM Manager1, Nursing).
• Gaining Informatics Knowledge for Negotiation Power

As described in Section 5.5.1, nursing manager interviewees perceived their negotiation with software engineers was limited by their lack of informatics’ knowledge. Many nursing managers believed that knowing each other’s languages could facilitate communication. In this study, eight out of 20 nurse manager interviewees received nursing informatics postgraduate education (40%). They described how their nursing department encouraged them to gain informatics knowledge in order to communicate with informatics departments.

For example, one nursing executive stated,

…One of our head nurses went to study an informatics degree. We also established the nursing informatics committee…We hope we can communicate with informatics staff better…We need someone who understands both sides of languages…When my head nurse went to study informatics, she told us that our ideas were random or we thought it’s simple and easy…(Case study/ UM Manager3, Nursing).

For example, one head nurse having informatics background described that informatics knowledge was the key in negotiating with software engineers.

You’ll find out, the software engineers take advantage of you because you don’t understand informatics. If someone understanding informatics negotiate with them, they’ll be speechless…(Case study/ HN3, NI member).

Additionally, some managers described sufficient communication was necessary in software programme development. They described that a communication bridge was needed in order to collaborate between nursing and informatics departments on developing nursing informatics. For example, one software engineer described,

They said that someone is needed between nursing and informatics departments, who is studying nursing informatics and understands nursing- they can be the communication bridge. Now our nursing informatics committee plays this role. Sometimes, I think that users’ ideas are very simple…and random…which is good. But maybe we can’t make it. I think there is a committee to filter these requests…it’s a good method…In terms of nursing informatics, I think communication is very important…How to make what you understand correspond to what they request clearly…I think communication and understanding their needs beforehand are very important (Case study/ IT1, NI member).
…Because our hospital has never developed computerised information systems before…You know nurses tend to use the concept of documents. The ways they talk have no the concept of informatics develop. You have to try your best to present their thoughts in a way that informatics staff can understand, then let the informatics department to do it (Hospital C/ Nursing Informatics Practitioner 1).

5.6 Summary to the Chapter

This chapter presented how nursing manager interviewees achieved their computerisation goal through negotiation and renegotiation with the top and the informatics department. Nursing managers’ accounts showed that developing computerised information system relied on an interdisciplinary collaboration, rather than being a task which could be completed unaided. However, the top, informatics and nursing departments had their own considerations and interests towards computerisation. Nurse managers perceived that they had insufficient power to influence the top’s decision-making to purchase computer trolleys and to gain the collaboration of informatics departments, due to lack of power, legitimate claims and informatics’ knowledge. When little space was left for nurse managers to negotiate, they adopted some strategies in order to make their negotiation more powerful, including passive resistance, recourse to power of hospital accreditation and gaining informatics knowledge. To sum up, both the top managers and informatics department played a decisive role in influencing the computerisation process. By contrast, nurse managers had limited autonomy in the development of computerised information system.

The interactions among the top, informatics and nursing department corresponded to the Strauss’ (1978) concept of negotiation. Strauss’ (1978) negotiated order was helpful in understanding the negotiators, the issues negotiated, the respective concerns and interests of each party, taking place of renegotiation. This finding chapter has shown that computerised information systems for nursing purposes was developed through the negotiated order (Strauss, 1978) which was constructed by multiple negotiations among the top, informatics and nursing department based on its own concerns and interests. Moreover, the negotiating interactions in this chapter were complex, woven together but imbalanced.
Chapter 6: Top Down Implementation

6.1 Introduction
Chapter 5 presented how computerised information systems were developed through negotiation and renegotiation. This chapter will present the implementation experiences of nurse managers and participating nurses in the case-study hospital. Section 6.2 describes how the case-study hospital implemented a new software programme. Section 6.3 presents how head nurses played their role during the changes. Section 6.4 examines the role of front-line nurses as end-users in the implementation process.

6.2 Top down Approach to Change

6.2.1 Centralised Decision Making
Participants’ descriptions reflected their perception that the implementation strategy adopted by the case-study hospital was the top down approach. Focus group participants reported that they were informed about computerisation decisions and tasks through announcements from the top.

Focus group participants described that announcements were made through the hospital email system and usually their head nurses would announce again as reinforcement. For example, Group D described how they received announcements through the email alert and their head nurse.

D5: Through email.
D1: (Parallel speaking) through email.
D3: The head nurse also will print it out and make the announcements.
D4: (Parallel speaking) the head nurse will announce it.
D5: (Parallel speaking) the head nurse.

Participants’ descriptions revealed that the implementation process was centralised and fixed because the adoption date, going-online date and training sources were predetermined. Every group reported that the announcement usually covered a predetermined adoption period of time, going on-line date, and the workshop training provision. For example, one nurse participant described how the implementation schedule was predetermined by the top depends on the content of computerised tasks.

B5: Depends on what the hospital wants to amend this time, the scope of the thing. If its document sheet needs to be changed, that may be its announced
today. After two days, it will go online completely. But if it relates to more about technical things, they will give us a period of time. Announce it first, then everyone try to use it and report problems if you have any. Some day it will go online completely. Depends on what they want to computerise.

Moreover, two groups described how the information was disseminated layer by layer. For example, Group C discussed that the announcements were made and cascaded from the nursing department level to the ward units.

C3: The head nurse announced it during the morning meetings, because they (head nurses) have held the department level meetings…then back to the wards and cascade the announcement.
C2: Then, they also put a notice in the ward,
C3: (interrupting), someone who hadn’t heard the announcement (during the morning meeting) would read the notice, or maybe your colleague would tell you.

User involvement at this stage was not reported by any group; further details of user involvement will be presented in Section 6.4.1.

6.2.2 Parallel Adoption

Every focus group reported that the hospital adopted a parallel strategy to implement a new information system. The parallel approach was outlined in Section 2.4.3. Most participants described that the conventional paper sheet format and new computer system were used simultaneously for a period of time.

The term ‘double tracks’ was used by the focus group participants and nurse manager interviewees which means using a handwritten paper format and computers at the same time. For example, one nurse indicated that during the parallel stage, both computerised order entry system and handwritten orders were used.

B3: You can use the computer directly to check the orders, but you still need a handwritten part. Need them both.

After a given period of time to adopt the new computerised system or task, the handwritten paper would be withdrawn completely. However, the computerised records still needed to be printed out. Another nurse described how the parallel approach was implemented. The handwritten format and computer system existed for a period of time. After getting used to the new system, the handwritten format would be discontinued.
C3: Usually, they will try to carry it out for several days...Let you try it for several days and get used to it then go on-line. Afterwards, the hand paper sheet format will be withdrawn.

6.2.3 Summary
Decision making about computerisation in the case-study hospital was perceived by nurses as centralised and fixed, including the schedules of adoption and learning resources. Their accounts revealed that the case-study hospital adopted a top down approach to implement computerised information systems. User involvement at this stage was not reported by any group. How front-line nurses perceived the issue of user involvement in the computerisation process will be presented in Section 6.4.1.

How nursing managers acted as change agents and gained their staff members’ compliance will be presented in the following section. How front-line nursing participants perceived and responded to the centralised, top down approach will be presented in Section 6.4.

6.3 Head Nurses
6.3.1 Change Agent
Many nursing manager and focus group participants described their perception that the head nurses were responsible for disseminating and teaching. Most focus group participants stated that their head nurses disseminated the latest computerisation information and demonstrated how to use the new system. For example, Group A and D said their head nurses taught and demonstrated how to use the system.

A5: Such as our computerised patient admission nursing assessment...During the morning meeting, our head nurses taught us...

A5: Gathering all of us during the hand over and teaching us.

D1: ...If something is going to go online...the head nurse taught us again and again, taught us repeatedly...

Moreover, the nursing executive who was the chair of nursing informatics committee described that head nurses particularly played a significant role in gaining compliance of front-line nurses during implementing computerised information systems. She explained,

The conformity of head nurses is very important. If you want the front-line’s compliance, I think you have to persuade these head nurses. If you can persuade them, they’ll keep a close watch on the front-line. If you can’t, they’ll pretend to
be sluggish. They might think the system is not user-friendly, so I don’t want to promote it.…They are key persons based on my experiences.…If they don’t cooperate with you, it’s impossible to gain the front-line’s compliance (Case study/ UM Manager1, Nursing).

6.3.2 Gaining Nurses’ Compliance through Persuasion Strategies

When comparing and contrasting the interviewees’ accounts, the descriptions of most nursing managers who were members of Nursing Informatics Committee revealed use of a considerable amount of persuasion skills.

• Selling

Most of the nursing managers explained that they sold the idea that computerisation is beneficial to nurses’ work, in order to gain front-line nurses’ compliance. For example,

You have to think what effectiveness it (computerisation) may have afterwards. It will be helpful in implementation, because the front-line would feel what they do is meaningful. They are not just doing it. They’ll be benefiting. They’ll conform…They would think “it’s worth” and they’ll do it. You have to let them know how this thing would benefit us. You have to emphasize this positive factor. They’ll cooperate. If you don’t, they probably would do it and grumble at the same time….(Case study/ UM Manager1, Nursing).

Some nursing manager interviewees described that in order to make their persuasion achieving the desired result, they had to persuade themselves before disseminating their staff members. For example,

Sometimes it requires a lot of careful thinking when implementing a new thing…I have to persuade myself first before promoting it…To think about how to say will make them willing to do so…(Case study/ HN8, NI member).

• Demanding

Besides the selling strategies, some nurse managers described the use of demanding strategy. They described in order to keep their jobs, front-line nurses needed compliance with the hospital’s policy. For example,

Because of the global financial crisis …I give them an idea that if you can’t follow the hospital’s steps, you’ll be eliminated and you’ll lose your job … (Case study/ HN2, NI member).

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Discussion

By contrast, only one head nurse stated that she encouraged her staff members to speak out and to discuss. She believed this strategy was more effective than the demanding one.

I’m in favour of voicing their opinions, which part they don’t like ...I hope they can have discussions ...If they can bring up some issues, it means they’re involved in this matter ...It’s a positive feedback ...Otherwise, the acceptance would not be good by forcing them (Case study/ HN8, NI member).

6.3.3 Summary

The accounts of nursing managers and front-line nurses showed that head nurses acted as change agents in disseminating the computerisation news and taught their staff members how to use the system. Most head nurses interviewees involved in the Nursing Informatics Committee said that a considerable amount of persuasion skills to promote computerisation were applied in order to gain the compliance of front-line nurses. Particularly, the account of the nursing executive interviewee, who was the director of the Nursing Informatics Committee, showed her perception that the head nurses played a crucial role in gaining the front-line nurses’ compliance.

6.4 Front-line Nurses as End Users

Front-line nurses were the main users of the computerised information systems. This section describes how nurses complied with the hospital’s decisions. Their perception regarding the top down approach to computerisation will be examined in Section 6.4.1. How front-line nurses adopted new computerised information systems and new technology equipment will be presented in Section 6.4.2.

6.4.1 Nurses’ Responses to Top Down Approach

• Generally Positive towards Computerisation

The accounts of each group of front-line nursing participants reported their positive beliefs regarding computerisation. They believed computerisation is a world trend which brings convenience, bringing time and efficiency to the healthcare service.

For example, one senior nurse reported the computer would bring convenience to nursing care.

A2: I think computerised systems’ convenience to nursing care is in no doubt.
Similarly, some participants reported they believed computerisation would save their time in paper work and chasing patient laboratory reports and provide better care for patients.

B4: I think this is...
B2: [Interrupting] a trend.
B4: Yeah, and computerisation will save our time a lot. Then the time saved can be used on patient care. No need to spend a lot of time on writing nursing records.

B4: Save more time.
B5: Would spend more time on patients.
B2: Yeah.
B5: For example, no need to chase laboratory reports, doctors’ orders, medicines. The information can be gained earlier. What interventions to be done (for patients) can be done as soon as possible.

Group C reported they perceived the computer’s help in efficiency and accuracy.

C1: In my experience, I think in terms of efficiency, it’s really good. Because of this point, I think it’s not bad.
C2: For me, it’s about accuracy…After computerisation, we recognise English easily and know the orders. It’s convenient for us to carry out doctors’ orders.

Group E reported computerisation is the modern trend. The participants compared the other hospitals’ progresses was faster than their own hospital’s. They also expressed their hopes regarding accelerating the computerisation progress.

E3: Good! It’s the current trend.
E1: Yeah, my classmates who work in another hospital told me their hospital had done the computerisation.. They already have portable computer trolleys. We are still using these (the conventional trolleys).

…
E2: Faster, go online faster. Yeah, we hope very much nursing records can be computerised.
E3: Yeah, many hospitals are already computerised.

• Compliance
All five focus group participants described their response to the top’s decision regarding computerisation and if they were complying with it. They described concisely and without hesitation. For example,

E2: …Because you have to do it…
D6: Just follow the order (of the top)!

Resistance or passive resistance was not reported by the front-line nurse participants. They believed that they were required to conform. For example, Group D participants stated,

D1: When the top wants to go online, you need to cooperate with this policy! You can’t say, “You don’t learn the systems because I don’t want, I’m unable to”.
D3: You can’t.
D1: You still have to learn it.

Additionally, some focus group participants described that when computerised information systems went online, the system functions and designs also set the rules for their work and forced them to conform to the systems. The details will be presented in Chapter 7 Digital Taylorism.

By contrast, doctors’ resistance to computerised information systems were described by some interviewees. Although the role of doctors was not the focus of this study, doctors’ resistance of computerised information systems was mentioned in the accounts of some nurse managers and software engineer interviewees.

Like our computerised physician order entry system, it had been resisted by doctors after going online for one week….It succeeded until after the second time of implementation (Case study/ IT2, NI member).

• Powerlessness

Whilst most participants described that they conformed to the top down decisions and implementation approach, three out of five focus groups perceived that they were unable to change decisions made by the top, even though they held different opinions. Their descriptions illustrated an obvious contrast between the organisation hierarchies of the coercive top and the powerless front-line nurses at the bottom.

They expressed their perception in a helpless tone. For example,

A6: ...When the top have made a decision, there is no room to do it another way, you know. So, no matter if you think how complex and how incontinent this stuff (computer technology) is. The top was like, “I already bought it and signed the contract. It must be used.”
B1: …We can only use it (information system). There is no way to resist it, yeah. Usually, it was a decision made by the top.
B5: Yeah.
B1: The bottom cannot do anything about it even we have different opinions. We can only accept it.

C2: It (the decision) can only be this way.
C3: Yes, only be this way.
C3: ...If you don’t accept it, nothing you can do. When they (the top) decide to go online, can we say no [bitter smile]?

• Concerns of Job Loss
As described in Section 6.3.2, the persuasion strategy to gain the cooperation of front-line nurses was demanding. Some head nurses said that compliance with the top down decision in order to keep the job position was instilled into front-line nurses. Subsequently, three out of five groups mentioned that they felt they needed to comply with and adapted to the top’s computerisation decisions or risk job loss. For example,

D3: Doing a job requires adapting [laughing]. So just adopt it (computerisation).

A3: This is [pause] the way society operates.
A1: [speaking at the same time] society.

C3: If you can’t adapt to it, you’ll quit the job.
C1: Yeah.
C2: Yes. It’s true.

• No User Involvement
Four out of five focus groups described their perception that they were not involved in the development and implementation of computerised information systems. For example, Group B participants described their experiences,

B2: It seems there is no room for involvement.
B1: Yeah! There is no room to (pause)…
B5: Involvement, maybe not.
B2: Yeah.
B1: Yeah.

Comparison was made between these four groups. Despite the perception of user non-involvement being the same, the focus group participants held different viewpoints when discussing room for user involvement. Whilst some participants emphasized that they were
the real users and hoped for their voices to be heard, some accepted the decision makers’ authority.

The accounts of two focus groups revealed that they had a greater awareness of user role and were able to represent the needs of themselves. For example,

D5: It is us, front-line nurses, who care for patients and also use the system. It is us clearly knowing what design would be more user-friendly and reducing our workload.

Moreover, they reported that although the head nurses represented the user role of front-line nurses in the Nursing Informatics Committee, only the bottom knew the reality of healthcare delivery. For example,

A2: After all, it’s us who need to do it (information systems). Only we understand the practical procedures better ...Before designing software programmes, we knew that the informatics engineers had talked to someone. However, they are not the people who work in clinical care.

D1: …Sometimes they held meetings with the head nurses. But head nurses are not the front-line staff. They don’t know exactly how to use the computerised information system ...because the head nurses don’t use the system. For example, head nurses themselves did not enter computerised nursing admission assessment hands-on.

By contrast, another two groups of participants believed that the authority of decision-making belonged to the top and that their role as front-line nurses was to execute the decisions and plans. For example,

B5: After all, the decision makers are the top; we are the doers. The most we can do is to report the manipulation issues we encountered after using it.
B1: Yeah.
...
B2: If they decide to computerise, I believe they have their own considerations
B5: Yeah.

C3: We are the doers.
M: Doers. You think you are doers?
C3: Yeah, we are. They make decisions. What the boss had decided to do is not up to we riffraff followers …It’s the truth.
Regardless of holding different opinions about room for user-involvement, both viewpoints of participating nurses reflected the powerlessness at the bottom described in Section 6.4.1 powerlessness.

**Limited Support by Managers**

Whilst every focus group mentioned their head nurses in their group discussions, only three focus groups discussed manager support. Of which, only one group’s account revealed their head nurse showed her empathy for her staff nurses’ user role. Group B participants mimicked their head nurse’s response,

B1: The head nurse would say, after a while, you’ll get used to it.
B5: Yeah.
B2: In the beginning, I don’t know how, neither [mimicking their head nurse’s tone].

By contrast, the other two groups of participants perceived limited manager support. Two groups explained how when they raised queries or opinions about computerisation decisions, their head nurses responded to them. Their accounts revealed that the viewpoints or opinions of front-line nurses were not valued by their head nurses or nursing department.

For example, Group A participants described if they made complaints, they did not receive and expect positive feedback from nursing managers.

A6: Sometimes if you complained to your head nurse, assistant head nurse or nursing supervisor, you may not receive positive feedback.
A4: We seldom expect to receive feedback on our opinions.

Similarly, Group C participants described when they raised any questions the standpoint of their head nurse was on the hospital’s side, rather on staff nurses’ side.

C3: She speaks for the hospital.
M: Do you mean she tries to persuade you?
C1: It’s not persuasion. It’s that this decision is made. You have to do it.
C3: You have to adopt it.

C2: We are the users,
C1: We discussed with her from the user’s perspective. But her standpoint is …
C3: On the decision makers’ side.
C1: Yes, on the decision makers’ side.
C3: For example, if we think this system has a problem and makes us unease of use. She usually talks to us from the hospital’s perspective saying why this project is needed.
6.4.2 Adoption Process

This section presents how nurses acquired skills to adopt new changes resulting from computerisation and how they made readjustments to new information systems and computer technology and grumbled at the same time.

• Acquiring Skills

As described in Section 6.3.1, demonstration by head nurses was one source of teaching computer skills to front-line nurses. Most focus group participants said that the resources provided for acquiring skills were classroom-based workshops and cascade training. Some of them described the methods of attending e-learning courses, e-mail information as references and practising trial versions of systems. In addition to the above formal training resources, peer support by helping and teaching each other was described by many participating nurses.

Classroom Workshops

Four out of five focus groups stated that the hospital provided classroom-based workshops to introduce new software programmes. They described that the workshops gave verbal teaching.

However, in terms of perceived usefulness, only one nurse participant explained that she felt workshops were helpful. Most participants expressed that without hands-on practice simultaneously they felt classroom-based workshops in learning new software was limited. For example, Group D participants described,

D4: …When we attended workshops. We felt confused. After hands-on practising, we found out actually it was quite simple. But the lectures sounded very complex.

D1: After the practice, you would identify where your learning problems are.

E-learning

Two out of five focus groups said that the hospital sometimes provided e-learning sessions. They had different opinions regarding the online approach. One group described that whilst they felt the e-learning method was convenient and flexible, the presentation style was boring.

A1: It’s convenient.
A4: You can watch it anytime you want.
...
A5: But I think the e-learning method has one problem. Sometimes the camera kept focusing on the speakers.
A6: No subtitles…
A5: We felt lost because the videos’ quality was blur and no subtitles

Another group described that because the e-learning method was time-consuming it was not their primary choice to acquire skills. They used it when they were available.

C3: We have the e-learning system.
M: Do you use it?
C2: When we have time.
C1: When we are available.
C3:...Because finishing one session takes much time.

_Cascade and Peer Support_

In contrast to verbal teaching of workshops and e-learning, four out of five focus groups described that cascade training and peer support were beneficial in acquiring skills. They described that few staff nurses in each ward were selected and attended training workshops. These nurses were then responsible for cascading the training to their fellow staff nurses in the wards. When discussing its effectiveness, one group remained silent and two groups commented positively. They described that they had someone to teach them and answer their questions.

For example, Group A participants discussed that

A6: There will be one staff teach you how and answer your questions. If they can’t answer your questions, they will be responsible for finding out the answers.
A5: It’s easier to communicate with your fellows.
A6: Yes. They understand where our problems are…and they are often immediately available.

However, three out of five focus groups mentioned that cascade trainings were only available for computerised information systems with complex functions only.

In terms of peer support, three out of five groups admitted that teaching each other between fellow staff nurses was helpful. They felt that it was a step-by-step and immediately available guidance to learn a new system or interface. For example, Group B participants compared classroom-based workshops and peer support. Their comments on workshops were similar to the other groups presented in the above. They felt that peer support benefited them much.
B1: The workshops held by the hospital help us understand…
B2: But I think its help was limited.
B5: Me too.
B2: I think the most helpful way is that we teach each other and practise immediately. Sometimes during the classroom workshops, you didn’t get hands-on practice. You still don’t know how.
B5: You listen but still don’t get it…

Email Information and Trial Versions
When the case study informed its staff about any new system by emails, the contents also provided the introduction and manuals. Some of the focus group participants briefly mentioned they used email information as references and practising trial versions of software programmes to learn new systems.

• Readjustment
As described in Section 6.2.2, the parallel strategy was often adopted by the case-study hospital to implement computerised information systems. Four out of five focus groups used terms such as “transitional period”, “chaotic period”, or “buffer period” to describe the process of parallel adoption.

A6: There was a transitional period during the parallel adoption.

B3: …There will be a transitional phase…for example adopting computerised physical order entry, it had a transitional phase.

C1: It was a chaotic period. We need a period of time to adopt it.

D5: There will be a buffer period to allow us to be familiar with the new information system...

Most focus group participants stated that when a new system went online, they went through a period of adjustment because of unfamiliarly. Three out of five focus groups described that they felt unable to adopt and troublesome in the beginning because it was a new system and technology. For example, Group B reported,

B1: This adoption of new systems to me was very huge I think…
B5: [Interrupting] having no sense of security.
B1: Yes, no sense of security.
Similarly, Group C said

C1: …We need a period of time to adopt it.
C3: Need to adjust for a while.
M: How do you adopt?
C3: Being chaotic anyway.
C2: It felt like going crazy.
C3: When the system just went online, …During that period of time, it was really very chaotic…How the other people were I don’t know. During the adoption period, I felt I really can’t get used to it…

Group D described that the beginning of adoption as “troublesome”.

D3: In the beginning to adopt, it was of course very troublesome.

By contrast, only one group of participants perceived that their adoption was fast. However, when the discussion topic flowed freely to the nurses on probation, they used the term “hard” to describe the process of learning computerised information systems and said they had experienced it themselves. Their accounts regarding adopting computerised information systems corresponded to the other four groups in some way.

E3: It’s really tough learning computers! We’d not experienced like that before.
M: Which part you think of as tough?
E3: Don’t understand it (computer systems)!
E1: Unfamiliar with it!
E3: Yeah, not familiar with it.

In terms of the means to readjusting to new systems and technologies, most focus group participants had a similar view explaining that they practised frequently until it became habit.

D6: In the beginning, you certainly don’t know what this key is for. After several times of practice, you’ll know.

E3: You get used to it after several times of clicking.

In terms of duration of readjustment, most participants felt it was difficult to quantify and different for everyone. Two out of five focus groups estimated that at least one month period of time was needed for them to get used to a new system. For example,
A4: From understanding to adapting ourselves to new computerised information systems, it probably needs one month’s time.

Group B discussed that their experiences of adopting computerised physician order entry (CPOE) also required at least one month’s time.

B2: At that time, it took us at least one month or more to adopt it. We adapted to it at least
B5: more that one month.
B2: Really took a while.

Another two groups stated that the duration depended on the frequency of system usage. Both groups of participants said that the more frequently they used it, the shorter the readjustment. For example, Group D participants commented,

E3: It depends
E2: It depends
E1: It depends on how often you use it. If use it you often, you’ll know how to use the system.

By contrast only a couple of nurses mentioned that the background of nurses was related to the duration of their adoption.

For example, one nurse described the factor of years of practice.

D5: I think it relates to the length in years of practice…
D3: Junior staff take a longer time.
D5: Like we (senior nurses) already know how to do this practice in mind. But junior nurses take longer to adapt it…

• Grumbling
Three focus groups discussed grumbling was part of their adaptation. They described grumbling, complaining and moaning to themselves or their colleagues when using new systems or technologies until they made readjustments.

For example, Group A participants describe,

A1: There will a period of …
Everyone: [overlapping] a period of…
A4: We grumbled whilst using it.
Many of them grumbled about feeling troubled, user unfriendliness and increasing workload. For example, they grumbled when they felt that the new systems were not easy to use.

C3: Why is this so difficult to use!
C1: We murmured to ourselves.

A6: If we felt this is really inconvenient…
A5: Everyone would grumble together.
A6: Maybe we go for a meal together and keep moaning about it. But after a period of time, we would get used to it.

Moreover, participating nurses described how they grumbled when they coped with the workload created by the parallel implementation approach. The details of duplication will be presented in Chapter 8 Hidden Work. Most focus group participants reported that the process of implementing computerised information systems duplicated their work.

C3: It’s annoying.
C1: We kept murmuring to ourselves.
C3: Yes. Many things haven’t finished and (computer) things cannot be done rightly in one time.
C2: (Computer) things keep go wrong.

B5: All of us feel the same way. We felt this (duplication) is troublesome. Our work is busy enough and we still need to cope with these changes.

In addition to grumbling for adopting new systems, all focus groups revealed their emotions when the topic shifted to computer and printer problems. Chapter 8 Hidden work will present findings that participating nurses frequently encountered hardware and software problems, including computer crash, printers out of order and insufficient computer numbers which interrupted their work. Participating nurses expressed their frustration when they needed to do extra work to manage computers, printers, and duplications.

They used the term “troublesome” most often to describe their circumstances. The term “miserable” was used to describe computer crash problems in particular. In addition, two focus groups of intensive care nurses used “troublesome” frequently during the group discussions. The descriptive numbers which appeared in the group discussions are presented in Table 6.1.
Table 6.1: Frequency of Emotional Terms

<table>
<thead>
<tr>
<th></th>
<th>Troublesome</th>
<th>Miserable</th>
<th>Grumbling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>16</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Group B</td>
<td>21</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Group C</td>
<td>7</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Group D</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Group E</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

For example, when topic in Group B flowed to the printers in their unit,

B5: Printers! Printers make us crazy [rising tone].
B2: Really make us crazy [rising tone].
Everyone: Yes!
B5: It breaks at least once a day.

The detail of their accounts regarding computer crash and how they expressed their emotions will be presented in Chapter 8.

6.4.3 Summary
The accounts of participating nurses showed their perception regarding the computerisation decision made by the top and how they technically adapt to new systems or computer technology. Their discussions showed that they held positive attitudes toward computers. Despite their accounts showing that they were compliant with the top’s decisions, they perceived their user role was powerless in terms of involvement in the computerisation process and manager support. In the process of adoption, participating nurses perceived that cascade trainings and peer support were more helpful for them to acquire skills than classroom workshops provided by the case-study hospital. Meanwhile, they noted that they attempted to readjust to change resulting from computerisation and grumbled at the same time in the transitional period.

6.5 Summary to the Chapter
The finding chapter showed that front-line nursing participants perceived that implementing computerised information systems was a top-down decision made by the top. A parallel strategy was adopted for new information systems which participants called the “double track” method as the conventional paper format and new computer system were used simultaneously for a period of time. In order to move computerisation forward, the head nurses played a key role as change agents in gaining the compliance through persuasion strategies and resolving potential resistance from nurses. Front line nurses generally showed a positive attitude towards computerisation. However, being daily users,
nurses’ accounts showed that they were relatively powerless and finding fault whilst using computer systems as their coping strategy.

The computerised information systems were developed by the case-study hospital itself, using the in-house approach. Therefore, the development of computerised information systems relied on interdisciplinary collaboration, including the commitment from the top managers, the support of budgets and informatics department’s collaboration. The development of systems was a result of negotiated order. Through their interactions of negotiations, covert negotiations and renegotiations, the exercise of power and power imbalance were recognised.

As Chapter 5 and this chapter have presented, both nurse manager interviewees and participating nurses perceived themselves to be relatively powerlessness in the development and implementation experiences. Despite nurses being the front-line end-users of computerised information system, nursing managers had limited power in negotiating the development and front-line nurses perceived themselves as having limited space to giving their voices. On the contrary, the top’s decisions and software engineers exercised their power in shaping the computerised information system development.
Chapter 7: Digital Taylorism

7.1 Introduction

In this chapter, the term “digital Taylorism”, originally coined by Parenti in 2001, is used to theorise and unify the findings of hospital management through computerised information systems. Taylorism, so-called scientific management, is regarded as management of work strategies (Braverman, 1974). The core concept of Taylorism is “organisation of labour process and control over it” (Braverman, 1974). In this concept, there are two distinct features. Firstly, work is systematically analysed into its simplest elements and workers’ performance is systematically improved in each of these elements. Secondly, there is direct control over the labour process to achieve control of the actual mode of performance of every labour activity (Braverman, 1974). In order to achieve this concept, there are three principles. The first principle is separation of skills of workers from the labour process (Braverman, 1974). The second principle is “separation of conception from execution” (Braverman, 1974, p114), which means separating thinking from doing. The third principle is that all elements of the work performance are systematically predetermined through management, in order to control each step of the labour process and its modes of accomplishment (Braverman, 1974).

It has been identified that the concept of Taylorism may enhance the understanding of the impact of computerised information systems on nursing practice. The process of nursing practice was designed and restructured after computerisation. Nursing activities were visible after computerisation which enabled further management control.

This chapter examines the design and application of computerised information systems in the case-study hospital using findings from different stakeholder perspectives, including front-line registered nurses, nursing managers and informatics staff. How clinical practice of nurses and administration work of nurse managers were managed through computerised information system to achieve hospital goals which was termed ‘Cyber Jurisdiction’ will be presented in Section 7.2. The term “cyber jurisdiction” was coined by the researcher to convey the concept of “cyber control”. How computerised information systems increased transparency of staff activities will be presented in Section 7.3. Nurses’ perceptions towards cyber jurisdiction and standardisation are presented in Section 7.4. Additionally, registered nurses reported that the design of computerised information created additional work of caring for computers which will be presented in Chapter 8.
7.2 Cyber Jurisdiction

When incorporating computerised information systems and new technologies to redesign workflow, the case-study hospital built internal control in computerised information systems and applied this to care delivery. These designs regarding system-based internal control can be categorised broadly into two areas which will be presented in the following Sections 7.2.1 Access control and 7.2.2 Workflow redesign.

7.2.1 Access Control

For information security purposes and hospital accreditation criteria the case-study hospital set up access control to its computerised information systems. System access was determined by the healthcare professional’s role and involved three parts: authentication, accountability and authorisation.

- **Authentication**

  In order to meet the criteria of hospital accreditations, the case-study hospital set up access control by username and password to restrict the system access in order to guard information security.

  In the beginning, our computerised information system didn’t need our personal passwords to log in. It means everyone can log in. Because of hospital accreditations, JCI accreditation in particular, emphasised patients’ privacy and we also thought it’s quite dangerous, it seems that everyone can check patients’ information, including clicking interventions, nursing practice. Therefore, we got system access control (Case study/ HN5).

  Besides logging in by username and password, some participating nurses described in the focus group that the case-study hospital restricted access carefully. For example, staff’s passwords were required to change every three months.

  B3: A couple months again, we were required to change our passwords every three months…

- **Accountability**

  Some nurse managers and software engineer interviewees described that adopting the design of automatic logout was to reinforce the accountability of user role among healthcare professionals. This design prevented any staff who left computers without logging out of the systems from logging into two computers at the same time. Because some staff left computers without logging out from the system, some managers believed
that compulsory design, for JCI accreditation criteria, protected patient information. For example, one head nurse stated,

Since last August, the system would log you out if you hadn’t touched the computer for three minutes. It’s compulsory log out …In addition, there is a reminder window on the screen when you’d already logged onto one computer and are trying to log onto another one. The system can automatically log you out …Because of JCI accreditation, the hospital paid a lot of attention to the information safety issue about leaking out. Otherwise, in the past, the screen just stayed there. Everyone came over could see it (the contents) … (Case study/ HN5).

Another reason was for the accountability of tracking staff behaviours within systems. Because the information system can identify what users did within the system, automatic logout design prevented usernames from being used by others and left records.

For example, one head nurse said the information system could record any moves staff made and how often staff just left the desktop computers without logging out of the system.

If you want to carry out any step within the system, you need to use your username and password to login. Then the computer records every behaviour you make….Many staff just left after using the computers. They didn’t think that someone would use their username within the system (Case study/ HN5).

Another head nurse stated that sometimes nurses remained logged in for convenience purposes. As a result, the system adopted the design of automatic log-out as protection.

We educated our staff nurses to log out of the system after use to prevent other people using their username or to make any changes on the system. It’s about accountability. But logging in and out every time you use computer actually takes some of nurses’ time. Staff are so busy though. Consequently, staff know this allows someone else to use their usernames to log in to the system but they still don’t want to logout, because they want convenience. For this reason, the system will compulsorily logout now (Case study/ HN10).

One IT staff described the responsibility of users and information security.

This (automatic logout) was for information safety required by hospital accreditations. In the beginning, the access control wasn’t that strict, it only needed username and password to login. Now if you don’t use the computer, the screensaver will show up and lock your username. You have to enter your password again to login. Actually, this also protects them (nurses). You don’t log out and someone else uses your username to make any changes. Once anything happens, it’s your responsibility. Information systems are very
convenient, but we need to consider the control of information safety. (Case study/ IT1, NI member)

The identification of users was related to their accountability within computerised information systems. How records of staff’s behaviours will be used in surveillance and control will be presented in Section 7.3.

**Authorisation**

Both nurse managers and participating nurses explained that the information system authorised and defined the access permissions according to healthcare professionals’ roles. Nurses were authorised with write access on the computerised information system and reading access with nursing-related activities. The doctor system was authorised to doctors and nursing practitioners.

Focus Group B nurses described the staff nurses’ access as limited with writing access on the computerised information system. Reading access was permitted only if the activities were nursing-related, such as doctors’ prescriptions.

B4: In terms of the doctor system, we can’t access it. We only can access…
B5: Nursing care plan system
B2: Computerised information system.
B4: Just for these bits.
M: The doctor’s system, can you read it?
B4: Well, something we can’t read. We only can read doctors’ prescription orders.

Similarly, Group D nurses described the reading access was not allowed if it was not related to nursing practice.

D1: We don’t have the authority to use it.
M: Can you read it?
D3: No, we can’t.
D5: The system separates the access very clearly, only your work is allowed (to access).

A few managers had similar accounts.

You can’t log into doctor’s and non-nursing systems. Not every system can you (a nurse) log in. You only can access the system that’s nursing-related…(Case study/ HN5).
If the systems are not related to our nursing, we don’t have reading access. (Case study/ UM Manager1, Nursing)

Two focus groups and several head nurses perceived the reading access for staff nurses was limited in particular which affected the provision of holistic care. How access control set the rules for work will be presented in Section 7.2.3.

7.2.2 Workflow Redesign

All nurse managers, software engineers and participating nurses stated that the case-study hospital incorporated computerised information systems and new technologies into its workflow redesign, in order to improve process efficiencies and maximize use of human resources. The examples mentioned by the interviewees and participants frequently were computerised physician order entry (CPOE), mobile blood glucose meter, and a RFID-based porter management system.

Many nursing managers involved in computerised information systems believed that computerisation may simplify the workflow and consequently save time for direct patient care and save on cost.

• Computerised Physician Order Entry

At the time of data collection time, CPOE had been implemented for two and half years. Both focus group participants and nurse managers perceived that CPOE was efficient. Through the computer network, doctors’ prescriptions were sent directly to the departments of pharmacy, laboratory, and radiology. Because doctors prescribed directly from the computer instead of paper, the processes of inputting by administrative staff and sending those paper sheets by porters was shortened.

For example, one participating nurse compared the differences of the processes between the previous handwriting period and CPOE period.

A6: …it is very convenient….we used to need to fill the form by hand. Then the filled form was sent by the porters to the secretary for charging fees. Then we asked the porters taking the prescription form to the pharmacy for collecting patients’ medications…It was so troublesome…After the computerised physician order entry going online, the (internet) network connects to the Pharmacy Department immediately and distributes medications to us directly. It’s very fast.
One head nurse described how the simplified work process avoided potential errors.

Often that doctors’ handwriting was slovenly. The dosage was hard to understand. Sometimes, administrative staff made typos...When every step went wrong, it created flaws in the care quality. Additionally, computerisation is a world trend. Therefore, CPOE is a must (Case study/ HN3, NI member).

**Blood Glucose Meters with Mobile Function**

At the time of data collection, blood glucose meters with mobile system had been adopted for six months. The case-study hospital was the first healthcare organisation to adopt this device and invested £50 thousand for 50 meters.

Claiming payments from National Health Insurance were required, presenting both patients’ blood glucose results and doctors’ orders.

For blood glucose results, if doctors’ orders are missed, the payment cannot be claimed (Case study/ HN10).

When using a traditional blood glucose meter, the nursing executive described how chasing missed prescription orders by doctors became burdensome to the “back-end”, such as head nurses and the insurance division.

After checking patients’ blood glucose level, nurses used to write down patients’ results on paper. Usually the insurance division sent the statistics to head nurses saying please make up those missed orders. Doesn’t it create much work for the “back-end”? (Case study/ UM Manager1, Nursing)

Therefore, the case-study hospital purchased blood glucose meters with transmission capabilities over the wireless network. The nursing executive believed the device had multiple advantages. It was helpful in achieving patient safety and completing the “back-end” work automatically.

One advantage is that the meter transmits results to the database of computerised information systems after matching with prescriptions. Without prescriptions, patients’ results won’t pass through...Nurse will not test the wrong patients because of using bar code bracelet identification...There is no wrong data...It utilises informatics function. The “back-end” work will be completed automatically...No claiming problems anymore because claiming needs both orders and data. This saves the “back-end” a lot of work...It really has benefits (Case study/ UM Manager1, Nursing).
Nurse manager interviewees suggested that a useful feature of new glucose meters was that they could analyse statistics and present blood glucose levels in tables, charts or graphs. However, no nursing participants mentioned that this benefits patients’ glucose level control.

**RFID-based Porter Management System**

Several nurse manager and software engineer interviewees described RFID-based porter management system during the interviews. They explained that the RFID-based porter management system redesigned the process of porter services. By adopting the technologies of RFID devices and mVPN, it improved efficiency because porters received and executed tasks without going back to the escort centre.

At the time of later data collection time, the case-study hospital had set up the RFID-devices and prepared for a pilot test in a few wards. Porters had to wear RFID tags after activating this system. The RFID readers set up on the ceiling within the case-study hospital were observed. The RFID devices (tags and readers) allowed the system to identify and track porters’ real time location. Staff nurses requested porter services through the standardised format on porter management information system instead of phone calls. Combing the detection function of RFID readers and information systems, the porter management system was able to identify the best available porters and allocated tasks though mVPN.

We used to have to ring porters continuously. But now using computer is better. You just input your request. The requests send to the escort centre directly. You don’t need to make phone calls. Porters come themselves, isn’t good? We used to need to tell porters what patients’ needs. Now it isn’t necessary. We just classify patients’ conditions into three grades. Grade A patients require both doctors and nurses. Grade B needs nurses only. Grade C needs porters. This saves a lot of phone calls and handover time between porters and nurses (Case study/ UM Manager1, Nursing).

Their accounts revealed that the porter management system fragmented porter services in sub processes. The record function of RFID provided a deeper level of transparency to activities. By engaging porters in this system, swiping RFID card at every point, the RFID devices recorded the time, location, and process of every job the porters carried out. The data were further analysed and calculated the best porter routes for different porter tasks. When porters did not follow the instructions of route and time, the system provided reminders and recording.
M: I don’t understand why RFID devices? Bar code doesn’t have record function, only for swiping purpose. But RFID can record information and save in the database. RFID can provide you the time of every subprocess. This information is all in the database (Case study/ HN3, NI member).

Moreover, their accounts revealed that he RFID-based porter management system led porters to be exposed to close supervision and changed escort service delivery.

This will help the ward’s operation and avoid ambiguous attribution of responsibilities,… It will make this part clearer because there is evidence, By using phone calls, sometimes we had disputes like saying you didn’t notify me and I didn’t send patients (Case study/ HN4).

• Fool Proof Design
Through the focus group discussions, nurse manager interviews and the demonstration of nursing executive (UM Manager1), a fool-proof design was applied in the interfaces of computerised information systems in the case-study hospital. The system design strategies for fool-proof design mechanism used pop-up windows and highlighted colours for patient assessments and reminders of specific conditions.

Both participating nurses and nurse managers described how pop-up windows were applied in a wide range of assessments and reminders, such as assessment of Barthel Index, assessments of blood transfusion reactions, assessment of discharge planning, pain assessment, reminder of medication adverse reactions history, and reminder of contact isolation procedure.

Pop-up frequency varied according to the different purposes. For example, the reminders of medication adverse reaction, contact isolation and blood transfusion reactions assessment showed up every time after clicking those particular patients’ names. Except those, most assessment windows popped up regularly one time every shift after logging into the computerised information system.

For example, one nurse in Group E stated,

E3: When you click one patient’s name first time on your shift, pop-up windows will show up. Afterwards, it won’t show up again. Next shift, they show up again after first clicking.
HN6 who was one of Nursing Informatics Committee members explained that the computerised patient assessments which adopted the pop-up window method were usually the assessments which were required for hospital accreditation purposes. Therefore, these necessary assessments showed up on the screen in front of nurses one by one after logging into the system and could avoid any omission.

The assessments are required everyday. So when I log in, they show up in front of me one by one. I don’t need to search them. They pop up one by one …The advantage is that at least there won’t be any omission ... (Case study/ HN6, NI member).

In addition, the strategy of highlighting patients’ names on computer screens was applied when any assessments and practice were unfinished, including the assessments mentioned above, nursing care plan, and admission nursing assessment and unchecked prescription orders. The highlight colour remained pink until the work was done. In addition, the information systems also highlighted patients’ names when patients had special situations such as signing up for organ donation and “do not resuscitate” (DNR).

How nurses perceived the fool-proof design in their work will be presented in Section 7.4 and how this design set rules for work will be presented in Section 7.2.3.

- **Automatic Function**
Some nurse participants and nursing managers described the applications of automatic functions in their work. This function was an expansion function based on the computerised information systems which existed, such as computerised incident report, nutrition assessment, meal subscription, and laboratory systems. The examples given by participating nurses for automation of computerised information systems in case-study hospital were automatic notifying and automatic meal subscription design.

**Automatic Notifying System**
Automatic notifying function was identified through the discussions of Focus Group B and the observation in wards. The notifying design distributed important patient information automatically in a very short time. The system simultaneously sent text messages by the means of mVPN (mobile virtual network) to selected healthcare professionals within the phone network in the case-study hospital. The design radically shortened the time to provide important information and was substituted for primary nurses to present
information to other healthcare professionals. Meanwhile, it reinforced the accountability of healthcare professionals by reinforcing their confirmations through their mobile phones.

For example, when observing ICU-2, the head nurses received the notice texts via the mobile after the incident was reported online by one of her staff nurse almost simultaneously. After one patient self-removal of endotracheal tube during lunch time, I observed the primary nurse went to one desktop computer located in the nursing station and filled in the incident report through the computerised information system. Five minutes after sending the report, the head nurse received the notifying text message through her mobile phone. In addition, the head nurse told me that the text provided a notice, rather than the whole report. So she needed to access computers to read the reports.

The automatic notification also applied to clinical practice, such as patients with malnutrition and abnormal laboratory findings. The case-study hospital adopted and computerised the tool developed by ESPEN Nutrition Screening 2002 (Kondrup et al., 2003) to detect the presence of mal-nutrition or the risk of developing under-nutrition for admitted adult patients during the hospital stay.

One nursing executive explained that the tool had two parts (See Figure 7.1 and Table 7.1). Nurses completed the items of impaired nutritional status in the nursing system and doctors graded the severity of diseases in doctor system. Then the system combined those scores from both systems. When patients received the scores equal or more than three points, identifying them as nutritionally at-risk, the system would send notifying messages to dieticians for further consultations.

…In the nutrition screening, the nutrition status section is filled in by nurses and the disease section is filled by doctors. Then the system will combine the scores from both systems. If patients’ score is equal or more than 3 points, the system will automatically notify the dieticians for nutrition consultations…(Case study/ UM Manager1, Nursing)
For abnormal laboratory findings, doctors received automatic mVPN notices. For example, one nurse said that doctors received patients’ information which facilitated a better understanding without nurse presentation.

B2: Doctors are not like nurses who care for patients directly. They understand patients’ conditions through us. I think that through computerisation, they’ll understand patients better during ward rounds. For example, now if laboratory results are abnormal, the medical laboratory scientists contact you. They also notify doctors through mVPN to let doctors know. I think it’s good and convenient.

Automatic Meal Subscription

The function of automatic meal subscription was revealed through the discussion of Focus Group C and some nurse managers. They described how in order to increase the

<table>
<thead>
<tr>
<th>Nutritional Status</th>
<th>Severity of Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 A.) Normal nutritional status</td>
<td>0 Normal nutritional requirements</td>
</tr>
<tr>
<td>1 A.) Weight loss &gt;5% in 3 months or B.) Food intake below 50–75% of normal requirement in preceding week</td>
<td>1 Hip fracture; COPD; Cirrhosis; Chronic Hemodialysis; Diabetes; Oncology; Pneumonia</td>
</tr>
<tr>
<td>2 A.) Weight loss &gt;5% in 2 months or B.) BMI 18.5 –20.5 &amp; impaired general condition or C.) Food intake 25–60% of normal requirement in preceding week</td>
<td>2 Major abdominal surgery; Large area or deep wounds, Stroke; Hematologic malignancy; Pericarditis; Pancreatitis; Oncology with concurrent chemoradiotherapy;</td>
</tr>
<tr>
<td>3 A.) Weight loss &gt;5% in 1 month (&gt;15% in 3 months) or B.) BMI &lt;18.5 &amp; impaired general condition or C.) Food intake 0–25% of normal requirement in preceding week</td>
<td>3 Multiple traumatic events; Multiple fractures; Major burn; Head injury (GCS 3–8); Poor wound healing; Bone marrow transplantation; Peritonitis; Intensive care patients (APACHE&gt;15); Severe sepsis.</td>
</tr>
</tbody>
</table>

Table 7.1: English Translation for Computerised Nutrition Screening for Admitted Adults Patients
subscription rate and meet the requirement of hospital accreditation, the design of automatic meal subscription was adopted. When doctors prescribed diet orders through CPOE for patients admitted, the system automatically subscribed meals.

Two head nurses had similar accounts describing that automatic subscriptions design was for the audit purpose.

(Automatic) meal subscription is because the hospital accreditations require for 40% of subscription rate among hospitalised patients (Case study/ HN10).

HN4: In order to meet the subscription rate, it (the system) subscribes hospital food without exception….
I: How was the result?
HN4: For the period of accreditation, it was higher. Now it increases about 5%.
(Case study/ HN4)

Only one focus group described automatic meal subscriptions at the end of discussions when they reflected how computers influenced their practice. They described this design was audit purpose and had increased subscription.

C3: This was because of the JCI (Joint Commission International) accreditation. It required a certain percentage of subscription rate. Therefore, it came out of this system design…
M: Why?
C2: For hospital accreditation purpose.
C3: It seems that the accreditation has the criteria regarding the assessment of hospital restaurants…At least, the computer’s automatic subscription made the statistics reports look better. Because of this consideration, the system subscribes directly. Otherwise, in the past, we subscribed hospital food for patients only when they requested…It does increase the meal subscription rate.

However, both nurses and head nurses said that the design was troublesome because the majority of patients did not want hospital food. Nurses needed to cancel meals as soon as possible to prevent discrepancies in medical bills. The details regarding this extra work will be presented in Chapter 8.

7.2.3 System Set Rules for Work
In many focus group discussions, some nurse managers and software engineer interviewees described how rules were set for work through enabling or disabling certain system functions in order to achieve hospital goals.
For example, in terms of access control, one nursing executive from other hospital provided a similar account.

When designing a system, if you are concerned how staff would cope or download files, you can disable these functions [laugh]. So they can’t make a copy of file and take it home (Hospital F/ UM Manager8, Nursing).

Moreover, three of five focus groups (Group B, C, D) stated that doctors and nurses had to follow system design exactly in order to carry out patient services. Because of the limited access, some participating nurses described how they were needed to chase people in order to get a document re-printed. The extra work created by limited access will be presented Section 8.2.2.

In terms of computerised physician order entry system, doctors were not the research focus of this study. However, two software engineer interviewees still raised the control issue of computerised information systems. They stated that because of the limited quota based on the National Health Insurance policy, the prescriptions of doctors were limited by computerised information systems.

One informatics staff described that the hospital participated the global budget payment management of National Health Insurance. Because the quotas of total knee replacement surgery were almost finished in the first part of the year, the top manager hoped the computers acted as the guard to remind doctors how many quotas left. In the future, this control of prescriptions may become compulsory (Case study/ IT2, NI member).

Because of the National Health Insurance policy, now our system needs to carry out control in many ways to avoid the payment being eliminated afterwards. My colleague who is responsible for computerised physician order entry said in order to control the budget, the system would control doctors’ prescriptions….For example, our NHI claims team decides if this effect is serious, then they will request our system programme to do the control…Sometimes, this control involved healthcare professionals’ judgements. It had happened before…. (Case study/ IT1, NI member)

In terms of blood glucose meter with mobile network function, one nursing executive said in order to prevent any errors; she decided to turn off the keyboard function of wireless blood glucose meter. Therefore, nurses can only use scan patient identification bracelets instead of typing their ID numbers in spite of the fact that the scanner was not easy and sensitive to use.
In the beginning, we had keyboards allowing nurses to type in (patients’ ID numbers). When the keyboards were available, nurses always input patients ID themselves. So they often typed in the wrong numbers ...So I decided to disable the keyboard function which force staff to scan the bracelets ...If you don’t turn the keyboards off, they always input by themselves and tell you it’s difficult to scan (Case study/ UM Manager1, Nursing).

One head nurse, involved in development of computerised information systems for nursing practice and administration purpose, praised the effectiveness of fool-proof design in completely satisfying the criteria of hospital accreditation.

…This is about the criteria of hospital accreditations. Through this design, the requirement of hospital accreditation will be met. For example, within 8 hours, the completion of assessments will be 100 percent without any problem (Case study/ HN6, NI member).

This head nurse further described that staff access would be locked if they did not complete pop-up windows.

M: What do you mean by lock up? It means you can’t access patients’ accounts. The system doesn’t allow you to access them (Case study/ HN6, NI member).

Therefore, through the perspective of system users, Focus Group D nurses explained that computerised information systems would keep pop-up windows until they complete the tasks.

D4: You have to do it, so [pause and laugh].
D3: For example like our discharge nursing assessment, discharge planning, admission nursing assessment, if you don’t finish them, the system would keep popping these windows up, keep popping them up to remind you.
M: So this is what you mean by you have to do it?
D3: Yeah!
D4: Yeah.
D5: You can’t win!

They also discussed the feature of highlight colour acting as the similar function and being chased by their colleague.

D3: If you don’t do it, your colleague on next shift would chase you. Because the screen would show in highlight colour, for example the discharge nursing assessment, it would keep highlighting your patients’ names in red if your work is incomplete.
7.2.4 Summary
This section examined how hospital management was a “system” to perform. The findings showed how the process and workflow of clinical practice were changed by computerised information systems in the case-study hospital. Through the system design strategies and automation feature of computerised information systems, the hospital management predetermined how and what tasks should be performed, by whom and in what time frame. As long as computerised information systems were continuously operated, these mechanisms set by the hospital management were always applied to clinical practice, because these controls were built into the system.

7.3 Information Transparency and Management
This section presents how computerised information system increased information transparency and its influence on hospital management. A number of features of computer technology were cited as information transparency will be presented in sequence. How the computerisation process increased the front-line nurses’ workload by inputting data into computers will be presented in Chapter 8.

7.3.1 Legibility
Whilst asking the question about the impact of computerisation on nursing practice, four out of five focus groups described legibility of computerised physician order entry benefited them when carrying out prescriptions. Nurses raised the issue of the difficulty in recognising doctors’ handwriting and felt that clear prescriptions prevented the possibility of errors.

B3: In the past, the prescriptions were handwritten. Some doctors’ writing was ugly and difficult to recognise. After computerisation…
B5: [Interruption] less errors or mistakes.
B3: I think it’s more convenient.
…
B4: Easier to understand.

E4: In the past, doctors’ prescriptions were all handwritten. Sometimes it looked like drawing pictures, really can’t understand what they’d written down [someone laugh]. Now computerisation made them clear and definite to understand. It also can show which doctor prescribed? Who carried out the orders? If there is an error, it allows you to track back to find out who checked these orders and to ask about. Yeah, it made these things very certain.
E2: Have fewer worries!
On the contrary, only a couple of nurse manager and software engineer interviewees described legibility of prescriptions and medication safety.

By hand writing sometimes is not clear. A different letter sometimes could mean different things. It’s very dangerous (Case study/ IT1, NI member).

The biggest benefit of CPOE is free of illegible handwritings. You are very clear what medicines they are (Case study/ HN10).

7.3.2 Easy Retrieving
Both nursing participants and managers perceived that retrieving information from computers was convenient and easy by just a keystroke and saved time by not flipping over paper documents.

Three focus groups described retrieving patient information from computers was easy. For example, Group A discussed the computerised information system provided much information and it was as easy as the snap of a finger to retrieve patients’ records.

A6: Computers got much information.
M: For example?
A6: Like pressure sores, any insertion of lines, or [pause]
A5: What medications administered.
A6: Yeah……If you want to check the past laboratory data, you only need to move your finger. You’ll know how your patients’ blood glucose levels were.

C3: Laboratory reports were usually printed on papers. Sometimes pieces of paper disappeared. After computerisation, we can retrieve the results from the computer database directly….

Similarly, some managers perceived that retrieving information from computers was quick, simple and easy, compared with flipping over pages of paper records. Besides patient information, managers perceived that easy retrieval of information was helpful in their administration management.

For example, one nursing executive described easy retrieval and information transparency as being helpful to management. The details of information transparency will be presented in the following section.

It helps with the management aspect. In the past, we needed to check paper-based documents. Now you can retrieve a lot of information in front of the
computer. For example, you want to know nurse-patient ratio, occupancy rate, and diseases in a particular ward, you can know this information when turning on computers (Case study/ UM Manager1, Nursing).

I remembered one time I was asked by the examiners of hospital accreditation. They asked me how do you know your staffs’ in-service education information. I only need to login the system and can retrieve information for individual staff or for the ward. In the past, I needed to flip over documents one by one. Now I can use the system to retrieve things by clicking the staffs’ names. Workshops’ names and hours were clearly understood at one glance (Case study/ HN4).

One advantage is when you need to search prescriptions, you can retrieve these items conveniently by searching computers, rather than flipping over patient charts. I think this really helps (Case study/ HN10).

In addition, some focus group participants also perceived other benefits of easy retrieval such as searching drug information and being free from scrambling paper charts.

For example, one focus group and one head nurse said that easy retrieval of drug information by searching under a keystroke was helpful to medication safety. The junior nurses of Group A described how drug information system was convenient to them to understand new medications. The senior nurse described this because they were familiar with nursing practice, this feature was helpful to junior nurses in particular.

A1: In the computer system, if you aren’t familiar with a particular drug, you can search its effects immediately by clicking its name when you check (computerised) prescription orders. It shows you its appearance and effects.
A4: It’s convenient. …Usually senior nurses already knew medications’ effects, uses, and side effects. But junior nurses maybe don’t know. So when they check medications which are unfamiliar, they can search them through the drug information system immediately.

Our drug information system is very good. You can click it (medications) to check its appearance. Through that system, you can make sure whether it’s correct. It helps in medication safety (Case study/ HN10).

Similarly, one nursing executive from other hospital also described how drug information system was helpful to junior nurses, in particular for medication safety purposes. Her hospital adopted PDAs. The drug information system in PDA updated daily enabled junior nurses to check drug information immediately for medication safety.

…For junior staff, it’s impossible to ask them back to a nursing station again and again for medication display board before administering medications….Sometimes the display board didn’t update in time. It’s possible
that medication errors could happen. …So we used PDA. We updated drug information daily. If there was unfamiliar medications, staff can check their appearances immediately through their PDAs at patient bedside …(Hospital E/ UM Manager7, non-nursing, Ex UM Manager Nursing).

Several nursing managers and two focus groups of nurses mentioned the other benefit of easy retrieving patient records from computers meant staff were free from scrambling patients’ charts.

Two focus groups formed by general medical and surgical ward staff had similar discussions that computerised information system save their time from scrambling with charts with doctors.

C1: …Now we don’t need to scramble patients’ charts anymore…
C2: Doctors need charts. We need them, too.
C3: We used to scramble charts. Doctors need them to prescribe orders and write progress notes. We need them to write our nursing records. We used to scramble for charts in turn.

E3: Now we don’t need to scramble for patient charts. Not necessary anymore. …Waiting for charts was troublesome.
Everyone: Yes [rising tone] !

One nursing executive described how computers were easy for retrieving patient information as long as they were accessible.

…every healthcare professional can read patient records wherever computers are available. No one needs to rush to grab paper-based patient records (Case study/ UM Manager3, Nursing).

One nursing informatics practitioner from another hospital described the responses of staff nurses after computerisation. One feedback was senior nurses perceived computerised information system saved them from scrambling for patient charts.

…Even for the senior nurses who are afraid to use computers, they think this is good because of saving them from scrambling paper charts (Hospital C/ Nursing Informatics Practitioner 1).

Easy retrieval saved nurses from scrambling with patient charts. However, because of limited computer numbers, all of five focus groups described how now needed to scramble for computers. The finding of queuing for computers will be presented in Chapter 8.
7.3.3 Transparency of Activities

Many managers perceived that computerisation made information transparent which benefited their managerial work greatly. They often used the phrase ‘understand at one glance’ to describe the degree of information transparency.

For our storeroom management, it (computer) helps a lot …It makes storeroom management easier to undertake. In a short period of time, you can identify at one glance where the problems are … (Case study/ HN3, NI member).

Taking the stock daily statement as an example, I check it everyday. The stock quantity and flow were clear to understand at one glance …If I find any problems, I can login the system to retrieve information … (Case study/ HN4).

I think that computerisation is beneficial to managers. They can see the overall information. It’s impossible to flip over pages of documents and collect information. But using computers, all information can be scooped up. For managers, it’s good points … (Case study/ IT1, NI member).

Section 7.2.1 presented how the hospital reinforced the accountability of users through automatic logout design. By recording any changes made by any staff, computerised information systems increased the transparency of staff behaviours. Many managers perceived this was helpful in identifying what users did and carrying out further investigations if necessary.

One advantage in computerisation is that every step on the system can be recorded. Unless our database is burnt, I think everything will be recorded (Case study/ HN3, NI member).

If you make any changes (in the system), you can see the records. Every change and time is recorded clearly. It’s easy to track back who makes these changes (Case study/ HN5).

The advantage is that the system has every record. If you need to investigate something, it is very clear (Case study/ HN10).

Only two focus groups described the information transparency as helpful when they needed to track back prescription orders.

E4: In the past, doctors’ prescriptions were all handwritten. Sometimes it looked like drawing pictures, really can’t understand what they’d written down [someone laugh]. Now computerisation made them clear and definite to understand. It also can show which doctor prescribed? Who carried out the orders? If there is an error, it allows you to track back to find out who
checked these orders and to ask about. Yeah, it made these things very certainty.
E2: Have fewer worries!

C3: When you need to investigate the missing prescriptions, it’s easier to track back, you know…

7.3.4 Statistics Analysis
From nursing executive to head nurses, many perceived that the statistics function of computers saved their time on manual calculations.

For example, nurse managers stated,

Computers save our time on manual calculations (Case study/ UM Manager3, Nursing).

In the past, we needed to do manual calculations to understand our ward dynamics. Now we don’t need to. It’s an advantage of the computer…We usually needed to carry out quality audits and manual calculations using Excel at the end of each month. It’s not necessary anymore. After inputting data into computers, the statistic reports will come out. It’s very convenient. For management and surveillance, it helps a lot (Case study/ UM Manager1, Nursing).

You can use computerised information system to do statistics analysis, efficiency analysis, further management, and investigate its causes (Case study/ HN3, NI member).

They described how the statistical analysis of computerised information systems benefited managers’ further surveillance and control. For example, when one software engineer interviewee described the benefits of computerisation brought to the case-study hospital, she explained,

In computerised information systems, it’s particularly easy for managers to retrieve information and statistics results. Much information can be retrieved by just one keystroke. It allows managers to control the overall condition … (Case study/ IT2, NI member).

7.3.5 Real Time
Nursing executive interviewees perceived that the feature of real time of computerised information system was helpful to them to make decisions and management immediately.

It’s very fast. You can read the statistics reports (from computers)
immediately. …It allows you to make decisions and management in time (Case study/ UM Manager1, Nursing).

Similarly, one nursing executive from other hospital shared the same viewpoint.

A head nurse is on a ward round at 8 o’clock. If the ward dynamic report can come out in time, at the same time, then the head nurse can note the patients’ conditions….I think the most important feature is real-time. It produces efficiency (Hospital F/ UM Manager8, Nursing).

7.3.6 Surveillance and Control

As discussed earlier, computerisation increased information transparency of staff behaviours and provided statistical analysis in real-time. Meanwhile, it was easy for retrieving information from computer databases. The accounts of nurse managers and software engineer interviewees revealed that all these features wove together to enable managers to understand what had happened and make further management decisions.

For example, one nursing executive described the newly developed nursing human resource management system. She compared how head nurses on duty managed nurse-patient ratio before and after using this system. She stated that this system provided the overall nurse-patient ratio of each ward in real-time and allowed head nurses on duty to make any adjustment immediately.

We have nursing human resource management system now. For example, head nurses on duty can have an overview of patient numbers and nurse-patient ratio of each ward …If the ratio is loose, they would tell charge nurses to make adjustments. If the ratio is tight, we’re concerned about whether staff nurses are very busy…In the past, it was a different story. Head nurses visited wards one by one. If one ward was busy in particular, they didn’t know the situations until visiting ward units because they even didn’t have time to ring head nurses to tell …(Case study/ UM Manager1, Nursing).

Some nurse managers who were head nurses described receiving statistics reports regarding ‘abnormal operations’. They needed to investigate these events and filled in any missing information.

Head nurses received email notices. You need to investigate these incidents. I spend a lot of time on manage those ‘abnormal operations’ everyday (Case study/ HN4).

Now information is prolific. We receive the statistics reports everyday, such as missing prescriptions for blood glucose tests, returns of specimen, patients
without meal subscriptions. We need to investigate these events in time….(M: Where do these statistics reports come from?) From the computers. The statistics reports identify any missing parts and we need to do further management (Case study/ HN10).

7.3.7 Summary
Both staff nurses and managers participating in this study perceived the feature of information transparency of computerised information systems differently Most participating nurses reported the perceived benefit of legibility when using computerised physician order entry. Many of them felt easy retrieval was convenient when searching patients’ information and saved them from scrambling through paper charts. Some discussed the benefits of information transparency in their nursing practice. Conversely, many nurse manager and software engineer interviewees reported their perception that computerisation was very beneficial to their manager roles and hospital management. They provided many more accounts of the benefits than the staff nurses. Managers described the computerised information systems as providing overall information via real-time statistics reports and allowing further surveillance and control.

7.4 Nurses’ Perception of Influences of Computerisation on Their Work
When discussing the influences of computerisation on nursing practice and management, several nurse managers and participating nurses described the computers as having pros and cons. Their accounts revealed conflict perception. Therefore, Versus coding (Saldana, 2009) was applied to unify their perception.

Informatics, this stuff has pros and cons (Case study/ HN4).

A6: It (computer) has pros and cons.

7.4.1 Efficiency VS. Being Trapped
When discussing the influences of computerisation on their work, all the focus groups agreed that if the operations of hardware and software were normal, the computer was efficient. They used the terms of “convenient, fast, and timesaving”.

C1: Although there is grumbling, I think so far computers are pretty good for efficiency in particular. I think this point is not bad.

D1: It’s pretty convenient. But when a computer crashes, it becomes cumbersome.
E3: Computerisation, I think, it accelerates our work.

          
E2: It’s good, as long as no computer crashes and we have enough computers.

Nursing participants perceived they could execute interventions and prescriptions for patients immediately because of reducing waiting time.

A4: The most important point is reducing waiting time. So you can give your patients interventions immediately.

B4: Computers save a lot of time for us.
B5: We can spend more time on patients because no need to back and forth between chasing laboratory sheets, prescriptions, medications. The information can be known faster. Interventions can be carried out faster.

C3: When checking prescription orders …we can carry out prescriptions more efficiently. Moreover, if we are very busy, we check computerised prescriptions, we know we definitely can receive medications from the pharmacy, no worry. In the past, for example, the time between a verbal prescription and carrying out the practice, you needed to wait for a long time.

On the contrary, four of five focus groups had experienced the situations that their practice was interrupted by both hardware and software problems. They explained that the function of computerised information systems influenced how their clinical practice was conducted. The phrase ‘cannot move’ was often used to describe the situations when their work was interrupted in the middle because of a computer crash, system bugs, and printers’ out of order. The influences of computerised information systems emerged during the time when the computerised information systems were out of order.

They stated nursing practice would be interrupted if the printers were out of order. For example, Group D described how printer out of order had delayed their work.

D5: …You don’t know when the printer is out of order. It just suspends there….When you realise this issue, everything is like…Oh! [vocalized roaring]…
D1: [interruption] it’s about printers. Because many things are not printed out, our whole work will be interrupted.
D3: [interrupted] just cannot move…If printers don’t print out, we just cannot move.

Furthermore, the issue that computer crashes affected clinical practice was raised by them. For example, Group D participants discussed,
C1: When the system crashes, many things cannot be carried out. Doctors cannot prescribe, discharge procedures cannot be carried out…There was one time, we were busy on discharge patients.

C3: [interrupt] then the computerised information system just crashed at that moment.

C1: So we couldn’t carry out discharge procedures. So everyone was waiting.

C2: [interrupt] waiting in vain.

C1: Yes, waiting in vain. At that moment only thing everyone did just sit and wait for the informatics department saying OK …So we can start…

C3: [interrupt] to continue our work.

Nurses perceived that the interruption of computerised information systems could suspend nursing care and delay patient interventions. Consequently, in order to meet patient needs, most of nurse participants developed a series of coordination work and troubleshooting which will be presented in Chapter 8.

Similarly, a few head nurses and nursing managers described the interruption of clinical practice resulted from computerised information systems.

When the printers were out of order or computer crashes, even in 30 minute time already made us feel distressed. Many treatments cannot be prescribed…because it’s all computerised (Case study/ HN5).

…Without it, you cannot do anything. Without it, there’s nothing you can do (Case study/ HN10).

One nursing executive from another hospital stated the similar circumstance.

…Our ward log was computerised using Visual Basic by our nursing department. When the system bugs happened, because of unfamiliar with this programme design language - the staff of informatics department didn’t know to fix it. When they didn’t know how to fix the system bugs, the operation of wards would be interrupted consequently… (Hospital E/ UM Manager7, non-nursing, Ex UM Manager Nursing).

7.4.2 Reminder VS. Information Overload

In terms of the design of pop-up windows and highlight colours, nurse participants from three focus groups perceived that this kind of fool-proof design (Section 7.2.2) had a reminder function for timely assessments and patients’ special condition.

Group B discussed that when patients needed contact isolation, the pop-up windows reminded them when they first click patients’ names during their shifts.
B3: After clicking patients’ names (on the screen), if anyone needs contact isolation, a small window will pop up to remind you that this patient needs this safety procedure. I think it’s good.
B5: It reminds us to pay attention to it.

Similarly, Group E discussed that pop-up windows reminded them to do the assessments, such as medication allergy reactions.

M: What do you think about pop-up windows?
E3: When you first click that patient’s name (on the screen) in your shift, it will pop-up...actually It’s OK.
E2: It reminds us to do assessments.
Everyone: Yeah.
E4: To remind us to do timely assessments.
E3: Assessment of medication allergy is another example. It reminds us to check it.

Group D participants emphasised that pop-up windows were helpful during the busy time and for unfinished practice in particular.

D3: …If you forgot to click the assessment of blood transfusion reactions. Another example is the discharge planning in the computerised information system. Sometimes you forgot them during your shift because cause you’re too busy. When your colleague in the next shift clicks patients’ names and the window pop-up, they also reminded you to finish it.

While the design of pop-up windows and highlight colour in system interfaces were perceived to have the reminder effect of nurses’ work, this did not mean that all front-line nurses as the role of users constructed it whole positivity. Three focus group participants recognised the disadvantages of information overload and work disturbance resulted from frequent pop-up reminders.

For example, two focus group participants described that there was a tendency to click “yes” without careful reading the window messages.

C3: You will feel like just keep clicking and passing through…

Group B nurses also described how the computerised pain assessment window still popped up when patients just received surgery and had not recovered from anaesthesia. They expressed that carrying out pain assessment at that moment was difficult and lead to them finishing the assessment carelessly.
B3: …Now our pain assessment is computerised, too. When patients are admitted to our ward, we need to finish it in computers. But this part is a bit difficult because at that moment it’s usually that patients’ conscious are unclear and their conditions are urgent. We just tick carelessly such as none or no any pain problem.

B5: Because most of them just received surgeries and haven’t recovered from anaesthesia completely yet.

Besides nurses’ user experiences, a couple of nurse managers and one of the software engineer interviewees also had similar perspectives. They also described that excess reminders could result in information overload and the opposite effect that users click ‘yes’ carelessly without reading the messages of pop-up windows. One software engineer (Case study/ IT2, NI member) described how many pop-up windows were applied in the systems to disseminate messages. He stated that frequent windows made the users felt tired of these messages and felt these were not important. As a result, users may click these windows carelessly. He gave the example that the pain assessment still pop up to anaesthesiologists when patients were anesthetised.

M: You mentioned that pop-up windows would interrupt workflow. How do your ward staff response based on your observation?

HN6: So some people habitually skip them because they felt these were troublesome (Case study/ HN6, NI member).

I think some people just see them as obstacles and click ‘yes’ without reading them… (Case study/ HN10).

Group D with paediatric ward nurses perceived the frequent reminders were cumbersome when they already knew patients’ specific conditions. Like the other focus groups, they described pop-up windows reminded them when they were very busy and forgot things (Section 7.2.2). However, frequent pop-up window reminders annoyed them as they already knew their patients’ particular conditions and this disturbed their work progress. They gave the examples of reminder of medication adverse history and contact isolation intervention. The participants suggested that such reminders would be enough once every shift rather than every time clicking that patient’s names.

D1: Our ward has many patients with medication allergies. I think it’s [pop-up window] supposed to show up just one time a day. Because every time we log in this patient’s name, it just continuously keeps popping up, keeps popping up…

D3: [interrupt] Very troublesome!

D1: Yes. Because it’s like if you click this patient 10 times, it will pop-up…
D3: For 20 times.
D1: Yes, 20 times.
D3: Yes, then you have to close it [the window] 20 times.
D1: Yes.
M: So you mean…
D1: This patient has a drug allergy history, we knew that. Since doing admission nursing assessment, we’ve known it. I think that one time a day is enough. But now it’s like I log in this patient 10 times, it shows up 20 times. I think that it not necessary to keep reminding us, we knew that.
D4: Isolation intervention is the same
D1: Yes.
D4: For example, reminder for patient with contact isolation intervention. Every time you click that patient’s name, it will remind you again.
...
D1: You felt hindered by it. It also affects our work progress.

Two head nurses had the same viewpoints that pop-up windows disturbed nurses’ workflow. HN10 described that whilst being useful reminders for those who are unfamiliar or new, such a design was troublesome for nurses who were familiar or senior because of wasting time and delaying work as Group D nurses described earlier. However, the rigidity of system still show up regardless who were the users.

We have something we are reminded of by pop-up windows. Sometimes I think reminder windows are necessary. Sometimes I think it’s very annoying, when you already clearly know what to do and then these windows remind you again. You feel that they waste your time… When you are familiar with your work, pop-up windows really delay your time. I think this kind of window is helpful for someone who is unfamiliar or a new staff nurse; pop-up windows can tell what requires attention next. But these things won’t stop popping up because you’re familiar with them. They stick there, you have to click them (Case study/ HN10).

HN10, who was involved in the development of computerised information systems and favoured the usage of fool-proof design, described frequent pop-up windows as ‘layers of check points’ which became barriers when manipulating the systems.

Once you log in the system, it is like layers of check points. If the assessments need to be completed every shift, the system automatically and regularly pops them up for you to carry out them. I think this is a fool-proof way. But, your work will be interrupted at the same time. This is not a good feature. But without other means, they have to be done (Case study/ HN6, NI member).

Despite the disadvantage of disturbing workflow, HN10 asserted that achieving hospital goals and avoiding any omissions were more crucial than unhindered workflow.
They show up one by one. Because these are important to hospital accreditations, the advantage is at least there won’t be any missing. It’s got pros and cons. It hinders your work, but prevents you from making omissions. The problem of missing something is more serious. If you finish these, they won’t show up. So it’s fine (Case study/ HN6, NI member).

7.4.3 Reference Resources VS. Binary Decisions

Four of five focus groups’ accounts showed that on the one hand standardisation of computerised care plan provided a reference resource for their practice. On the other hand, they affected the provision of individualised care and their thinking.

Two focus groups (Group A, Group C) discussed that computer provided a general reference which could act as a basis for their practice.

C1: Handwritten care plan, sometimes you haven’t got any ideas. A computerised care plan system is very convenient. You click the disease, then you can have a general understanding (about interventions). It can help you to associate or give you a basis as to what potential nursing problems patients might have.
C2: They show you what to do.
C1: So you’ll have a reference.

However, one senior nurse mentioned this function benefited junior nurses more than senior one because senior nurses had sufficient working experiences.

A4: I think computers are the thing but if you’ve practiced in clinical care for a long time, what treatments and interventions you are supposed to give are all in the senior nurses’ heads, because you’ve worked for a long time…I think (computers) this thing is more helpful to junior nurses, new nurses.

Three of five groups stated that when using computerised information systems, nurses’ role was to make a choice. For example, Group B participants described how they perceived the influence of computerisation in their nursing judgement and their discussions also illustrated the group dynamic.

M: Do you think that computers affect your thinking? Such as nursing judgement?
B2: No.
B3: Yes.
M: How to say?
B2: I don’t think so.
B3: I think it will. For example, our care plan. In the college, we learnt that ‘Difficulty in Breathing’ and ‘Ineffective Breathing Pattern’ are different (nursing diagnoses). But when we work and plus computerisation, we just choose one of them randomly. As long as patients received intubation, we
just randomly choose one of them, depends on which one we read first (on the screen) then we just choose it. Actually their definitions are different. So (computerisation) it affects our thinking.

B5: Computers standardise things. It can’t meet individualisation, but nurses can provide individual care depending on patients’ needs.

B4: Many things have become standardised. Computers already set them up. So we just choose from them, that’s all. But in this way, it decreases the part of providing specialised care we can give for patients.

M: How the other people think?

B2: After listening to your ideas, it seems it’s like this way.

B5: It does, doesn’t it?

Nurse C1 clearly described the difference between handwritten and computerised care plan and how these two styles influence her nursing care provisions. She also perceived that work efficiency was valued, even by patients.

C1: When care plans are handwritten, I got to squeeze my brain to think what I can do for the patients. But when it is computerised, it becomes [pause] pick and choose to do it, ‘cos (computer) it gives many choices. Then, I was like, do this one would be enough. So when it is open and blank, I got to think very hard what can I do. I think the ways of nursing care are a bit different...I think that the open and blank style would have individualisation. But if (we got computerised care plans) let me choose [laugh], it’s more efficient. The difference is here. But there is no way to deal with it, now we think it’s really efficient, even the patients value it too.

Three groups reported that when the contents of computerised nursing care plan cannot meet patients’ needs, they tended to choose a similar one as a substitute. For example, Group B discussions above described they randomly choose a similar one. Group A also described that they chose a similar one. Group C stated they finished the work without attention to details.

A6: ...When I’m in a hurry, no matter how I search (computerised nursing care plan) [elevated tone], I just can’t find the right disease ...Can’t find the right one!

M: In this situation, what would you do?

Everyone: Find a similar one (as an alternative).

Four of five groups raised the issue that individual need of patients could not be met. The rest of one group perceived that computers and care are not related. Care is care, a computer is a computer.
In terms of nursing managers, only one nursing manager described her perceptions that whilst ticking and choosing interface of information systems simplified documentations, it also simplified patients’ individualisation and nursing speciality.

**7.4.4 Summary**

By versus coding (Saldana, 2009), this section presented the conflict perception regarding the influences of computerisation by participating nurses and some manager interviewees through the user role perspective. Firstly, nurses perceived that the computerisation facilitated efficiency of care delivery whilst clinical practice was vulnerable to computer and printer issues. Secondly, they perceived that interface design of pop-up windows reminded them of those unfinished tasks and also led to overload of information whilst manipulating patients’ accounts on the system. Thirdly, they perceived that the standardised contents on the computerised nursing care plan system provided reference information for patient care. Whilst nurses perceived the choosing and ticking method was convenient, they also perceived this method affected their thinking, judgement in identifying the best care plan for patients.

**7.5 Summary to the Chapter**

As reviewed in Section 2.5.2, information system management literature suggests that adopting information technology enables organisational change. According to Table 2.4, the findings chapter showed that the case-study hospital applied computerised information systems to enable two changes: (1) automation and (2) business process reengineering. Furthermore, the findings showed that the case-study hospital adopted the concept of business process re-engineering into the following information systems and changed the practice: (1) Computerised Physician Order Entry, (2) Blood Glucose Meters with Mobile Function, and (3) RFID-based Porter Management System.

This chapter showed that computerised information systems were able to organise the clinical practice process in a systematic approach were based on the goals of hospital management. The findings of cyber jurisdiction in Section 7.2 showed that through the system design strategies and automation features, computerised information systems were able to directly control the process of work performance by set desired criteria within the system. Computerised information systems structured clinical performance by different kinds of system-design strategies. Each step of clinical performances was pre-planned, pre-calculated and built into the computerised information systems to achieve the hospital management goals. Moreover, the findings of information-transparency in Section 7.3
showed that computerisation increased the visibility of clinical activities which subsequently facilitated managerial direct control over each steps of job performance. The findings reported by participating nurses and nurse managers correspond to the two distinct features of Taylor’s core concept described in Section 7.1. Thus, a Tayloristic manner of working is reinforced by the application of computerised information systems.
Chapter 8: Hidden Work

8.1 Introduction

In this chapter, Wadel’s (1979) concept of hidden work was applied to theorising and unifying participating nurses’ coping strategies for computer technological breakdown and mitigating solutions for the inconvenience the implementation process caused. The concept of hidden work (Wadel, 1979) has broadened the concept of work. Wadel (1979) defines hidden work as unrecognised working activities which have major characteristics of work and are not called work. These unrecognised activities have three distinct features: contingent, indirect efforts vaguely linking with formal work, and occurring in everyday life. Therefore, due to these attributes, hidden work is easily regarded as a natural progress of events rather than work (Wadel, 1979). While many activities directly related to production of socially valued goods and services are widely recognised as work, Wadel (1979) argues that it is necessary to give these unrecognised everyday activities both active and functional notions.

It has been identified that the concept of hidden work may illuminate the nature of nurses’ coping strategies. These activities reported by nurses in this study were unrecognised, unrecorded, and context-related contingencies. These tasks appeared to be vague, trivial and difficult to quantify, but were connected with patient care-service provision. Moreover, participating nurses carried them out naturally as part of their everyday practice.

This chapter presents how computerised information systems created additional often invisible work burdens and influenced front-line nurses’ care delivery. Section 8.2 examines how nurses take care of problems caused by computer hardware and software. Section 8.3 presents how the process of computerisation implementation placed additional and unexpected workload on nurses in order to achieve the organisational goal as a whole.

8.2 Caring for Computers

As described in Chapter 7 Section 7.4, while normal operation of computerised information systems enhanced work efficiency, computer crashes and printer out-of-order made nurses feel trapped and influenced nursing care. As a result, most participating nurses described taking on additional roles involving taking care of computers and printers in order to provide patient care. One participating nurse described how her colleagues and she were busy between patients and computer systems. In addition, nurses duplicated their
work spending time on both paperwork and computer systems. Therefore, the metaphor “caring for computer” was developed to convey the concept of extra work carried out by participating nurses after computerisation.

D5: So far, we need to take care of paper sheets printed, to take care of computer prescriptions, and then go to the bedside to proceed with these prescriptions. It means that you’re coming and going in between…The difference between now and then is that, we only needed to take care of paperwork in the past. Now we spend time on both computers and paperwork…

Section 8.2.1 presents hardware and software problems which front-line nurses participating in the study encountered. Moreover, the case-study hospital had developed the coping procedures for computer crashes. How participating nurses perceived those official coping procedures will be presented in this section. By contrast, participating nurses developed a series of alternative actions and described their preferred ways. Their coping strategies were analysed and classified into two categories: intangible coordination and troubleshooting, which will be detailed in Section 8.2.3 and 8.2.4.

8.2.1. Context of Caring for Computers

- Immediate Needs

Most nurses reported that they experienced computer crashes and printer out-of-order which interrupted their care practice. They described their need to manage those problems to provide patient care because they encountered the strains of meeting patients’ needs at the same time.

Two groups of nurses working in intensive care units described the strains of giving interventions promptly. For example, during the discussions, Nurse A6 described how they managed computers and printer problems in order to execute doctors’ prescriptions regardless of patients having urgent conditions or not.

A6: It’s not really for urgent conditions only. When doctors prescribed medications or laboratory tests, it means you need to execute these interventions. If they (computers) are broken at this moment, then you need to spend your time to deal with them…

Two out three groups of nurses working in general wards had experienced pressure from prolonged patient waiting-times. For example, Nurse D3 described how she was busy going and coming between chasing the informatics staff and facing patients’ pressure..
D3: It’s a very common situation that during the time of processing patients discharge procedures, computers are dead and printers are dead. We spend time on chasing the engineering department, the informatics department. They reply they are investigating. Then the time is passed. On the other hand, patients grumbled at the same time saying why is it taking you so long to deal with discharge procedures …..

Similarly, Group C nurses described the same experience.

C3: Patients would press you saying, “Oh, miss, I want to be discharged”…
C1: That’s right [laughs].

• **Computer Crash**

All five focus group participants described the experience of computer crash caused by either predictable or unpredictable availability. They stated that sometimes the computer systems were suspended for 30 minutes because of the routine generator tests and system maintenance. Those events were usually arranged late at night and could be identified beforehand through email announcements.

A5: …Sometimes, the computers will crash because of the generator test. They will tell you beforehand when computers cannot be used…
A6: So far we haven’t encountered a severe computer crash. It’s usually because of routine maintenances…Usually it doesn’t take too long.
A1: Yes, not too long.
M: How long does it take?
A5: About half an hour.
A6: It often takes place on the night shift, because the night shift has fewer treatments.

Four out of five focus groups experienced unpredictable computer crashes resulting from central operating system failure which meant all computers were unavailable. Moreover, as presented in Section 6.4.2 Grumbling, nurses revealed their emotions during a computer crash or if printer was out of order. When asked about the influences of computerisation on their work, two focus group participants raised this issue immediately. Two groups (C & E) used the term “very miserable” to describe a computer crash scenario. One group described a computer crash as “cumbersome”, another group (D) said “hindering”.

In the Group C discussions,

C3: A computer crash is miserable.
Similarly, Group E participants described when no computer was available due to system crash; it was also a “miserable situation” for them.

E3: …A computer crash is really miserable. When the central system fails, you’ll know it. Everyone cries aloud.
M: Have you encountered it? (Asked the rest of participants)
Everyone: Of course [rising tone]! [E2 answered louder in particular].

In Group D, nurse D1 described such a situation similarly and described their perceptions regarding the pros and cons of computer systems which is detailed in Section 7.4.

Everyone: [silence for few seconds]
D1: It’s (computer system) quite convenient. But, when the computer crashes, it hinders you.

• Insufficient Numbers

Moreover, participating nurses described the insufficient number of computers as being a more prominent issue during the day shift (8am to 4pm). When discussing the viewpoints of current hardware equipment, four out of five focus groups raised the issue of computer quantities, all except Group A. The participants of Group A were all working night shift (12mn to 8am).

Participating nurses perceived they were in the lowest priority of computer users comparing with the other healthcare professionals. For example, the accounts of Group D and E discussing the topic of insufficient quantities of computers revealed that staff nurses were in the lowest priority of computer users, behind doctors and nursing practitioners. For example, Group E participants described the computer quantities, the ownership and the priority of users during the day shift.

E3: Six nursing practitioners.
E4: …Six of them use six computers, one computer for each person.
E2: Six nursing practitioners, three doctors, and one secretary
E4: 10 people
E3: …We only have 11 computers.
M: So only one is available for you?
E3: (Smile) Yeah.

Furthermore, the types, allocation and quantity of computer hardware equipment also created extra work for nurses. How the computer quantity affected nurses’ time-
management will be presented in Section 8.2.2. How its type and allocation caused the duplication of nursing work will be presented in Section 8.3.2.

**Printer Problems**
Achieving the aim of a paperless and filmless hospital environment was one of goals for proceeding to fully-computerized patient records. However, paper-based patient records were still essential and primary valid documents because the legislation of electronic patient records was under review in Taiwan. The legislation progress was reviewed in Chapter 2. In addition, as described in Chapter 6, the case study hospital adopted the parallel implementation approach which used paper-based and partial electronic patient records in parallel during migration towards completely electronic patient records.

Despite the electronic patient records being created, modified, stored and retrieved through computers, healthcare professionals were required to print electronic records, sign their names and place those documents onto paper-based patient charts. One study conducting focus groups with front-line nurses in a hospital located in Taiwan reported the similar principles. Nurses are required to print out nursing documentations every shift with their personal seals, equivalent to signatures, as verification (Lee, 2008).

Consequently, printers played a crucial role but created a heavy workload. During the observation, the workload of laser printers was heavy. The printout records included prescriptions order sheets, laboratory test request forms, doctors’ progress notes, nursing admission assessments, nursing care plans, and discharge patient education sheets.

Many nurses raised the problem of the printer being out of order frequently. This was a prominent issue to them during the focus group discussions. Four out of five groups stated the printer was broken everyday. In addition, it was noticed that the group dynamics were agitated, when the topic was shifted to the printer issues. For example,

A6: The printers are often out of order.
A1: It seems that printer is out of order every shift…

E2: Oh, talking about printers, they are always broken [rising tone].
E1: Yes, they go on strike everyday.
E4: Yes.
Nurses described the common problems as being network disconnection, paper jams and poor printing quality. They explained that even when patients had immediate needs, they had to spend time on printer problems themselves.

D1: Sometimes the computers have no problem, but the printers have.
D3: Yes [rising tone].
D1: Dealing with it gives you a busy morning…Really, because it prints nothing out, this will cost you some time…
D3: It costs you at least one or two hours.

B5: How often is a printer supposed to have maintenance?
Everyone: [being excited, rising tone].
B5: We have to do it by ourselves.

Printer issues were an unexpected finding. Its importance to nurses’ work surprised the researcher because the reference to the printer issue in the literature is small and becoming paperless is one of aims for adopting electronic patient record systems in healthcare settings. How nurses coped and managed the limitation of hardware and software problems will presented in Section 8.2.2 and 8.2.3.

• Official Coping Procedures for Computer Crash

Official coping procedures for computer crashes were discussed by two focus group participants. It was noticed that senior participants in the groups knew that the hospital had developed official coping procedures for computer crashes; interestingly the other junior participants did not know of its existence. For those who knew the procedures, they explained those procedures were for hospital accreditation purposes. The procedures required staff to fill in paper-based forms and send them to administration staff. Nurses A4 and C3 both described the procedures which were for the hospital accreditation.

A4: It’s kind of like for the purpose of hospital accreditation. The hospital developed the coping procedures and the so-called emergency box full of paper forms.

C3: Yes, we have them (coping procedures). It’s for the situation of emergency blackout or a computer crash…You have to fill in those forms, bring them to the administration staff, and make several phone calls back and forth…When preparing for hospital accreditations, the hospital will keep reinforcing that if there is any emergency, how can you find those paper sheets, how can you go through these procedures. After accreditations, we just forgot them completely…
However, participating nurses said that in reality the official coping procedures had never been used. They reported that it was because no severe computer crashes had been encountered so far at the time focus groups were conducted. Another reason they explained was that for patients with urgent conditions, the wards had equipped emergency medications for cardiopulmonary resuscitation.

A6: It has never been used.
Everyone: [becoming restless]
A5: I remember one time we looked for the box’s location, but it still hadn’t been used, because the system recovered finally.

Moreover, they felt the official procedures were lengthy and complex. Therefore, for a short period of computer crash, they preferred to either adopt their ways as alternatives for patient care or contact informatics staff and wait for their services. For example, Group A participants described they felt the borrowing method was a quicker alternative. The details of borrowing method will be presented in Section 8.2.2.

A1: It (coping procedure) hasn’t been used.
A5: Most of the time, we just borrow alternatives, because borrowing is much faster.

For example, Nurse C3 described how the procedure was too troublesome to use. The other participants described that comparing with the lengthy official coping procedures, they preferred simple troubleshooting such as shut down and restart than waiting for the informatics staff in reality.

C3: …The procedures are very troublesome…They are too complex to remember, because there are too many….
C1: When the computer crashes, we often choose to ring the information department, then stay in front of computers trying to shut them down and restart. That’s what we do….
C3: …When you really encounter the situation (computer crash), you are just being foolish and have to wait for the informatics staff to repair it.

Although the case-study hospital had developed the coping procedures for computer crash, these participants felt that those procedures were rhetorical for audit purposes. Consequently, they preferred using their ways as quick alternatives to provide patients’ needs. Their coping strategies will be presented in Section 8.2.2 and 8.2.3.
8.2.2. Intangible Coordination

• Coping with Verbal Orders

As described in Section 8.2.1, comparing with the lengthy and complex official coping procedures, nurse participants explained that the borrowing method was a prompt alternative to maintain patient care.

Three out of five focus groups said that whilst patients had urgent conditions during the period of computer crash nurses accepted doctors’ verbal orders for medications instead. Because without computerised prescriptions, the pharmacy did not distribute medications, nurses borrowed medications from other patients as a quick, temporary solution until the system was restored.

For example, Group B nurses described the scenario of computer crash and how they cope with when patients had immediate needs.

B2: We had encountered computer crash once during our evening shift, because of system failure…no computers were working.
B5: Yes, a software system problem.
B2: Do you remember there was one new patient admitted (to our unit), we wanted to give a blood transfusion and medications. But we couldn’t execute these at all.
B5: Completely – couldn’t carry them out at all.
B2: …We only could wait for the system restored. The doctor only could give verbal orders. Then we asked our colleagues whether their patients used the same medications and borrowed from them urgently.

Group A participants also used the method to cope with computer crash.

A5: Sometimes the computer crashes because of the routine maintenance. If during that period of time, your patients need some urgent treatments and those prescriptions, that’s really troublesome.
M: How do you manage a situation like that?
A6: If nothing happens, the first method is borrowing. The second one is filling in paper form as a substitute.

In addition, one nurse expressed her concerns about blood transfusions and patients’ life, because this treatment could not have alternatives such as medication.

B5: So it is dangerous. For example, like a blood transfusion is completely computerised…If we don’t have the (printed) documents, we cannot request blood products. Medications can be borrowed, ‘cos other patients used the same medications. But for blood transfusion, it is dangerous. For emergency medications, they’re still manageable, ‘cos we’ve got the emergency trolley.
• Chasing People
When a computer crashes or a printer is out of order, nurses contacted the informatics departments. Focus group participants stated during the day time, the informatics staff usually arrived at ward in 30 minutes. However, four of the focus groups described that troubleshooting sometimes took longer. If the problems were unable to be solved on site, informatics staff usually brought a substitute device.

E4: ‘usually arrived within 30 minutes.
E2: ‘usually arrived within 30 minutes. But it doesn’t include solving the problems. They usually can fix them within one hour. If they can’t, they would bring us a substitute one.

In addition, if the computer problems involved a third party, nurses needed to act as principle coordinators to chase the other healthcare professionals. For example, every focus group stated that because their system authority was limited, they needed to chase their head nurses or doctors in order to re-print particular patient documents. For example, Nurse A5 described how she chased both the doctor and the informatics staff on duty, in order to obtain the printed blood transfusion sheet for her patient’s blood transfusion therapy.

A5: One night, my patients needed blood transfusion therapy…The doctor prescribed (on the computer) from the duty room. Usually, the blood transfusion sheet will be printed out from our printer (in the nursing station). It didn’t print out. Then I rang the doctor to check whether he had prescribed it. The doctor said he had. Because we nurses had no re-print authority, can’t re-print the blood transfusion sheet, then I said to him, “But the printer didn’t print out and I can’t print it out either, could you re-print it again for me?” Then the doctor said he/she re-printed it, but still it didn’t print out. So I called the informatics department and they replied “How can it be possible”. Then I asked, “Do you have any means to re-print? Could you print it for me?” Then they said they couldn’t. The IT staff said, “Ask your doctor to prescribe it again using a different computer”. Then I need to call the doctor again saying, “I’m very sorry, could you get up and come to the nursing station to prescribe it again on a different computer”. It was embarrassing.

Similarly, Nurse C3 explained that if a nursing admission assessment did not print out successfully, they needed to chase their head nurses.

C3: …At the time the admission nursing assessment just went online, we couldn’t re-print it. The system allows us to print it only once. At that time, the authority of re-print function was limited; the authority only belonged to
the head nurse and assistant head nurse. Then every time we printed the
documents, they failed, for example, the paper jammed, then we needed to
go to the head nurse for re-printing…

In addition, if nurses couldn’t carry out their practice further from computerised
information system because of doctors’ work, nurses also needed to chase doctors until
they completed their tasks. For example, Nurse D1 described that when proceeding
patients’ discharge procedures, doctors often forgot to execute a compulsory step called
“repertory of physician orders” from the doctor system. She described how nurses chased
doctors to complete it, in order to carry out patients’ discharge procedures in the nursing
system.

D1: We often encounter a situation where we carry out the discharge procedures
on Sunday …or maybe during the lunch hour, when doctors are around.
Before we close patients’ accounts for the discharge procedures, doctors
must complete “the repertory of physician orders”. But doctors often forgot
to do this step and just left (the nursing station). We often had the surgeons
leaving without executing this step. Because they didn’t complete this
process, we couldn’t close patients’ accounts for discharge. Then I needed
to phone him. Sometimes the doctor was busy, during a surgery, or
something else. Then it would delay our time for discharge procedures…We can’t carry out his action, (because) we don’t have that
authority.

D5: Yes!
D1: It belongs to the doctor’s order entry system. But we can’t log into that
system….We need to keep phoning that doctor.

• Asking Colleagues for Support

Each group discussed how they manage their time between patients and computers. In
prioritising caring patients and caring for computers, participating nurses described they
put patients’ needs first. Three groups stated they usually asked their colleagues who were
available to help with computer issues.

A6: (the time priority) is Okay, because it is impossible that all of 12 to 13
nurses on the same sheet are busy at the same time. If that’s the case, maybe
my patient needs a sheet and you are around it looks like you’re available.
(I’ll ask you) could you help me out with this computer…

Group B and C described how they ignored the problems until their colleagues who were
available could manage them.

B2: Yeah, whoever encounters computer problems, manages it. If it is a busy
time, then I’ll ask a colleague to help me.
B4: Some colleagues just ignore it. But next time, it still cannot print out. The next person still has to phone the informatics department.

C3: … [Laughs] if later someone is free-ish, then they'll phone the informatics department saying our one computer is broken.
C1: Yeah, yeah, yeah.
C3: Please come to fix it. When you are busy, you just skip it. [Everyone starts being noisy]. When you are busy, you just pretend ignorance. [Everyone roars with laughter].

* Queuing for Computers

As described in Section 7.3, the advantage of easy retrieval of information without restrictions saved nurses from scrambling paper-based patient charts. However, the limitation of computer numbers resulted in nurses needing to queue and borrow computers.

When discussing their experiences after computerisation, nurses gave positive feedback and raised the issue of people queuing for computers at the same time. All of the focus group participants had experience of queuing for computer technology devices. Four out of five focus groups described their experiences of rushing and queuing for computers. They claimed that they spent time finding an available computer. In addition, the participants described that queuing for computers was a prominent issue on day shifts and on general wards in particular.

For example, Nurse C3 explained that it was because doctors and nursing practitioners occupied most of computers.

C3: It depends on what shift you are on. In the day shift, you have to rush for it [laughing]. The day shift is more difficult, because many people need to use it. For example, the doctors and nursing practitioners need to prescribe and type their progress notes. We also need to use it, too.

Additionally, Nurse D1 described

D1: In the morning, we five people are on day shift; we were like rushing for computers. After the handover, it’s first come, first served, because so far we don’t have one person one computer…

Nurses’ accounts revealed that they understood that ownership of computers was an unspoken rule. Except for queuing, nurses maintained that when there were immediate needs to use computers they looked for and borrowed from doctors and nursing practitioners.
Group E nurses described how they borrowed computers from nursing practitioners.

E4: They should invest in some more computers. Otherwise, we have no computers to use when we need to carry out something. When you wait and queue for it for a while, you felt like, oh many things are still undone [signing]. Sometimes, we need to ask them…could you lend me the computers…

E3: We have to mind-read and go to ask, “If you aren’t using it, could you lend me the computer for a while”. Or if you felt you had a closer relationship with a certain NP, just use hers.

Nurse E4 described how she seized the time to use computers when the doctors went to bedside for clinical rounds.

E4: Take advantage of the time of doctors’ clinical rounds and use their computers without them knowing.
E1: But sometimes they forgot to save their files.
E3: [Laughing out loud]
E4: They get angry
E1: (They) will grumble at us.

Group C nurses said they needed to request NP to lend them computers to proceed patients’ discharge. Nurse C1 discussed when she worked in another ward, nurses needed to request nursing practitioners for computers.

C3: …Rushing for it.
C1: Rushing is not enough. We have to request that nursing practitioners lend us the computer for completing patients’ discharge procedures…Each NP has their own computer. Even though they’ve already logged out of the system, you can’t use it as you wish…Without computers, you can’t discharge patients.

Nurses explained that they had experienced a time when there was no available computer. They said that they would judge whether things were pressing or not and re-organised nursing work. How they re-organised their work to avoid spending time on queuing for computers will be presented in the following section.

By contrast, a few participants described when they had immediate needs at hand. Their responses revealed that not having available computers gave them a sense of helplessness. For example, as described in Section 8.2.1, Group E participants calculated the number of computers for doctors and nursing practitioners were ten. Because doctors and nursing
practitioners had high priority to occupy computers, staff nurses only had one computer available. One nurse of Group E described that despite nurses having urgent needs, there was no way to deal with it because of no resources.

E3: …We nurses have only got one computer. Sometimes we hurried to get something (for your patients). You can’t do anything about it…

The other nurse described how when there was no computer available, the only thing she could do was prolong the waiting time of her patients.

C1: Just being thick-skinned to ask patients to wait for me, wait for a while. Yeah, I think it’s the way, (pause) delay patient’s discharge time.

Group A nurse participants, who were on night shift from 12 midnight to 8 am, did not discuss the issue of queuing for computers, because during the night shift, no doctors and nursing practitioners occupied computers. However, they described how they needed to queue for a blood glucose meter with mobile network function to test blood glucose level in the morning.

A5: …We have 26 beds in our unit and have got only one blood glucose meter. You know, during the time of testing blood glucose in the morning, it was like everyone really rushed for it…

• Re-organising Nursing Work

In terms of coping with the issue of insufficient computers only one group discussed how when things were not pressing, they re-organised their work instead. Group E stated that computers were available during the lunch hour of doctors and nursing practitioners. They accumulated less urgent work and utilised this period of time as the alternative.

E4: …You can wait for the lunch time; they (doctors and nursing practitioners) have a lunch break. You can use the lunch hour to check the computerised prescriptions. Use that time to do things together. If there is really no computer, then you don’t have to use computers.

E2: We are all like this because of no computers …

M: What do you do when the computer crashes for 30 minutes?
E2: Write our nursing records.
E3: Still have something else that needs to be done.
E4: Yes.
E3: When we don’t need a computer urgently…
8.2.3 Troubleshooting

• Paper Jams and Printing Quality

Some participating nurses and software engineer interviewees explained that considering the budget factor, the case-study hospital purchased laser printers which can be replaced with compatible toner cartridges, instead of the best choice in the short list recommended by the informatics department.

For example, one software engineer interviewee described the purchase principle. He described the top’s decision making is budget-oriented. The Informatics Department provided a short list of recommended laser printers. The top managers did not choose the best one because they considered the price. Also the best, user-friendly printers had no compatible cartridges as substitutes (Case study/IT2, NI member).

Consequently, in the focus group discussions, many nurses noted that poor printing quality and paper jams were common. Three focus groups said that printing quality of their laser printers in their wards was poor because of using compatible toner cartridges as replacements. For example, Group E stated,

E3: Printers…
E2: The quality is poor.
M: What kind of quality?
E3: When it prints, sometimes…
E4: [Interrupting] Paper jams happen.
E3: Yes.
E4: [Interrupting] and it’s too dark.
E3: Yes, it is. Sometimes, the dark lines are at the bottom, or in the middle (of papers), or the paper becomes crinkled.

Nurses spent time on troubleshooting the printer issues. For example, Group D nurses described how they spent time on printers dealing with non-original toner cartridges.

D3: Computers and printers can detect if this is a compatible toner cartridge. They tell you it’s not the original one.
D4: Yes.
D3: It takes your time. You need to spend time on it.

Four out of five focus groups stated that a printer paper jam happened frequently. Nurses cleared paper jam themselves.

A1: Sometimes, paper jams happened.
A6: Paper jams are troublesome. We have to clear them ourselves.

- **Shut Down and Restart**

Many nurses described how they performed the initial troubleshooting step, shutting down and restarting computer systems and printers. For example, Group D nurses described how they performed this initial troubleshooting step before contacting informatics staff.

M: Do you wait for informatics staff to deal with it?
D1: No. We contact the informatics department if we can’t deal with it. Sometimes they can’t come immediately. So we try to shut printers down for a while and then restart them.
M: Does it work?
D1: Sometimes it does.
D4: [parallel] sometimes it goes back.

Group C nurses described when computer crash, they contacted informatics staff and shut down and restarted computers.

C1: When computers crash, we call the informatics department immediately and stay by the computers to shut down and restart them….

Particularly, in terms of printer problems, three focus groups described how network disconnection was a common reason causing printer to become out of order and delaying their work. They explained that they used shut down and restart method to solve a printer being out of order in particular.

A4: Sometimes the network connection has problems. So printers can’t printout.

- **Telephone Technical Support**

Three out of five focus groups stated they had experiences of technical support by telephone during weekends and night shifts. These participants perceived that they received limited technical support during off days, in terms of waiting times and problem-solving.

They claimed that informatics staff were allowed to stay at home during the on-duty period of time. If any information technology problems happened during off days, nurses either had to wait for them travelling from home or receive telephone technical support.
Nurses perceived that both methods were time-consuming. For example, Group A nurses described,

A2: One time the printer was broken. So we phoned the IT member of staff on duty and told him the problem. He was at home and sleeping. [Everyone laughs].
A6: Yes, We waited for him for a very long time.
A2: Because they were on duty, (they) didn’t need to stay at the hospital. After managing for a while, he told us this was probably caused by the system software problem and we would have to wait for the original engineer until the following day.

Group B described how sometimes nurses manipulated troubleshooting under telephone technical support if informatics staff on duty were unable to come on site. They perceived telephone technical support was a time-consuming method because nurses were back and forth between the informatics staff’s directions and handling the computer.

B4: We have to communicate with the informatics staff for a very long time, by phone. You have to give him that…
B5: The computer series number.
B4: Yes. After checking it, he tells you, alright, you wait and see the results. After a while, he rings back to you, then you have to report to him what’s going on (on the screen), give him that [pause]… Sometimes if they cannot come, we have to do by ourselves. Whilst you listen to his directions on the telephone, then you handle the computer.

In addition, Group B was the only group who discussed the results of telephone technical support. They described how communications through telephone made staff from different disciplines made it more difficult to understand each other completely.

B4: Because (informatics staff) he couldn’t see and wasn’t on the spot.
B5: Couldn’t see our problem.
B4: Yeah, the reason that caused our problem. We only can report what we see to him. But it may not be the actual cause.
B5: We can only report what we understand.
B1: Their speciality and our speciality (are different). So sometimes the communication is really troublesome.
B2: That’s right, different specialities.
B5: There is a difference! Things they need and we need urgently are different. They are in a hurry for computer numbers, printer numbers. We are concerned about our stuff.

Three groups described how sometimes these technical problems remained unsolved until next day when informatics staff on duty were not the original software programme engineers. As Nurse A2 described above, Nurse B2 had a similar account,
B2: When the problem can’t be fixed, he often says wait until next morning.

However, staff nurses perceived that meeting patients’ needs cannot be delayed. Therefore, they changed the printers’ location as a method of working around the problem. The details will be presented in the following section.

- **Changing Printers’ Location**

As described in the above section, participating nurses described how sometimes informatics staff were not able to solve printer problems immediately, particularly during evening, night and weekend shifts. Four out of five focus group participants described they experienced this situation during evening, night and weekend shifts in particular, when the informatics staff on duty were not the original engineer who developed and was responsible for that particular information systems. In this case, the printer problems existed overnight. For example,

D5: Night shifts have more problems. If the one on duty today is not the software programme engineer, he probably tells you I don’t know how to fix it, so wait until tomorrow. But some things can wait, something can’t.

As described in the earlier section, printers were very important to nurses’ work. Two focus group participants described that changing the printer location was their strategy to tackle this situation. For example, Group A described how they chose to print documents from another ward.

A5: …During the night shift, the support team of the informatics department usually has only one member on duty. Sometimes, he doesn’t know how to solve the problems, either.

M: If this happens, what do you do?
A5: We print documents to the printers of our opposite neighbour…Then go to collect (them).
A4: [interrupting] you can choose your printer’s location…

Group B participants perceived that telephone repair was time-consuming and influenced their work. They preferred that changing the printer’s location was an easy method to satisfy their immediate needs.

B2: I feel this way is very troublesome.
B5: [Overlapping] It’s really wasting time and means we can’t do anything else.
B2: So we end up choosing to print from another ward…We phone them saying
we print our stuff to your printers, because ours were broken. Therefore, they often receive our phone calls.

8.2.4 Summary
In Chapter 7, participating nurses perceived convenience and efficiency as the results of computerisation. However, in this section nurses also described how hardware or software problems had negative impacts on their care delivery, such as computer crash, printer out of order and insufficient computer quantities. The official coping procedures developed by the case-study hospital showed that the hospital had backup solutions for severe computer crash hospital wide. However, nurses perceived these procedures as time-consuming if applied to the temporary computer downtime situations. Because meeting patient needs was their first priority, nurses developed quick and realistic alternatives to solve those immediate situations and to prevent technological breakdown delaying patient service. Meanwhile, due to limited technical support, nurses described how they shared some part of system maintenance work which revealed that nurses took the initiative when facing computer technological breakdown. Consequently, while caring for patients on the one hand, nurses care for computers on the other hand.

8.3 Duplication
Every focus group raised the issue of double the work after implementing computerised information systems. As described in Section 6.2, the case-study hospital adopted parallel approach to implementing computerised information system which resulted in duplication in this period of time. However, the accounts of participating nurses revealed that the duplications resulted from a wide range of factors, including hardware, software and hospital policy issues. Three reasons are identified as causing nurses to duplicate their work will be presented in the following sections, including (1) parallel implementation strategy, (2) rigidity of the desktop computers and (3) data entry duplications.

8.3.1 Parallel Implementation Strategy
As Chapter 6 showed, when computerising important practices, such as computerised physician order entry, the case study hospital adopted a parallel implementation strategy, which means that both computer and handwriting were needed for the same document or task. The process of parallel strategy led front-line users to duplicate their work. The handwritten documents usually would be withdrawn when the computerised information systems could operate smoothly.
Groups A, B and C described their experiences of the parallel strategy and double the work. In the Group A, the participants discussed their experiences regarding the parallel period. Adopting a parallel strategy was to assist the computerised physician order entry.

A4: The reason was because the computerisation hasn’t been completed yet. They felt parallel (strategy) will be more, like before, the beginning stage of (computerised) physician order entry was also parallel.
A6: Super troublesome
A5: Yeah!
A4: Got computer (entry) also got handwriting (paperwork)
A4: Then afterwards, gradually, the computer try-out felt more stable and more OK, then the handwriting part was stopped. But it’s still half parallel, because (prescription) orders still have got to be printed out.
A5: Like the prescription orders in the past, doctors already prescribed through computers. This was not enough. They still complete prescriptions by handwriting. Then the medication administration sheets have to be checked and afterwards we’ve got to check the computerized prescriptions. Very busy!

Nurse C3 in Group C described how the work was long drawn-out and troublesome during the early phase of the computerisation due to early design flaws. Thus nurses had to provide manual back up to the computerised information systems.

C3: The computer, yeah, is more convenient, but it’s also got an inconvenient part though, the tasks became long drawn-out…In the past, it was paper-based documents only. Gradually, a lot of things continuously went online. Then after going to online, sometimes, for example, when some systems can’t print out, they usually requested us to write another handwritten copy. Then it became - handwritten copy and also a computer part, then you’ve got to do double the work anyway …Yeah, during the connection time …
C1: (overlapping) now it's OK.
C2: (overlapping) now it's OK.
C3: Afterwards, many people were against it! Felt it was too troublesome, needed to handwrite and also type, so many things.

The Group B participants described how the parallel of computerised physician order entry and handwriting prescriptions was time-consuming and how they needed to chase doctors and nursing practitioners.

B2: Because at that time, paperwork and the computer were synchronised…But in the beginning doctors still needed to write down (prescriptions), they didn’t complete the computer entry. Sometimes, the computer system got prescriptions, but the paper format didn’t…
B5: Really took a long time to get used to it.
B2: The nursing care quality really was different
B5: [overlapping] just spending time on checking the prescriptions.
B2: [overlapping] just checking the prescribed medications. What interventions you (doctors) want. You have to chase doctors or NP quickly…If what they want is not what we want, then what we do is not what they want, then that will be troublesome …

8.3.2 Rigidity of the Desktop Computers
As described in Section 5.3, the budget issue made the top managers hesitant about purchasing portable computer trolleys for front-line nurses. During the data collection period, it was observed that the computer equipment was desktop computers located in the nursing station on each ward, including intensive care units and general wards. The accounts of nurses revealed that the types and quantity of hardware equipment would affect the process of how nursing staff carried out their work. Because the hardware limitation caused by lack of portable computer trolleys, participating nurses described their work processes as double the work resulting from hardware limitation and how they coped with the situation, in order to complete the work.

Four out of five focus groups (Except Group A) maintained that they needed to complete the patient assessments at the bedside, then they went back to the nursing stations for data entry by desktop computers. The participants from different groups had similar experiences in documenting the computerised admission nursing assessment. Because no portable computer trolleys allowed nurses to complete the nursing assessments and to document the computerised admission nursing assessment at the bedside synchronously,

In the discussion of Nurse D6 about the portable computer trolley, she also delineated clearly how the hardware allocation and quantities affected nurses carrying out nursing work.

D6: …..need to ask, to jot down, then come back (to the nursing station) to find computers, to wait for computers. Sometimes, you don’t have time to do the computer entry, (maybe) you need to administer medications right away. You have to wait until you finish your busy things to sit down to enter…

The other group participants had similar experiences.

C3: In the past, it was in paper format. It was straightforward. You do ticking, choosing, and writing on printed assessment forms. That’s it, a copy of valid document. After the admission nursing assessment going online, we need to finish the patient assessments at the bedside, then go back to the nursing station for computer entry. After doing that, we also need to print the document out…
B2: …We need to use that laminated document sheet to tick (by the whiteboard pen), after the ticks, you need to spend time in front of computers to tick (computer entry)…Because usually, assessing admission nursing assessment takes 5 to 10 minutes, if after the (bedside) assessment, we got something to do, actually (we) will spend more time on the computer…because printing the (computerised admission nursing assessment) document out, you need to find a piece of paper, then to sign it (your signature), then need to draw the figures of family tree. I think this is a very troublesome thing.

Due to the above situation, different wards also developed different coping strategies. From the participants’ accounts, the strategies were generally two types: (1) ticking or jotting down on a piece of laminated document or paper at the bedside first, then back to the nursing station for computer entry according to the piece of paper; (2) in case the piece of paper was lost, it was preferred to recite from memory regarding the assessment items and the patients’ result, then go back to the nursing station for computer entry. If there was any missing part, the nurses would go to the bedside asking their patients again.

In the discussions, Group B and C used a Chinese idiom, “For every measure from the top, a countermeasure at the bottom”, to describe that they developed their own coping strategies. They developed the method using the laminated document and marked on it, then came back to the nursing station for computer entry.

C3: ...Afterwards, we thought up a plan. For every measure from the top, a countermeasure at the bottom. Our head nurse printed out and then laminated the document. Then you can mark and tick on that laminated sheet…Now probably everyone already memorised the most of the contents (of admission nursing assessment), the most of the items needed to be asked (patients) are remembered, now we don’t use the laminated sheet that much.

For the wards that did not use the approach of laminated document, nurses described that they coped depending on their personal habits. Some nurses made notes with a piece of paper at bedside first, then back to nursing station for computer entry.

D3: Yeah, for example, in the beginning stage of computerised admission nursing assessment, in the beginning, we needed to carry out a piece of paper in addition….All at once, you can’t remember that many (assessment items). Yeah, therefore, you’ve got to bring a piece of paper, the previous paper sheet (of admission nursing assessment) to bedside to ask (patients).
Some nurses expressed they preferred to recite from memory in case the piece of paper was lost. If any part of the assessment was missing, they went to the bedside again.

E2: …I won’t jot down on paper [laughing], because the piece of paper would be gone, … (I usually) ask (at bedside) then come back (to the nursing station) to make the entry.

E3: (if any part was missing), go (to bedside) for it again.

D1: Sometimes some parts (of admission nursing assessment) would be missing. Then just go to bedside again.

In short, regardless of how nurses developed their ways of coping, either jotting down on a piece of paper as the substitute or reciting from memory then running to the bedside again if any part of assessment was missing, double the work resulting from the computer hardware limitation was inevitable.

8.3.3 Data Entry Duplications

The participants of Group A discussed the duplication of patient bedsore data, in both computerised sheet and in paper format. As well as completing paper-based bedsore sheets, nurses were required to input patients’ bedsore information onto the computerised information system because of the hospital policy requirements. However, nurses were not the main users of this information.

A4: Because in the past, for bedsores, we had a sheet to fill in. But now, we need to go online to enter. It became double the work. :

A6: [Overlapping] it’s double.

A4: Yeah. This benefit is that you can grab the records that what had happened in the past. But, under the moment of doing it, you will feel so troublesome, because you need to (do it) parallel.

In the beginning, the context of discussions was regarding the issue of user-friendliness raised by Nurse A4. Nurse A4 who stated the bedsore areas in the computerised bedsore sheet were limited and too general. Therefore the contents of computerised bedsore sheets cannot reflect patients’ actual bedsore locations. However, some participants discussed that the computerised bedsore documents were for the purpose of quality assurance and the handwritten bedsore sheets were for patient medical records.

A4: …Actually, some patients’ bedsore location, you can’t tick, because it wasn’t on that location (according to the design of computerised bedsore sheet) …You only have to tick the nearest location.

A2: The computerised document said: if there is no area, please select the nearest
location.
A5: Now the computerised (bedsore) sheet, it doesn’t belong to patients’ medical records. Yeah, only the bedsore sheet in paper format belongs to…Because of the printed (computerised bedsore) sheet…you need to file the sheet away in the quality control file.
A2: …I think that that (computerised bedsore documentation) should be for quality control purpose, because there is one colleague doing that job…
A5: Because they (nursing department) will monitor the prevalence of bedsore, sizes of bedsore wounds …
A4: …If the report of bedsore looked bad, the head nurse will scold.

8.3.4 Summary
This section presented nurses perceptions of the burdens of the computerisation process. The process of parallel strategy led front-line users to duplicate their work because both paper-based and information systems needed to be completed. Moreover, as described in Chapter 5 the hospital still hesitated regarding the purchase of portable computer trolleys for front-line nurses’ use. Nurses duplicated their work to overcome the rigidity of desktop computers, in order to finishing practice which had been computerised. Due to the hospital policy, some data-entry tasks were shifted to front-line nurses.

8.4 Summary to the Chapter
This chapter examined the contexts of technological breakdown and meeting patients’ needs which front-line nurses encountered and explored their coping strategies for unavailability of computers and printers. Moreover, participating nurses bore the burdens of computerisation process. They duplicated their work in order to overcome the inconvenience caused by transitional progress of information system implementation resulting from the top’s wait-and-see decision making. Besides the extra work, nurses revealed their emotions at dealing with hidden work through grumbling which was presented in Chapter 6. As a result, their workload was increased by doing extra work resulting from unavailability of computers and printers. As the findings presented, the characteristics of those extra tasks were often invisible, context-related, indirect patient care, and trivial. Wadel’s (1979) concept of hidden work was applied to give insights into invisible tasks.
Chapter 9: Discussion

9.1 Introduction

Chapter 5 examined the process of developing computerised information systems for nursing purposes through Strauss’ (1978) Negotiated Order perspective. Chapter 6 explored how computerised information systems were implemented in a case-study hospital. Chapter 5 and 6 findings were about the exercise of power at the organisational level. However, their focuses were different. Chapter 5 presented the power relations and exercise at the horizontal level, which are inter-departmental. Chapter 6 presented the power issues at the vertical level, which is the nursing hierarchy. Chapter 7 investigated redesign and management control of clinical practice by computerised information systems and theorised using the concept of Taylorsim (Braverman, 1974). Chapter 8 analysed extra work carried out by participating nurses on the front-line in order to deal with computer technology breakdown and the problems encountered during the implementation process. This was theorised using the concept of Wadel’s (1979) “hidden work.”

This chapter will discuss the four chapters of findings in sequence. In order to enhance the understanding of the exploratory findings, several theories have been selected to illuminate the findings, including Lukes’ (1974) Three-Dimension, Turner’s (1986) Vocabulary of Complaint, Foucault’s (1977) Discipline and Punish, and Orlikowski’s (1992) Duality of Technology. Moreover, current evidence is compared. Through comparing literature and theories with conflicting findings and similar findings, it is helpful in gaining a deeper insight, and in learning the underlying reasons to explain the findings (Eisenhardt, 1989). Its aim was to enhance the internal validity and analytical generalisation of this single case study.

9.2 Power relations in Negotiating Computerised Information Systems Development for Nursing

9.2.1 Summary of Developing Computerised Information Systems

Chapter 5 examined the development of nursing information systems in the case-study hospital from nurse managers’ and a few software engineers’ perspectives. The findings showed that developing nursing information was an interdisciplinary collaboration. However, due to different agenda and stakes among the top, informatics and nursing department, the development process involved complex negotiations and an imbalance of power relations. The nursing department had limited autonomy in deciding the
development and attempted to negotiate and renegotiate to solve the difficulties encountered.

9.2.2 Strengths & Limitations of Negotiated Order Concept (Strauss, 1978)
As presented in Chapter 5, the concept of “negotiated order” by Strauss’ (1978) was applied to analyse the interactions among the top management, informatics department and nursing department. Chapter 5 showed that the negotiations of the current study took place when the top, informatics department and nursing department held different opinions on the computerisation development and tried to reach agreement. His concept was helpful in exploring the structural context and the struggles for developing nursing information systems among three groups in the case-study hospital.

However, Strauss’ (1978) theory has limitations in relation to understanding of power relations during negotiations. The findings also showed that their power relations were not the same level. Hewison (1994) suggests that negotiations among professional relationships often consist of power or political components. Various interested parties associated with negotiations have different level of influence on different occasions depending on their status and the other people involved in the ongoing negotiations (Hewison, 2005).

Therefore, in order to explore the complex power relations in developing nursing information systems, adopting the power theory may complement the limitation of negotiated order concept (Strauss, 1978). Some information system literature suggests that Foucault or Giddens’ theories may be helpful for interpreting information systems (Lyytinen, 1992; Willcocks, 2004). However, Lukes’ power theory (1974) was identified as the most suitable theory because it is most helpful in explaining most of the findings regarding power relations in the current study.

9.2.3 Unsuitable Theories
In this section, Foucault’ Power-Knowledge concept (Ransome, 2010) and Giddens’ Structuration theory which had been suggested for studying information systems studies (Walsham, 1993; Jones, 1999; Jones et al., 2004; Willcocks, 2004), will be overviewed. Despite the prevalence of using theories to interpret information systems studies, the rationale why these theories did not fit the findings of current study will be given.
**Foucault’s Power-Knowledge**

Codes of meaning and frames of references define objects, ideas and meanings as knowledge. Control over construction and operation defined knowledge as Power-Knowledge (Ransome, 2010). The simplest sense of Power-Knowledge is that taking away the idea of absolute truth, knowledge would be decided by a group of people. Because the same people create belief and decide what knowledge is, they can easily claim they are the most knowledgeable. Thus, a powerful minority who are able to impose their idea of the right or the truth on the majority affect people in general (Fillingham, 1993).

It is identified that the concept of Power-Knowledge (Ransome, 2010) is only able to explain partial power relations of the current study, the expert power of informatics department. Moreover, the Power-Knowledge concept can be covered by Weber’s concept of legal authority (Weber, 1947; Gerth and Mills, 1991). Weber defined three pure types of legitimate authority, also called ideal type authority, which are traditional, charismatic and legal authority (Weber, 1947; Gerth and Mills, 1991). The discussion of sources of power will be presented in Section 9.2.4. Therefore, the Power-Knowledge concept is not applied.

**Structuration Theory (Giddens, 1976; 1979; 1984)**

Giddens’ (1976; 1979; 1984) Structuration theory proposes a structure and agency view. Giddens’ Structuration theory is the most widely used social theory in information systems studies, despite this not being his intention in the beginning (Jones et al., 2004). Information technology and systems are discussed in Giddens’ writing implicitly. Because to an extent information systems are regarded as social systems, some literature suggests Giddens’ Structuration theory as a means of interpreting information systems’ studies (Jones, 1999).

It is identified that Giddens’ (1976; 1979; 1984) Structuration theory may not fit the findings of the current study for two reasons. Firstly, it is hard to categorise computerised information systems whether it is structure or agency in this study. The systems were constructed by the three parties in the case-study and produced influences on all stakeholders. Secondly, as described in the above, computer technology was not the intention of Giddens’ theory and his theory discussing materials is limited (Jones, 1999). Nevertheless, the duality of technology (Orlikowski, 1992), an extension of Giddens’ structuration theory, focuses on the dual influences of computer technology possibly being helpful in explaining the findings of Chapter 7 (Digital Taylorism) and Chapter 8 (Hidden work). It will be presented in Section 9.5.
• Resources for Computerisation

As described above, Giddens’ (1976; 1979; 1984) Structuration theory may not fit this study’s findings. Nevertheless, his concept of resources is helpful. Giddens’ (1984) ideas that “rules and resources structure social practices”, and “power is the use of resources to secure outcomes,” may be helpful to illuminate the resource issue in the complex negotiations processes.

According to Giddens’ (1984) concept, the “resources” in the process of developing nursing information systems in this study are (1) budget for computerisation, (2) legitimate claims to mobilise, and (3) knowledge and skills for software design. Giddens also distinguishes two types of resources, allocative and authoritative. While budgets for computerisation and knowledge and skills for software design are regarded as “allocative” resources, the legitimate claims to mobilise is an “authoritative” resource.

If examining the above three resources individually, each of them contains the connotation of “power”. In order to understand each resource in-depth, Lukes’ (1974) three dimensions of power is used to examine these resources.

9.2.4 Lukes’ (1974) Power Theory

In this section, the key concept of Lukes’ (1974) power theory will be overviewed. How Lukes’ concept may fit the power relations of the current study and particularly in the development of nursing information systems will be presented.

Lukes’ (1974) conceptual analysis of power presents a way of identifying power through three dimensional views. In terms of the one-dimensional view of power, Lukes adopted Dahl’s (1957) concept of power, that is, “A has power over B to the extent that he can get B to do something that B would not otherwise do” (p202-203). The distinct feature of a one-dimensional view of power is the focus of observable behaviours embodied in the concrete decisions of important issues. It assumes that decisions involve actual, observable conflicts and regards wins at decision-making as the manifestation of power (Lukes, 1974).

In terms of a two-dimensional view of power, Lukes adopted Bachrach and Baratz’s (1962) work of two faces of power: decision-making (behaviour) and non-decision-making (non-behaviour). The distinct feature of the two-dimensional view of power is that Bachrach and
Baratz’s (1962) concept of *mobilization of bias* which emphasises the controlling over the agenda and preventing potential issues from being actual. The concept of non-decision, which appears to be no-action, is the result of power drawn into two faces of power (Lukes, 1974).

Lukes (1974) argued that actual and observable conflict is regarded as essential to power implying that power is only exercised in the conflict situations. By critiquing the first two views of power being too behavioural a focus, Lukes (1974) stated that manipulation and authority of power may not be involved in actual and observable conflicts. In the three-dimensional view of power, Lukes (1974) proposed that influencing and shaping desires or preferences is regarded as the supreme form of exercising power to secure people’s compliance by controlling their thoughts and desires, preventing people from having complaints, and making people accept their roles in the existing order of things.

- **Explanations of Power Exercise in the Case-study Hospital**

It is identified that Lukes’ (1974) theory may illuminate the power issues in this study and may be helpful in explaining most findings from the top to the bottom of a hierarchy.

- First dimension: As Chapter 6 (Top down implementation) presented, the front-line nurse participants were compliant with the decision of computerisation made by the top. The details will be presented in Section 9.3.
- Second dimension: as described in Chapter 5 (Negotiated order), the top, informatics department and nursing department exercised “non-decision making” on their negotiations and renegotiations during the process of developing computerised information systems for nursing purpose. The details will be presented in the later part of this section.
- Third dimensions: (1) As Chapter 6 described, the nurse managers applied persuasion skills in shaping the desires of front-line nurses to use computers; (2) As Chapter 8 (Hidden work) described, front-line nurses naturally carried a variety of hidden work to cope with technological breakdown issues, in order to provide services for their patients and maintain the operation of the case-study hospital as a whole. The details of this supreme form of power exercise will be presented in Section 9.3 and 9.5 in sequence.

As presented in Chapter 5, the findings showed that the power relations of developing computerised information systems for nursing were complex and woven together. It is
argued that identifying how decisions were made, resources for computerisation, sources of authority of each party may help the understanding of the forms of power exercise.

In terms of the decision making process, Lukes’ (1974) second dimension of power theory specifically gives insight into the non-decision making behaviours of the top, informatics and nursing department personnel presented in Chapter 5. It helped to identify that non-decision making took a variety of forms, including a wait-and-see attitude by the top, postponing of nursing priorities by the informatics department, and passive resistance to the computerised information systems going on-line by nurse executives. The top and the informatics department exerted Lukes’ (1974) second face of power, “non-decision making”. However, “passive resistance to information systems going online” by the nursing executive may also be regarded as the exercise of “non-decision making” power as a form of resistance.

In terms of resources for computerisation, as described in Section 9.2.3, Giddens’ (1984) insight that resources structure power illuminates the struggles among these three parties. In terms of sources of authority, as Section 9.2.3 presented, Weber’s ideal types of authority (Gerth and Mills, 1991) are helpful in clarifying different sources of authority in negotiations among the top, informatics department and nursing department in this study. The reason for adopting Weber’s ideal types of authority is that Lukes’ one-dimensional view of power is deeply rooted in Weber’s concept of power (Lukes, 1974). Weber defined the inner justification of legal authority to dominate as being because of legitimacy (Weber, 1947; Gerth and Mills, 1991). Legal authority means that commands and functional competence of power holders are given based on an impersonal norm which is rationally established by legislation, rules, agreement, and imposition (Weber, 1947; Gerth and Mills, 1991). Thus, obedience in the case of legal authority is because of legally established impersonal orders (Weber, 1947).

Examining the negotiation process presented in Chapter 5 through Weber’s lens of authority, the top had legitimate authority to dominate the computerisation budgeting as well as the informatics department having legitimate authority to dominate software design. The authority of the top and the informatics department is constructed by their posts and high level in the organisational hierarchy. In terms of the legitimate claim to mobilise resources, by examining all the claims of nurse manager and software engineer interviewees presented in Chapter 5, it is identified that the nursing department lacks legitimate authority in this domain. Consequently, as Section 5.5.2 presented, nurse
executives adopted different claims to appeal for renegotiation. These claims showed that the nursing department searched for a basis of legitimacy in order to renegotiate with the top and informatics department.

Moreover, the informatics department takes advantage in the negotiation and exercises power because of possessing informatics knowledge. The nature of informatics work and the dependence of the rest of the departments within the case-study hospital made informatics department personnel powerful. From design to modification, the informatics staff used their professional expertise, software programme development, to exercise power. Thus, the informatics department has the power to prioritise the agenda and decide whether to do system amendments or not. However, it is argued that the prioritisation of informatics department may not come from within, but is a reflection of the top’s agenda.

By contrast, Section 5.5.1 showed that nursing managers seemed to be the group of people being imposed on by the beliefs of the informatics department. However, nursing managers also identified the significance of informatics knowledge. Therefore, as Section 5.5.2 presented, many nursing managers earned the postgraduate degree in informatics or nursing informatics. Moreover, except that one nursing executive used her authority to passively resist the systems going on-line, most nurse managers sought power outside of nursing. This further reveals the powerlessness of nursing in the healthcare systems.

It is argued that due to lack of the above three resources to achieve the desired outcomes, and without delegating authority and discretion by the top, the nursing department appeared to lack capacity in the matter of computerised information system development for nursing. Additionally, being regarded as a subordinated role to medicine and having little managerial and organisation control inherently in nursing occupational status (Mowforth, 1999; Wilkinson and Miers, 1999; Denny, 2005) may contribute to the difficulties that nursing managers encountered in developing computerised information systems for nursing.

- **Limitations**
  It is argued that Lukes’ power is helpful in identifying the existence of power, rather than in the context or dynamic of power. Lukes’ (1974) three dimensions of power enabled the researcher to identify where power lies and confirm that the data analysis was on the right track. However, Lukes’ (1974) power theory cannot help explain why power is exercised in this way. For example, what makes both the top managers and informatics staff exert
“non-decision making” over nurse managers and the development of computerised information systems for nursing.

Thus, there are three possible explanations regarding the power exercise of non-decision making. Firstly, although both the top and informatics department have their own legal authority, it is argued that the top has supreme position in deciding on computerisation. Secondly, it is argued that non-decision making behaviour reflects the top’s concerns of computerisation. As reviewed in Chapter 2, evidence regarding impact of computerisation on clinical practice was inconclusive. The top may expect evidence of conclusive cost-effectiveness from empirical studies or other hospitals. Furthermore, as Chapter 1 described, the legislation and policy of electronic patient records in Taiwan were still under review. The top may wait for reaching a settlement of related legislation.

9.2.5 Discussion of Current Evidence

Empirical studies reporting the development process of computerised information systems are scarce.

One study reported that after receiving government funds for implementing computerised physician order entry system, two challenges are encountered which delayed the plan for two to three years (Westbrook et al., 2007). The first one is negotiating the government funds to support the system implementation. The second one is that the software commercial vendor delayed in achieving system upgrades. These challenges correspond to the difficulties nurse managers encountered in the current study.

The other study described how several resources in the implementation context section corresponds to three resources in this study (Lium et al., 2006). Lium et al. (2006) used questionnaires to explore the usage and satisfaction of electronic patient record system among doctors, nurses and secretaries in a Norwegian hospital. Compared with most of studies, Lium et al.(2006) provided detailed background information of the study setting, the system, and implementation context. According to Lium et al.(2006), this Norwegian hospital was one of first hospital to scan and eliminate its paper-based medical record in 2001. After introducing electronic patient record system, the hospital had withdrawn the paper-based medical records immediately.

In terms of budget for computerisation, the project is well funded. In terms of legitimate claims to mobilise, the hospital administration and the chief clinicians gave strong
commitment (Lium et al., 2006). In terms of knowledge and skills for software design, the system supplier company is given in the published paper which suggested that its system-building approach is prewritten software packages as described in Chapter 2. Moreover, Lium et al. (2006) described how that key persons have informatics education background and the Chief Executive Officer is one of the leading experts on electronic patient record systems in Norway. The position and background of this key person in Lium et al (2006) further supports the argument that legitimate claims to mobilise, and knowledge and skills for software design are crucial resources in this study. Despite the fact that the county, hospital, and context, system were different, three resources for computerisation in Lium et al.'s (2006) study corresponded to those in this case-study hospital.

It is suggested that three ingredients for developing a computerised information system were universally essential for computerisation. Harley (2004) suggests that the case study focuses on analytical generalisation about theoretical propositions, rather than sample population. Although this was a single qualitative case study, by comparing with the extant literature, the findings of current study showed some extent of analytical generalisation about theoretical propositions.

9.3 Top Down Implementation

9.3.1 Summary of Implementation Computerised Information Systems
The findings of Chapter 6 in relation to top down implementation showed that the computerisation decisions were decided by the top managers. The process of implementation was centralised because the schedule was predetermined. The findings showed that head nurses’ persuasions were powerful in gaining compliance of front-line nurses; head nurses perceive themselves as selling the ideas. No active or passive resistance to computer technology was identified from the data of the participating nurses. The study found that while front-line nurses were compliant with the computerisation decision; they were grumbling during the adoption period and encountering technological breakdown issues.

In this study, neither the nurse-manager nor software engineer interviewees in the case-study hospital reported what system-building method they adopted. However, according to the implementation processes and contexts they described and from the accounts of nurse manager interviewees, it is likely that the case-study hospital adopted the method of system lifecycle method (See Section 2.4) for building their computerised information systems. For example, the computerised information systems developed in the case-study hospital
were usually large and complex. The case-study hospital had clear stages for and control over building computerised information systems from proposing a project to implementing the system. Thus, the findings showed that the user involvement of front-line nurse participants was very limited.

9.3.2 Unsuitability of Diffusion of Innovation (Rogers, 1995) and Technology Acceptance Model (Davis, 1989)

As described in Section 2.5.3, Diffusion of Innovation (Rogers, 1995) and Technology Acceptance Model (Davis, 1989) were predominant theories for implementation and diffusion in information systems studies and their strengths and limitations were critically examined. As described in Section 2.5.3, one of the major reasons that neither theories were employed in this study was that the frameworks of two theories focusing on individuals’ perceptions of innovation characteristics conflict with the theoretical paradigm of the current study, realism which emphasises context greatly. However, it is worth investigating further why two predominant theories are unable to explain the findings of the current study. It has been identified that two theories were found to be unable to explain several key findings regarding the implementation management of the current study, regarding (1) the power relations and implementation contexts in the case-study hospital and (2) nurses’ compliance and grumbling at the same time. The detailed argument will be given in the following paragraphs.

- Ignoring Power Relations and Implementation Contexts

Rogers (1995) states that the adoption of innovations in organisations is more complex than the single individual’s innovation-decision process, because the former adoption of an innovation comes from the authority in organisations, and the individuals in a social system have little chance to say no in innovation-decision. He also outlines the decisions usually made by the powerful minority when he distinguished three types of innovation-decisions (Rogers, 1995). Despite noticing the power relations as a part of adoption of innovations in organisations, both the theories of Diffusion of Innovations (Rogers, 1995) and Technology Acceptance Model (Davis, 1989) tend to be individual-focused in computer technology adoption and ignore the facet of power relationships and their impact on the distribution of computer technology.

For example, the current study found that developing and implementing computerised information systems involved a considerable amount of power issues. It is argued that when computer technology adoption in healthcare organisations which have complex
power/authority relations, adopting computerised information systems may not be a selection of one option: adoption or non-adoption; it may be more a matter of compliance with an organisational requirement. For example, the implementation findings in Chapter 6 showed that front-line nurse participants held positive attitudes in terms of using computer for healthcare practice. Demographic data in Chapter 4 showed that participating nurses used computer technology in their daily life which revealed them as having at least an average level of computer competency. However, two individual demographic factors alone are insufficient to explain nurses’ compliance with computerisation. As presented in Section 9.2.4, through Lukes’ first dimension of power perspective, accepting top down authority and perceived powerlessness of one’s own role in the development and implementation decision-making process may play a significant role in these front-line nurses adopting computer technologies. Front-line nurses may comply because of the head nurse’s role, not what they said, as the front-line nurses accept top down power and authority.

Moreover, nurse participants and nurse managers also reported several findings beyond innovation characteristics such as “perceived usefulness” and “perceived ease of use” (Davis, 1989) (See Table 2.10 in Section 2.5.3), including the extent of user-involvement, implementation-approach, computer equipment and training resources, manager support, perceptions of their roles in the development and implementation. Moreover, under a mandated usage context as a result of top down implementation, using computerised information systems was a top down order needed to be compliant to these participants. Nurse managers’ concerns were that nurses adopted computer technology well and fast. However, clinical nurses’ concerns were that after adoption incorporating computers into daily practice may mean an impact on their work style and workload.

Many studies’ recommendations often stated that by understanding users’ individually perceived characteristics of innovations, it is helpful to design training interventions (Hilz, 2000). If the hospital management would like to exercise Lukes’ (1974) third dimension of power as presented in Section 9.2.4 to “shape desire” of individual users, both theories appear to be a good tool for educating and training nurses to having positive perception toward computers. However, caution is needed in emphasising the promising side of computer technology or having positive attitudes toward computers as computers may not have real benefits in facilitating clinical practice and enhancing patient care quality.
• **Dichotomy between Adoption and Non-adoption**

As described in Section 2.5.3, diffusion of innovation (Rogers, 1995) classifies adopters into five categories. However, the essence of this classification is to group individuals into two dichotomous categories: adoption and non-adopti on. This dichotomy is the same in the technology of acceptance model (See Figure 2.3): actual use and non-use. Similarly, the extant literature often categorises users’ acceptance of computer technology into adoption or rejection.

Such dichotomous categories imply a pro-innovation bias may result in failures to learn important aspects of diffusion (Rogers, 1995) and overlook user responses, perspectives and circumstances. For example, the current study identified that focus group nurse participants were compliant with computerisation decisions but grumbled whilst trying to adapt new systems or technologies. If taking the adoption-rejection dichotomy, their perceptions may be ignored. Therefore, two theories are incompatible with the findings of this study. It is suggested that two models may suit the case of optional adoption at individual level better).

### 9.3.3 Role of Middle managers

• **Shaping Desire (Lukes, 1974)**

Lukes’ (1974) third dimension of power is a really helpful perspective which enabled the researcher to identify the effects of computer training workshops, education and persuasion on nurses’ behaviours. It also provided insight into nurse manager’s perspectives of training and persuasion strategies. Many nurse manager interviewees had described the importance of training and education. However, their reservations were how to make front-line nurses accept computerised information systems through training and education, rather than the findings of how nurses acquired skills presented in Section 6.4.2. Furthermore, a considerable amount of persuasion, such as using the selling skill, were applied by nurse managers, in order to get the front-line nurses to accept the concept that computerised information systems would benefit nursing practice. Although these persuasion skills were regarded as an indirect approach to obtain compliance, compared with the direct punish and reward method (Rothschild and Miethe, 1994), its influences may be profound in selling the persuasion strategy in particular from the Lukes’ (1974) perspective of third dimension of power.
Usefulness
As described in Chapter 6 findings, the top in the case-study hospital hesitated about the purchase of portable computer trolleys. Due to the limitation of hardware equipment, nurse manager interviewees emphasised the usefulness of computers to front-line nurses, rather than the benefit of ease of use in this study. Because no resistance, passive resistance or avoidance behaviours were reported by nurse manager interviewees and front-line nurse participants, it is likely that nurse managers’ persuasions succeeded to some extent. However, it is also likely no focus groups would admit it.

The contents of persuasion reported by nurse manager interviewees in this study were mainly the idea that computers will help front-line nurses’ work. The strategy emphasizing the usefulness of computer technology corresponds to Holden and Karsh’s (2010) findings. They systematically reviewed 21 health information technology studies adopting Technology Acceptance Model (Davis, 1989). Comparing with the ease of use, sufficient evidence suggests that the perceived usefulness of IT is likely to affect clinicians’ acceptance and usage of IT (Holden and Karsh, 2010). To some extent this may explain that in spite of the fact that desktop computers caused more work (duplication and queuing for computers), nurses were still compliant with the computerisation implementation.

9.3.4 Role of Front-line Nurse
As described in finding Section 6.4, reporting front-line nurses’ perspective on the computerisation process of the case-study hospital and their technical adoption of new computer technology, the accounts of participating nurses revealed that they had generally positive motivation and beliefs towards computers. However, they revealed their dissatisfaction with the management of the computerisation process in the case-study hospital. As presented in Section 2.4.2, the technology-orientation of system life cycle limits user involvement. This corresponds to the findings of the implementation process in the case-study hospital. In short, nurses perceived that they played a powerless role in the computerisation process, acted compliantly with top down computer decision making, and grumbled because computerised information systems did not support their work or increased their workload.
Unsuitable Theories

As examined in Section 9.3.2, diffusion of innovations (Rogers, 1995) and Technology Acceptance Model (Davis, 1989), which are popular in information technology innovation adoption studies, are identified as unhelpful in explaining the implementation findings of the current study. In order to identify theories to explain front-line nurses’ perceptions of computerisation, the theories about emotions and organisational change were analysed, including the works of Antonacopoulou and Gabriel (2001) and Fineman (2000; 2003) on emotion in organisational change.

Fineman's (2000) Emotion in Organisations is not relevant, in terms of employees’ collective complaints. In relation to the work of emotion and change, Fineman (2003) discussed how organisational change elicits many feelings, including loss, anxiety and resistance to change. Change is emotional and facing change means to confront conflicting feelings (Fineman, 2003). Fineman’s work is helpful in understanding that the emotion of grumbling shown by participating nurses was not a surprise. However, it is identified that his work does not cover employees’ collective complaints.

Similar to Fineman (2003), Antonacopoulou and Gabriel (2001) highlight that change triggers an immense amount of emotional response and individual or group responses vary widely. Antonacopoulou and Gabriel (2001) suggest that emotion and learning are interrelated, interactive, and interdependent; organisational situations generate emotions depending on how individuals interpret situations and learning is influenced by different emotions (Antonacopoulou and Gabriel, 2001). Therefore, they argue that individuals’ responses to change are complex and various; it is too simple to dichotomise resistance or readiness to change. Consequently, they point out that diverse experiences and meanings of changes are ignored, for example: controlled and uncontrolled (Antonacopoulou and Gabriel, 2001).

Antonacopoulou and Gabriel (2001) promote the idea that learning and emotion are interdependent which can partially explain the emotions of front-line nurse-participants resulting from acquiring skills to adjust to computerisation change (Finding Section 6.4.2). However, this was not the only source which triggered participating front line nurses to complain. Antonacopoulou and Gabriel’s (2001) work is unable to explain nurses’ grumbling elicited by the nursing job context and computerisation implementation management.
• **Vocabulary of Complaints (Turner 1986)**

In this section, the theory of Vocabulary of Complaint (Turner, 1986) will be outlined. How Turner’s concept fits the nurses’ perceptions of current study and how it is helpful in explaining the meaning and functions of grumbling among front-line nurses will be presented.

Without providing a specific definition, Turner (1986) briefly describes how he terms alternative occupational ideology as vocabulary of complaint. Turner (1986) argues that all occupations have vocabularies of complaint. Complaint systems are regarded as an occupational sub-culture and complaints are regarded as occupational vocabulary (Turner, 1986). By analysing the complaint system of nursing, complaints are suggested as regular features of nursing occupation and complaint and compliance co-exist in nursing as occupation (Turner, 1986).

Turner’s vocabulary of complaint has two key concepts. Firstly, vocabularies of complaint are regarded as coping mechanisms for conflict circumstances between norm and actual practice. They serve as survival methods on the job whilst questioning the authority of formal structure (Turner, 1986). Secondly, vocabularies of complaints as occupational discourses are structured by the alternative occupational ideology, rather than individual, literal and descriptive experiences of stressful situations. He argues that these complaint discourses are collective experiences and have the function in recommending and legitimating attitudes of opposition (Turner, 1986).

• **Explanation of Nurses’ Powerlessness, Compliance and Grumbling**

Several key elements in the findings regarding the role of front-line nurses correspond to Turner’s (1986) key concepts of vocabulary of complaint.

- As the findings presented in Chapter 6, examining the role of front-line nurse, complaint and compliance co-existed in participating nurses at the same time in response to top down implementation approach and lack of user involvement.
- Through articulate expression, grumbling to participating nurses was the coping mechanism under conflict circumstances. Participating nurses described that grumbling whilst using the system was a part of their adaptation. It is noticed that their grumbling appeared when they handled hidden work caused by computer systems in particular. This corresponds to Turner’s (1986) viewpoint that a complaint system is a coping
mechanism when facing conflict situations. The details of conflicts will be presented in the next paragraph.

- Grumbling collectively was nurses’ occupational discourse, rather than single individual’s articulation of stressful situations. It is noticed that their grumbling appeared in stressful situations such as caring for a computer and duplication in Chapter 8, and making readjustment to a new system or technology in Section 6.4.2. However, the findings show that grumbling was common in the majority of nurses. This corresponded to Turner’s (1986) notion that vocabularies of complaints are occupational discourses.

- Turner proposes that vocabulary of complaint has five major functions. Three out of five functions correspond to the current study. The details will be presented in the next paragraphs.

Turner’s five functions of vocabulary of complaints focus on the doctor-nurse relationships within hospital systems, which is not the job context of the current study. However, Turner’s idea that complaints have functions and meaning in the nursing occupation provides insights into nurses’ grumbling of the current study. Furthermore, it is identified that three out of Turner’s five functions are helpful in explaining grumbling by participating nurses.

Firstly, grumbling as verbal expressions serves as a conversation function to nurses in the current study. Grumbling of focus group nurse participants manifested in conversations among their peers only, neither to reject nor to transform the management of computer system implementation in the case-study hospital. The findings showed that participating nurses perceived powerlessness in their role. Because they believed that computerisation decisions were already made and unable to be transformed, they were compliant with the top’s decisions and verbally expressed their dissatisfaction with management approach. This corresponds to Turner’s (1986) concept that vocabulary of complaint is for “conversation function” meaning that nurses use it to relieve emotions and frustrations rather than as active resistance. Due to lack of power, grumbling to them was a means of releasing their oppressed emotions at least and to question the management approach at most. Additionally, Lukes’ (1974) first dimension of power may be helpful to explain at a deeper level why grumbling serves as conversation function among participant nurses only. The hospital management exercised their power of authority over front-line nurses to make them accept computerisation. Nurses’ grumbling may be regarded as an obvious conflict; despite it being a powerless one. Furthermore, it is suggested that the reasons resulting in such a collective complaint may be that focus group nurses who participated did not
perceive the benefits of computerisation as the top promised or they expected. The further details will be presented in the next paragraph.

Secondly, the grumbling by nurses that computer systems and technologies were unable to support the needs of front-line nurses in daily clinical practice showed “devaluing function” of complaints (Turner, 1986). Devaluing function of complaints by nurses in Turner’s (1986) work is to draw attention to the negative role of doctors that reduces the contributions of doctors to the healthcare provision and emphasises the importance of nurses. In the current study, devaluing the computerised information systems and technologies implies that they complained of the absence of control in relation to two major issues.

The first issue was that participating nurses felt a lack of control of unintended consequences created by computerised information systems. They held positive attitudes toward computers believing computers would bring efficiency to their work, yet they perceived computer’s unintended consequences created negative influences on their work. Nurses described how they grumbled whilst the system was unable to support their work, requiring them to do many forms of hidden work, including intangible coordination, computer and printer troubleshooting and duplicated work as described in Chapter 8. The theory of unintended consequences by Orlikowski (1992) will be presented in the later sections to discuss the findings of Chapter 8 Hidden Work.

The second issue was that nurses felt a lack of control, through being ignored greatly in the computerisation process. Section 6.4.1 described how participating nurses perceived no user involvement to give their voices in the computerisation process and receiving limited manager support in facing such a change. The participating nurses felt the conflict when they were computer system heavy users compared with the rest of healthcare professionals in the hospital, and yet they had the least power to appeal about their needs themselves in designing and implementing a system.

Thirdly, nurses’ grumbling connoted the emphasis function showing the contribution and value of their role in maintaining the hospital’s operations properly. Chapter 8 showed that participating nurses developed a series of coping strategies to meet patients’ needs and to accomplish their work when hardware and software equipment caused any problems. Nurses’ grumbling draws the attention to their hidden work and up-front management as well as them putting their patients and hospital’s operations as the first priority.
9.3.5 Discussion of Current Evidence

Empirical evidence investigating how healthcare professionals adopt new computer technology is scarce. Jensen and Aanestad (2007) is the one study identified. They examined the electronic patient record (EPR) adoption process by doctors and nurses in two wards from two Danish hospitals. Qualitative data were collected including observing how doctors and nurses interact with EPR in the wards, interviewing doctors (n=10) and nurses (n=14) and reviewing related documents.

Jensen and Aanestad’s (2007) study gave an overview of the context under study. In terms of the electronic patient record system, two surgical wards from two hospitals adopted the same off-the-shelf system, which was rather inflexible and allowed limited modifications. By contrast, the case-study hospital in the current study developed their computerised information systems with the informatics department. In terms of decision-making, Jensen and Aanestad’s (2007) study was similar to the current study. Adopting a standard EPR in Jensen and Aanestad’s (2007) study was not initiated by the bottom up approach and healthcare professionals were not involved in decision-making regarding the selection of the system.

Despite the fact that the systems and the healthcare organisations were different in each study, some of their findings were similar to this study. Jensen and Aanestad (2007) found the resources for acquiring skills identified by participants were formal training sessions, peer support, and user manuals. Both nurse and doctor interviewees highlighted the significance of “learning-by-doing” and “hands-on training” for acquiring skills. In addition, peer support was regarded as essential, particularly in the nursing group. These findings corresponded to the findings Section 6.4.2. Some of their findings also corresponded to the findings of Digital Taylorism and Hidden work in this study. The details will be discussed in Section 9.4 and 9.5.

However, the implementation reported in the Jensen and Aanestad (2007) study tended to focus on the technical aspect of adoption. Despite that authors noticing, the user involvement was limited under study, how the healthcare professionals viewed their role in the computerisation process was not stated in the published paper. Moreover, they briefly mentioned some nurses were frustrated about the complexity of using the system, without reporting further accounts. By contrast, the authors described their standpoint viewing the healthcare professionals’ role as “active player”, neither slave nor master. The authors still regarded the role of healthcare professionals as active, rather than passive, because the
users choose not to use the technology or work-around. It is argued that this is the authors’ viewpoint which may not reflect healthcare professionals’ view in their role in the study of the development and implementation process. The users’ viewpoints may be helpful to understand the computerisation process. Comparing Jensen and Aanestad’s (2007) study to the current study, the findings of this study were more in details, covering both nurses’ perception of their own role and adoption in technical aspect.

As a critical examination in Section 2.2.10, three longitudinal surveys surveyed nurses’ attitudes towards computers and found that nurses’ attitudes become less positive significantly after implementation (Murphy et al., 1994; Sleutel and Guinn, 1999; Smith et al., 2005). Similarly, a recent survey study found that nurses’ (n=705) perceptions towards computerised information systems are optimistic before training and significantly decreased comparing post-training and 6-month after implementation in a large number of items (Ward et al., 2011).

Ward et al. (2011) indicated that measuring at 6 months after implementation is common. However, this time period may be least favourable in terms of satisfaction due to staff adapting to new systems and workflow changes. Ward et al. (2011) suggest that promotion of the benefits of implementation to build expectations to a realistic level is needed to avoid disappointment (Ward et al., 2011). However, it is argued that nurses’ disappointment may be just one contributing factor. Based on the findings in this study, possible explanations for the significantly less positive attitudes may be the powerlessness of the nurse user role in the implementation process and the unintended consequences of computerisation in increasing nurses’ workload. The unintended consequences will be discussed by Orlikowski’s (1992) duality of technology in Section 9.5.

9.3.6 Oppression in Nursing
Drawing Chapter 5 and 6 together, the findings showed that whilst nurse-manager interviewees’ were powerless in developing nursing information systems, front-line nurses perceived themselves as powerless in relation to nurse managers who they perceived as exercising a “tough” management style. Miers (1999) described oppression in nursing arguing that oppressed managers oppress their staff. Her concept may explain why the findings showed that inferior nurse-managers exercised power on the lowest and most powerless subordinated front-line nurses in this study. Hence, this section argues that it was not the computer technology that the front-line nursing participants did not like; rather it was the top down change strategy they did not like. Demographic data showed that
participating front-line nurses used computer technologies in their daily life. They had a generally positive perspective in terms of adopting computers into nursing practice.

Evidence regarding oppression in the process of developing and implementing computerised information systems is limited. However, one grounded theory study interviewing hospital registered nurses (n=28) from seven hospitals in Taiwan identified that the leadership style of hospital managers through nurses’ perceptions is hierarchical (Su et al., 2011). Su et al.’s (2011) study indicated nurse-managers are classified as inferiors and oppressed by the hospital managers and doctors. Thus, nurse-managers are not given sufficient power and are seldom involved in the decision making (Su et al., 2011). In this study, nurses perceived that hospital priority is given to doctors and nurses’ need is ignored. This study also found that nurses perceived that autocracy of the nursing department did not support nurses. Consequently, the study found that nurses perceived themselves as the lowest and most powerless subordinates in the hospitals (Su et al., 2011). Although the research focus of Su et al.’s (2011) study was not regarding computerised information systems, its sample selection and study-setting are similar to this study. Moreover, its findings correlate to power relations of this study, such as the nurse managers’ lack of power position in negotiation presented in Chapter 5 and front-line nurses’ powerless perception described in Section 6.4.1. Su et al.’s (2011) study also further supports the concept of oppression in nursing of the current study.

9.4 Surveillance and Control in Computerisation

9.4.1 Summary of Digital Taylorism

The findings of Chapter 7 in relation to digital Taylorism showed that the case-study hospital computerised a series of healthcare activities, including computerised physician order entry system, blood glucose meter with mobile network function, RFID-based porter management system, and automatic notifying system. Through system design techniques, the criteria and standards of management were set into the computer systems and structure of healthcare service provision. Moreover, the findings showed that computerised information systems were able to provide different levels of transparency of healthcare activities done by healthcare professionals. While both nurses and nurse managers perceived that computerised information systems were tools for retrieving information, nurses regarded it as for patient care, whereas nurse managers regarded it as being for management purposes. The findings also showed that nurses perceived the dual influences of computerisation on their work which will be discussed in Section 9.5.
Much literature suggests that electronic patient records systems are essential for better quality of patient care, this section of discussion argues that computerised information systems are able to facilitate the practice of healthcare professionals subject to managerial surveillance and control. A later section will debate whether computerised information systems up-skill or deskill nurses’ practice.

**9.4.2 Workflow Redesign - Sociological Perspectives**

The general information system literature describes the idea of re-engineering work or workflow redesign by the terms of “combining steps” and “streamlining of procedures” (Laudon and Laudon, 2002). However, the sociological perspective views such efficiency-benefits as the result of substitution and task integration (Flecker and Hofbauer, 1998; Greenbaum, 1998). How substitution and task integration are helpful in explaining the findings of the current study will be presented in the following section.

- **Substitution**

  Through a sociological perspective, Greenbaum (1998) describes that the analysis function of computer systems substitutes the middle-management function in terms of gathering and analysing information. Moreover, its accessibility allows upper-level managers to approach information over distances without the role of middle-managers. Several key findings of the current study correspond to Greenbaum’s (1998) ideas. Section 7.3.4 shows that the statistics analysis function is one of advantages of computer systems. Moreover, Section 7.3.6 also corresponds to the feature of statistics and remote access. The findings showed nursing executive interviewees were able to access the information of nurse-patient ratio of each ward for labour arrangement in real-time without actually visiting wards and collecting information personally.

Data from the current study develops the substitution concept (Greenbaum, 1998) further. The substitution in this study is not only limited to the middle-management posts as well as statistics function and distant access as Greenbaum (1998) described. The findings in Section 7.2.2 show that computerised information systems substituted some management function of nursing practice which used to be performed by front-line registered nurses in the case-study hospital, such as automatic summing-up of nutrition assessment scores, automatic meal subscription and automatic matching prescription orders and blood glucose results. Meanwhile, the automatic notifying function of computer systems substitute nurses’ communication function, such as informing dieticians of patients with nutrition
imbalance, notifying physicians about abnormal laboratory results and telephone contact for requesting porter services.

Additionally, it is argued that such substitution correlates to the concept of deskillling by Braverman (1974). Section 7.4.3 showed that whilst standardised nursing interventions in the computerised nursing care plan system provided references for general practice, the nursing role was degraded to picking and choosing from a set menu. The standardised contents on the system were predetermined by the hospital management and the choosing and picking method separates nurses’ thinking from providing care practice. This corresponds to the critique of Taylorism by Braverman (1974) presented in Section 7.1.

- Task Integration

The concept of task integration by Flecker and Hofbauer (1998) is helpful to explain the workflow change by computerisation. Different tasks are assigned to one employee which intensifies the utilisation of labour, such as integrating auxiliary work with clerical work, integrating indirect production work with direct production work and assigning more products or customers to salespersons (Flecker and Hofbauer, 1998).

Several findings of the current study correspond to the concept of task integration. Through re-structuring the workflow, computerised information systems integrated tasks to a particular group of healthcare professionals, such as doctors and nurses. These tasks were data-entry jobs in particular. Section 7.2.2 showed that after implementing computerised physician order entry system, doctors were required to finish prescriptions by computers. This system substituted the work of porters and integrated data-entry tasks of administrative staff to doctors. Additionally, the case-study hospital adopted a new type of blood glucose meter which was able to transfer glucose information to computers via wireless network. After the adoption, the work of chasing missed blood glucose orders by the insurance department and head nurses was integrated into front-line nurses’ practice. For labour management system and porter management system, the automatic function substituted the middle-management function and allowed remote access. The data-entry jobs were integrated to front-line nurses and thus became one part of hidden work. Furthermore, Braverman (1974) regarded reutilisation of tasks and deskillling as work intensification. It is argued that task-integration is consistent with the concept of work intensification (Braverman 1974). It is also argued that task-integration by computerisation in the information age develops the concept of work intensification further.
9.4.3 Discipline and Punish (Foucault 1977)
The invention of computers stimulates disciplinary control onto a new level (Poster, 1984). In the electronic age, the ability to monitor people’s behaviours is widened greatly by information processing mechanism of computers which gathers any traces of activities without the restriction of space (Poster, 1984). It is identified that Foucault’s (1977) disciplinary concept may illuminate the findings of Chapter 7. In *Discipline and Punish*, Foucault’s (1977) concept of disciplinary society contended that normalisation of behaviour through surveillance practices is beyond the prison wall. This section will draw upon Foucauldian lenses to explain the workflow redesign management after the introduction of computer technology in the case-study hospital. The concepts of normalising judgement and Panopticon will be outlined. How the surveillance and control functions of computerised information systems may become disciplinary technologies will be discussed.

- **Normalising Judgement**
  Foucault’s (1977) notion of normalising judgement has three key concepts. Normalising process involves (1) establishing normality through setting the principles to be followed, (2) differentiating any non-observance by comparing the individuals’ performances from another, and (3) reducing gaps by corrective measures (Foucault, 1977).

- **Panopticon**
  Foucault (1977) used Benthams’ architectural figure, called Panopticon, to convey his concept of permanent visibility for surveillance and control. Foucault’s panoptic mechanism serving the function of observation has two key concepts. Firstly, it enables the observers to see many different individuals and all activities at one glance. Secondly, it allows the observers to see constantly without interruption in space or time. Foucault contended that the observation mechanism penetrates into individuals’ behaviours by drawing up differences and to altering, training and correcting individuals. Thus, Panopticon is the discipline mechanism improving the exercise of power (Foucault, 1977).

- **Explanations of Disciplinary Power of Technology**
  Several key findings presented in Chapter 7 correlate with the core concepts of discipline principles described above (Foucault, 1977).

  Firstly, the findings of Section 7.2 revealed the workflow redesign through information technology which is consistent with the concept of normalising judgement (Foucault,
1977). Foucault’s concept of normalisation means the process of establishing rules, detecting any non-compliance and correcting deviations (Foucault, 1977). The findings showed that desired practice standards were built into the computerised information systems by software programme design techniques. These techniques included highlighted-colour texts, pop-up windows, suspending the proceeding practice and finally locking up users’ accounts. These rules were embedded in computerised information systems, serving the function of an internal control mechanism and which is applied to care delivery. Based on the standards set, computerised information systems are able to detect any non-compliance: what users are supposed to do and have not done. Thus, in order to correct the deviations in practice, the systems reinforced the norms by compulsory design techniques to correct deviations in practice.

Secondly, the findings of Section 7.3 correspond to the Foucault’s (1977) concept of the panoptic mechanism. The accounts of participating nurses and nurse managers showed that computerised information systems were able to record all events which made all of completed and uncompleted clinical activities visible. The statistical function of computer technology was able to enumerate any activities on the system. Additionally, the information could be retrieved without time and spatial limitations.

Thirdly, as presented in Section 7.3, the transparent information produced by computerised information systems in real-time made nurse managers able to understand what had happened at one glance and extended management surveillance. This corresponds to Foucault’s suggestion that the panopticon facilitates hierarchical observation (Foucault, 1977). “Hierarchized, continuous and functional surveillance” is significant to disciplinary power (Foucault, 1977).

Therefore, this section of the discussion argues that computerised information systems may become a disciplinary technology. They imposed a deeper level of transparency, imposed precise practice norms, differentiated any non-observance and corrected deviations in practice. The systems may become tools forcing front-line nurses to comply with rules, objectives and goals set by the hospitals. Once the work goes online, nurses may not have a choice between compliance and noncompliance. In order to provide services, it is a must for users to comply with the system exactly. Therefore, computerised information systems may extend managerial control over staff nurses and reduce their discretion. It is through these systems that managerial control may be reinforced in the digital era.
9.4.4 Discussions of Current Evidence

Many recent studies found that nurses perceived the influences of computerisation on their performance (Lee, 2004; Lium et al., 2006; Hurley et al., 2007; Jensen and Aanestad, 2007; Lee, 2007; Kossman and Scheidenhelm, 2008; Jensen et al., 2009; Shield et al., 2010; Huang and Lee, 2011; Ward et al., 2011). Many findings of these studies correspond to findings of digital Taylorism in this study which will be discussed in the following paragraphs after the overview of these studies. The research design of some studies was presented in Section 9.2.5 and 9.3.5 (Lium et al., 2006; Jensen and Aanestad, 2007; Ward et al., 2011). The research design of the rest of studies will be presented in the next paragraphs.

Research design of these studies varied. Some qualitative studies conducted interviews (Lee, 2004), focus groups (Lee, 2007), or collected multiple qualitative data including interviews, observation, and documents (Jensen et al., 2009). Some are mixed-method studies combining questionnaires with interviews or observations (Hurley et al., 2007; Kossman and Scheidenhelm, 2008; Huang and Lee, 2011).

The sample recruited and computer technologies studied in most studies are similar to the current study. Most studies recruited front-line nurses working intensive care units or wards at hospitals (Lee, 2004; Hurley et al., 2007; Lee, 2007; Kossman and Scheidenhelm, 2008; Huang and Lee, 2011). Only two studies also recruited doctors and secretaries (Jensen et al., 2009; Shield et al., 2010). Only one study setting was in outpatient centre (Shield et al., 2010). However, these studies did not recruit nurse managers or informatics staff into their studies. Therefore, their sample selection tends to reflect only the role of system end-user during the computerisation process in the hospital setting.

The sampling strategies of most studies were not stated in the published paper. One study selected all nurse employees (Hurley et al., 2007) and one used convenience sampling (Kossman and Scheidenhelm, 2008). Computer technologies studied included computerised nursing care plan system (Lee, 2004), nursing information systems (Lee, 2007), electronic health record (Kossman and Scheidenhelm, 2008; Shield et al., 2010), electronic patient record (Jensen et al., 2009), barcode medication administration system (Hurley et al., 2007), and clinical information system (Huang and Lee, 2011).
• **Substitution**

Some recent qualitative studies conducting interviews and focus groups reported that nurses perceived that functions of reference, communication and management of computerised information systems influence their practice (Lee, 2004; Jensen and Aanestad, 2007; Lee, 2007; Kossman and Scheidenhelm, 2008; Shield et al., 2010). These findings correspond to the finding of this study presented in Section 7.2 and 7.4.3 and further support the concept of substitution. Two studies found that nurses perceived that computerised nursing information systems provide a “reference function” to help their documentation processes (Lee, 2004; Lee, 2007). For example, Lee’s (2007) study found that nurses perceived the convenience of completing nursing care plans on the nursing information system. When nurses enter a patient’s condition, the system provides a series of items for nurses to pick and click. However, one study found that nurses worried that the feature of “click and print” in computerised nursing care plan system may limit their critical thinking process (Lee, 2004; Kossman and Scheidenhelm, 2008). Nurses’ concerns consist with the argument of deskilling described in Section 9.4.2. One study reported that nurses described the electronic patient record act as communication media which saves their phone calls contacting other departments and simplifies their work process (Jensen and Aanestad, 2007). One study reported that nurses perceived that the management function of the electronic health record saved their manual work of pulling and reviewing charts and sending letters (Shield et al., 2010).

• **Task Integration**

Research reporting that new tasks are integrated with nurses’ practice after workflow redesign by computerisation is scarce. However, a few studies identified that doctors perceived this change (Lium et al., 2006; Jensen and Aanestad, 2007; Jensen et al., 2009). The findings correspond to the finding presented in Section 7.2 and further support the concept of substitution. Two qualitative studies found that doctors perceived they spent more time on administration tasks on the computer after introducing electronic patient record system (Jensen and Aanestad, 2007; Jensen et al., 2009). The findings show that some tasks carried by nurses and secretaries are integrated with their current practice, including entering prescriptions into the system, retrieving x-rays for patient consultations and referring patients for occupational therapy appointments (Jensen et al., 2009). One questionnaire survey study identified that a considerable amount of doctors (40.9%) perceived that some important tasks become cumbersome and more difficult after withdrawal of paper medical records, including ordering ultrasound, CT scan, x-ray, and writing prescriptions (Lium et al., 2006).
• Information Transparency

As described in Section 7.3, the findings on transparency of information revealed that participating nurses perceived computerised information systems enhancing their job performance and patient care, whilst nurse managers perceived that the systems facilitated their management. Thus, it is argued that computerised information systems are not only a tool to help clinical practice but also a device to measure performance.

Many recent studies reported that nurses perceived that there were benefits of information transparency for patient care, including legible charting (Shield et al., 2010; Huang and Lee, 2011; Ward et al., 2011), easy access (Kossman and Scheidenhelm, 2008; Ward et al., 2011), easy retrieving of patient information, (Lium et al., 2006; Hurley et al., 2007; Jensen and Aanestad, 2007; Kossman and Scheidenhelm, 2008), improved access to patient charts (Shield et al., 2010), and real-time patient information (Shield et al., 2010; Ward et al., 2011). These findings echo the participating nurses’ viewpoints of the current study in Section 7.3.

Additionally, these studies did not identify the issue of information transparency being used as a management control strategy. Particularly, these studies only sampled front-line nurses and the limited insight into management issues corresponds with the findings from front-line nurses in the current study. There are two possible explanations for nurses’ lack of awareness of these issues. Firstly, different roles and levels in the organisational hierarchy lead different groups of participants viewing and focusing on different aspects of computerisation naturally. Secondly, electronic patient record systems are often promoted for enhancing quality of healthcare and patient safety. Through exercising Lukes’ (1974) third dimension of power, one aspect of the dual influences of technology is concealed. Thus, nurses were not aware that a deeper level of information transparency facilitates hospital management. The theory and discussions of duality of technology will be presented in Section 9.5.

• Disciplinary Technology

Empirical evidence regarding control of computerised information systems over clinical performance is limited. Some recent studies found that nurses perceived electronic health record systems or nursing information systems are a great help in organising their work by providing task lists (Kossman and Scheidenhelm, 2008), just-in-time reminder and prompts (Lee, 2007; Kossman and Scheidenhelm, 2008; Shield et al., 2010). They also perceived computerised information systems enable efficient documentation (Kossman and
Scheidenhelm, 2008; Huang and Lee, 2011) and streamlining workflow (Huang and Lee, 2011). By contrast, few studies found that doctors perceived that an electronic patient record system led to more control for practice which challenges their expertise, professional, and clinical freedom (Jensen and Aanestad, 2007; Jensen et al., 2009). Doctors perceived that they are compelled by the system regarding standard medication prescribing procedures and consistency in documentation. For example, doctors are required to document when they read patient test results every time (Jensen and Aanestad, 2007; Jensen et al., 2009). Regardless of the discrepancy in perceptions between nurses and doctors, these findings correspond to the Section 7.2.3 findings that desired practice standards were able to be set into the systems through software programme design. It also further supports Foucault’s (1977) concept of normality presented earlier. As a result of workflow redesign after computerisation, nurses’ performances were driven by computerised information systems.

Only one study investigated the disciplinary aspect of computerised information systems (Doolin, 2004). Doolin’s (2004) study which investigated the surveillance and control of medical management information system over clinical performances of hospital doctors based on the Foucauldian conception of power (1977). The research design is a qualitative case study interviewing different levels of stakeholders including clinical and cooperation staff (n=43) in one New Zealand hospital (Doolin, 2004). The sample selection approach of Doolin’s (2004) studies drew stakeholders from different levels of hierarchy crossing different departments which is similar to the current study. However, the sample in Doolin’s (2004) study tends to reflect the role of managers with non-nursing background. Because the interviewees in the Doolin (2004) study are directors, managers and the study focus is doctors’ practice, only charge nurses were recruited into the study.

Similarly, Doolin’s (2004) study found that medical management information system generates clinical information, information on cost, and tracking patient utilization of clinical resources during hospitalisation of each patient. The system places clinical activities under scrutiny and enables management to focus attention on profit and loss-making areas. Using visible clinical decisions with financial implications and comparing performances of individual doctors, hospital management attempted to influence doctors’ decisions toward ‘normal’ work practices (Doolin, 2004). The findings correspond to the findings in Section 7.2 and 7.3 and further support the concept of disciplinary power (Foucault, 1977) of technology discussed earlier.
However, in Doolin’s (2004) study, the visibility of information enables “normalising judgement” (Foucault, 1977) carried out by hospital management. The findings of this study showed that through advanced computer technology, differentiating any non-observance, comparing individuals’ performances, executing corrective measures were able to be processed in the computerised information systems. Thus, computerised information systems become a tool of management to exercise disciplinary power constantly without interruption in space or time and without physical presence of managers.

In addition, few studies conducted in a non-healthcare setting are drawn into this discussion for two reasons. Firstly, the studies are well-known call centre research which identified IT-driven labour process and led to Taylorisation of white-collar work in UK call centres (n=108) (Baldry et al., 1998; Taylor and Bain, 1999). Secondly, Eisenhardt (1989) suggests linking the result with literature in other contexts may sharpen and elevate the conceptual level of the study and strengthen internal validity and generalisability.

Through questionnaires, interviews and focus groups, the studies found that the telephone and computer technology are integrated into call centres to structure, scrutinise, monitor and speed-up labour process. The introduction of an automatic call distribution system directs calls automatically which substitutes the need for switchboard operators. Consequently work is intensified by minimising manual operations and maximising time spent with customers. The use of tightly-defined scripts attempts to structure and routinize the speech of workers. As an electronic panopticon, the system acts visually displaying waiting calls and calculates numbers and duration of calls which enables managers to track and measure operators’ performance (Baldry et al., 1998; Taylor and Bain, 1999). The findings of call centre studies correspond to the findings of Chapter 7 which also support both concepts of Taylorism and disciplinary technology.

9.4.5 Upskill VS Deskill Debate
As described in the literature review Chapter 2, the nursing field attempts to increase the visibility and obtain more nursing autonomy through integrating computer technology into nursing practice for the purpose of up-skilling (Sandelowski, 2000). Several nursing informatics’ experts claim that adopting computer technology into nursing practice may develop a visible and recognisable professional presence (Saba, 2001; McCormick et al., 2007; Saba and Taylor, 2007). Just as in the history of nursing occupation, ICU nurses appear to have higher professional status due to using technology (Denny, 2005). This idea needs to be treated with caution in this study, because computer technology can not
only up-skill, but also deskill (Greenbaum, 1998). Moreover, the current study showed that what nurse managers were able to control in the development of nursing information system was limited in Chapter 5 and Section 9.2.4. Computer technology may potentially become the management tool as shown Chapter 7 digital Taylorism. Computerisation may not produce the result the nursing group hopes for, but may lead to loss of autonomy. Furthermore, hidden work described in Chapter 8 may stretch front-line nurses rather than supporting them. The unintended consequences and duality of computer technology will be discussed in the next section.

9.5 Unintended Consequences of Computerisation

This section discusses the findings of hidden work presented in Chapter 8 through the lens of duality of technology (Orlikowski, 1992) and by comparing and contrasting the current evidence.

9.5.1 Summary of Hidden Work Findings

As Chapter 8 described, the computerisation of many tasks led to healthcare service provision becoming heavily dependent on computer technologies. Consequently, computer technological breakdown became a prominent issue which negatively impacted on nurses’ work. Chapter 8 examined the context of computer technological breakdown from the front-line nurses’ perspectives and how nurses applied self-developed strategies to cope with computer and printer downtime. The findings also showed how these coping activities appeared to be trivial, but were significant in maintaining the hospital operation. Additionally, because of the parallel implementation of computerised information systems, nurses were required to duplicate their work by using both computer and paper-based method during this transitional period. As these additional burdens were placed on the front-line nurses; these tasks consumed nursing time and took nurses away from patients.

9.5.2 Strengths and Limitations of Hidden Work (1979) Concept

As Chapter 8 presented, Wadel’s (1979) concept of hidden work was applied to theorise nurses’ coping activities resulting from computer technological malfunction and implementation transitional phase. Her concept is helpful in understanding the characteristics, value and function of these invisible activities. Whilst Wadel’s (1979) social construction analysis of work concept tends to focus on the domain of paid-work and non-paid work, it is remarked that these data may develop the concept of hidden work further by adding “extra work” in. However, her concept is not appropriate to explain the
fundamental causes of hidden work resulting from computerisation. Therefore, Duality of Technology (Orlikowski, 1992) is selected for this purpose.

9.5.3 Duality of Technology (Orlikowski, 1992)

Orlikowski (1992) proposes a theoretical model, called Structurational Model of Technology, drawing on Giddens’ theory of structuration to examine the interaction between technology and organisations. It has been applied to study different kinds of technologies in organisations (Orlikowski, 1993; Orlikowski and Gash, 1994; Orlikowski and Yates, 1994; Orlikowski, 1996; Yates et al., 1999).

It is identified that duality of technology, one of the premises, is helpful to explain the findings regarding the impact of computerisation. As the early analysis period, the researcher conceived the idea that “the computer is like a double-edged sword” in relation to nurses’ work from the data of participating nurses and some nurse manager interviewees. The key idea of the dualistic view is that technology does both enable and constrain human action which facilitates the performance of certain kinds of work and hence constrains the performance by facilitating it in a particular manner (Orlikowski, 1992). Moreover, Orlikowski points out that the dual influence of technology, intended and unintended consequences, tends to be suppressed by emphasising only one view of technology and concealing the other one in organisations (Orlikowski, 1992).

• Explanations of Computerisation Consequences

Several key findings of the current study are consistent with the concept of duality of technology (Orlikowski, 1992).

Computerised information systems have both enabling and constraining influences on participating nurses’ practice. The dual influences of computerised information systems on nurses’ performance are manifested in Chapter 7 Digital Taylorism and Chapter 8 Hidden work. The increased surveillance function of computerisation is an intended consequence of the introduction of computerised information systems by top managers. However, managing technological breakdown and implementation problems produce unintended consequences and constrained nurses’ professional performance.

Furthermore, as described in Section 7.4, due to several front-line nurses and nurse managers perceiving the pros and cons of computerisation, the findings were presented by the versus coding (Saldana, 2009). Being the role of system end-user, their perceptions of
computerisation influences on their work echo the concept of duality of technology (Orlikowski, 1992).

Additionally, the constraining features and unintended consequences of computer technology are often an invisible aspect in promoting electronic health record system in healthcare settings. As reviewed in Chapter 2, promoting electronic health record systems is a world trend, despite the fact that this promotion needs further underpinning evidence. By contrast, some empirical studies found that nurses perceived some negative influences of computer use on their practice which received less attention. Those unintended consequences of technology were identified through the accounts of organisation members posited by the lower hierarchy in the current study. As Section 6.3.2 described, nurse managers demonstrated a considerable number of persuasion skills to gain front-line nurses’ compliance and to promote computerised information systems by emphasising only the usefulness of technology. Similarly, an empirical case study in Danish hospital reported that when introducing electronic patient record system, the hospital management promoted the system as a necessary tool for work efficiency and the best possible patient service provision (Jensen et al., 2009). Whilst applying Lukes’ third dimension of power to shape desires of adopting technology, the enabling feature of technology is emphasized and the constraining feature is often concealed implementation management.

- **Limitations**

It has been identified that either hidden work (Wadel, 1979) or duality of technology (Orlikowski, 1992) is insufficient to understand why these activities performed by nurses were hidden. Therefore, in the later section, the explanations developed by the researcher will be presented.

**9.5.4 Discussion of Current Evidence**

Several recent empirical studies reported both an enabling and constraining impact on nurses’ work in their findings, which further supports the concept of the duality of computer technology (Lee, 2004; Hurley et al., 2007; Jensen and Aanestad, 2007; Eley et al., 2008; Kossman and Scheidenhelm, 2008; Lee, 2008; Lee et al., 2008; Rahimi et al., 2008; Shield et al., 2010; Huang and Lee, 2011; Ward et al., 2011). These findings will be discussed after the overview of their research design.

Many of these studies were presented in Sections 9.3.5 (Jensen and Aanestad, 2007; Ward et al., 2011) and 9.4.4 (Lee, 2004; Hurley et al., 2007; Kossman and Scheidenhelm, 2008;
Shield et al., 2010). The sample recruited and the computer technology studied in the rest of studies are similar to the current study (Eley et al., 2008; Lee, 2008; Lee et al., 2008; Rahimi et al., 2009). However, their research design and study scale varied. One qualitative study was conducted in focus groups with nurses in a hospital (Lee, 2008). Three quantitative studies conducted cross-sectional (Eley et al., 2008; Rahimi et al., 2009) or longitudinal (Lee et al., 2008) surveys of nurse-user experiences. The setting under study of two studies are similar to this study (Lee, 2008; Lee et al., 2008). Excepting these, one study is a national survey (Eley et al., 2008) and one study conducted in clinics (Rahimi et al., 2009).

On one hand, these studies report that nurses perceived improved efficiency through quicker documentation and information retrieval processes. On the other hand, however, as the healthcare practice is more dependent on computerised information systems, they are also vulnerable to technological breakdown, such as slow computer-response time and system downtime, which affects nurses’ workflow (Lee, 2004; Hurley et al., 2007; Jensen and Aanestad, 2007; Kossman and Scheidenhelm, 2008; Shield et al., 2010; Huang and Lee, 2011; Ward et al., 2011).

The findings of several studies correspond to some parts of nurses’ hidden work in this study. These invisible activities include queuing for the computer (Eley et al., 2008; Kossman and Scheidenhelm, 2008; Lee, 2008; Lee et al., 2008), troubleshooting (Lee, 2004), duplication (Kossman and Scheidenhelm, 2008; Eley et al., 2009; Shield et al., 2010), and increased computer time (Hurley et al., 2007; Eley et al., 2008; Rahimi et al., 2009; Ward et al., 2011). Consequently, patient time is decreased and nurses perceive they are distanced from patients (Jensen and Aanestad, 2007; Kossman and Scheidenhelm, 2008; Ward et al., 2011). These findings identified nurses’ perceptions of computer technology and invisible activities resulting from computerisation which is consistent with the current study. Thus, it is argued that computers become the co-client in healthcare setting. The discussion of this new arena of work will be presented in Section 9.5.6.

9.5.5 Why it is Hidden

As identified the in above section, many empirical studies researching perceptions and experiences of using computers among front-line nurses reported similar results corresponding to the hidden work findings of the current study. However, these studies failed to treat nurses’ accounts as unintended consequences of computerised information
systems or recognise nurses doing more work to cope with the hardware and software issues.

There are several possible explanations for this omission. It is argued that several factors may contribute to hidden work being unidentified, including the stereotypical image of nurses’ complaints, the nature of hidden work, the invisible side of duality of technology and the boundary of nursing work. The details will be discussed in the following paragraphs.

Firstly, some studies regard nurses’ accounts as complaints or criticism about computer technology or information systems (Lee et al., 2008) or classify positive and negative attitudes (Huang and Lee, 2011). It is true that nurses’ grumbling was one of nurses’ perceptions analysed in the current study. The findings were presented in Section 6.4.2. The function and meaning of participating nurses’ grumbling has been discussed through the concept of vocabulary of complaint (Turner, 1986) in Section 9.3.4. It is likely nurses’ complaints are regarded as a stereotype. However, it is the nurses’ occupational vocabulary. If regarding nurses’ accounts as complaints, it is very easy to fail to identify that the root cause of nurses’ complaints and criticisms is an unintended consequences created by computers which constrain nurses’ workflow, increased workload, and taking away patients’ time.

Secondly, as described in Chapter 8 and above, the characteristics of hidden work as being unrecognised, unrecorded and unrewarded, may be another contributing factor for being difficult to pick up.

Thirdly, as with Orlikowski’s (1992) argument, the constraining aspect of duality of technology tends to be invisible. Many studies critically reviewed in Sections 2.2.2 and 2.5.3 may have the stance of promoting computerisation in healthcare provision, the so-called pro-innovation bias reviewed in Section 2.5.3. The focus of these studies is nurses’ acceptance of computer technology. Consequently, it is likely that these studies fail to take a critical view to study the impact of computerisation on nursing practice.

Finally, nurses appeared to regard direct patient care as their formal work. What they had done in terms of caring for computer or duplications were described by them as “trivial matters” which are not considered as work.
What nurses do to cope with computer problems seem to be invisible, but very crucial. It is like a small cog in a large wheel. With nurses’ coordination, patients may receive proper services. Another area manifesting Lukes’ third dimension of power (shaping desire) may be the finding of hidden work that nurses took many actions to cope with the computer and printer issues in order to meet patients’ needs. Mowforth (1999) argued that the boundary of nurses’ work is usually loose due to the belief in the best interests of patients’. She pointed out that this was the revelation of Lukes’ (1974) third dimension of power, because nurses may not be unaware of their behaviour, possibly being shaped by a patriarchal power. Her argument enlightened the findings by examining the hidden work of nurses by Lukes’ (1974) third dimension of power. In the findings of hidden work, nurses’ perceptions that meeting patients’ needs was regarded as their responsibilities led front-line nurses to take the up-front role to cope and troubleshoot computers’ and printers’ problems. It was because nurses did not think that their service provision could be affected by computer and printer problems.

9.5.6 Computers as Co-Clients
After computerisation, nurses’ roles at the front-line are not only care provision, but are extended to include responsibility for computerisation information systems at the user interface. Hence, it is argued that besides patients, computers become co-clients of front-line nurses. There are two reasons for this. Firstly, responsibility for invisible activities such as technological breakdown and coping with the implementation problems falls on nurses, rather than the other stakeholders who make decisions, such as managers or informatics staff. In other words, the constraining features of computerised information systems are placed on front-line nurses’ shoulders. Secondly, when examining the value and function of these hidden activities critically, we can see that hidden work is extra work and also hidden extra cost. While the introduction of computerised information systems appears more efficient on the surface, the existence of hidden work means less time for patients. These invisible activities are extra work for nurses which increase nurses’ workload. Hidden work takes nurses away from patient care which is an unseen cost to healthcare service systems.

9.6 Summary to the Chapter
The discussions in this chapter presented a considerable amount of power relations in the development and implementation phases. The power of computer technology and its impact on the front-line care service also have been discussed.
Section 9.2 applied Lukes’ power theory to examine the power relations in the development of nursing information systems and argued that having no resources and power at hand increased the difficulties for nurse managers.

Section 9.3 has applied Turner’s theory to examine front-line nurses’ powerlessness, compliance and grumbling under the top down implementation context. This section has argued that it is not the computer that nurses do not like, it is the way of carrying out computerisation implementation that nurses do not like.

Section 9.4 has applied a sociological view to examine the concept of workflow redesign in information system management literature. The argument is that computerisation may deskill and intensify nurses’ work. Moreover, another key discussion is that through Foucault’s (1977) disciplinary principles, computer technology has disciplinary power to extend managerial surveillance and control. It is a matter of some debate as to whether computerised information systems have resulted in the up-skilling or deskilling in the nursing professions.

Section 9.5 has discussed the dual influences of computerisation on nursing work. In particular, hidden work resulting from computer technological breakdown and implementation burdens are regarded as unintended consequences and are often invisible. It has been argued that computers may become co-clients to front-line nurse.
Chapter 10: Conclusions

10.1 Introduction
This single, embedded, qualitative case study explored the influences, contexts and practice politics involved in adopting computerised information systems in a Taiwanese hospital. It also examined their impact on the nursing profession. This final chapter will reflect on the research process and provide conclusions regarding contributions made by this study. The strengths and limitations of the current study in relation to the research objectives will be considered in Section 10.2. The extent to which this study has contributed to knowledge will be examined in Section 10.3. Finally, in order to build on this exploratory case study, a number of implications for practice and recommendations for further research will be made in Section 10.4 and 10.5.

10.2 Critique of Research
10.1 Strengths
The study was conducted in a rigorous way whilst maintaining the flexible nature of qualitative case study design. Moreover, multiple data sources are a particular strength of this study. As reviewed in Chapter 2, many previous studies were of a single profession. Studies of user groups frequently only involved front-line nurses. By contrast studies examining implementation often only recruited hospital managers, informatics staff and doctors, without involving front line nurses. Despite being a single case study, this study explored the impact of computerisation on the role and practice of clinical nurses by the method of person triangulation (Haber and LoBiondo-Wood, 2002). Participants from different levels of the organisational hierarchy as well as from the different professional groups were recruited, such as users, managers and informatics staff.

Another strength is that the context of computerisation was investigated in-depth and holistically through multiple data sources and methods including interviews, focus groups and observation of artefacts (computers). This fitted with the concept of realism which was the research paradigm of this study. By examining how nurses adopt computer technology, the local implementation process and the hospital context, the conditions of the case-study hospital were specified in detail using 'thick description' (Geertz, 2003). Thus this study attempted to achieve analytical generalization (Eisenhardt, 1989; Harley, 2004). This design strengthens the explanations of these findings and enhances our understanding of the introduction of computerisation and its impact on nurses in Taiwanese hospitals.
10.2 Limitations

There are several limitations to the study, including issues of recruitment and data collection.

Fewer software engineers were recruited than was initially anticipated. No top managers, such as chief executive officers or doctors in charge of medical administration, were recruited in this study. The identity of the researcher was as a research student from a nursing background who lacked an informatics background. The request for interviews was thus perceived as less important to the hospital operations and senior staff were reluctant to give their valuable time. Nursing research was seen as low priority which reflected the findings in Chapter 5. Another reason for this could be that the top managers permitted the research study on the one hand, but also attempted to set the limit of the research focus to the nursing group. This reflected the experiences of gaining access presented Chapter 3.

Difficulties in obtaining software information regarding computerised information systems in the case-study hospital were also experienced. The Informatics Department refused the researcher’s request to access the information systems in the case-study hospital for patient data protection purposes. The researcher subsequently negotiated informally with the Informatics Department for official and domestic documents about computerised information systems for healthcare professionals, such as interface design and function, step-by-step manuals. They were reluctant to release the related information because of the issue of intellectual property however some useful background data was accessed.

Recruiting front-line nurses for focus group was more difficult than expected. The reason for this seemed to be that nurse managers and staff nurses in the case-study hospital were unfamiliar with qualitative research. Participating in focus groups was a new experience for them. Recruitment of participants by nurse managers was rejected by the researcher as involving the potential risk of social desirability bias (De Vaus, 2001) which may have affected the scope and nature of discussions within the focus groups. Consequently, the researcher had some difficulties in recruiting focus group participants. Using focus groups discussions was more time consuming and not as flexible as questionnaires to meet staff nurse’s busy schedule. These reasons may have resulted in lower participation than was ideal as presented in Chapter 3.

The possible personal influences (Mason, 2002) of the researcher was reflected on before and during the field work. The researcher’s personal viewpoint towards computers may
have influenced the interactions with interviewees and focus group participants. The researcher did not have recent practical experience of nurse information systems. This point was emphasised to the interviewees and nursing participants. Some nursing executive interviewees asked whether the researcher was able to write information system software programmes. The researcher used this opportunity to clarify her personal stance. The dress code of researcher was also considered during the observation period. A smart code with soft colours was adopted to help the researcher blend into the environment and to prevent patients and staff members from thinking that the researcher was a hospital employee or manager.

The further limitation in this study is the translation process. Much attention has been paid to the data analysis, interpretation and translation of Chinese quotations to make these as rigorous as possible. Due to culture and language differences, loss of meanings in translation may be possible. Lastly, like most case studies, another limitation is that the findings were from a cross-sectional single case study in Taiwan which restricts the findings to a certain time frame and a certain location.

To sum up, whilst some limitations of the research were recognised, this study fundamentally achieved most of its research objectives. The issues of how computerised information systems were decided, designed and implemented and the influences on nursing practice are described and presented in this study. A case study is an appropriate strategy to explore these issues. The particular strength is the embedded design which revealed multiple levels and professional roles in the organisational hierarchy. This study was a learning process because it was the first empirical field study conducted by the researcher. Lessons have been learnt from practice in the field, such as skills for gaining hospital access, ethical approval, recruitment and negotiating with gatekeepers. However, the design of the study and rigorous research process was sufficient to produce sound findings which may have usefulness and resonance with managers, professionals and researchers who are interested in the topic of computerisation in clinical practice and also interested in understanding organisational change.

10.3 The Contribution of the Thesis

This study contributes to knowledge through its findings and through the use of social theories to explain the study findings, as well as through its research design. One novel contribution of this study is the use of a single case study design, based on a Realist paradigm.
The contribution of this design was in seeking explanations whilst considering their context. As presented in Chapter 2, many empirical studies mentioned that the hardware and software equipments used by information systems and hospital management varied between hospitals. Using Realism to guide the research design made the study focus context-oriented rather than technology-oriented, as shown in the frameworks of Rogers’ (1995) diffusion theory and Davis (1989) Technology Acceptance Model (See Section 2.5.3). The contribution of this context-oriented approach to information system implementation studies is avoiding potential pro-innovation bias and individual-blame bias, which are often implicit in information system implementation studies as critically examined in Chapter 2. As the study focus looked beyond the relationship between computer technology and individuals, the strength of the context-oriented approach contributed a breadth of vision in understanding the implementation process and consequences of computerisation.

Another contribution of this study is the adoption of sociological theories to explore this topic which is innovative in this field. The study context is about computerisation in a hospital setting. Social theories were adopted to theorise and explain the findings of this study. Some of the theories applied to the data are newly employed in the information systems studies context.

- The Negotiated Order (Strauss, 1978) perspective has been used to examine the relationship between doctors and nurses (Hewison, 1994). In this study, the theory is used to understand how computerised information systems are implemented in nursing. It identifies that the process of developing a computerised information system is shaped by the negotiated order constructed by top managers, informatics staff and nurses.

- As reviewed in Section 2.5, implementing computerised information systems is resource intensive and time-consuming. However, this study contributes to knowledge by adopting Giddens’ (1984) Resource concept to examine which resources play an influential and decisive role in driving the computerisation process.

- This study applies Turner’s theory (1986) in a new context. By using the theory of Vocabulary of Complaints (Turner, 1986), this study identified that compliance and complaints co-exist amongst end users (front-line nurses) in the context of the top down implementation of computer technology as described in the case-study hospital. Front-line nurses accepted the computerisation decisions made by the top, however, nurses grumbled to express their dissatisfaction with their lack of user involvement and
increased workloads caused by computerisation. This study contributes to knowledge by transcending the conventional dichotomous classification of computer technology adoption into either adoption or non-adoption/rejection.

Furthermore, through Lukes’ (1974) Three-Dimension of Power, this study contributes to knowledge that the process of computerisation in hospital settings involves a considerable exercise of power, from negotiations for developing the system to adoption by users. This contributes to knowledge of implementation issues presented in Section 2.5, by illuminating that power relations are one crucial and often invisible factor which impacts on the operations of organisations profoundly, including promoting computerisation and nursing informatics in particular.

As discussed in Section 2.6, literature discussing Taylorist concepts of job design (Braverman, 1974) and Foucault’s (1977) Panopticon concept of surveillance and control of work by computer technology is not new. However, this study develops labour process theory and Foucault’s (1977) disciplinary concepts further in information systems studies. This study coined the term “cyber jurisdiction” to theorise a concept describing how clinical practice can be managed and controlled by the use of computerised information systems. This gives the insight that computer technology itself is not only an electronic Panopticon, but also a normalisation apparatus. This study contributes to the knowledge that computer technology may enhance management control whilst the rationale for implementing computerised information systems is ostensibly to improve clinical care.

As discussed in Section 2.3, this study is not the first one to find that nurses perceive that their critical thinking abilities and scope to deliver individualised patient care are impaired by computerised information systems. Moreover, as examined in Section 1.5, promoting computerised information systems is a world trend yet implementation processes lacks conclusive underpinning evidence. The articulation of efficiency resulting from computerisation is ambiguous in the information systems literature for healthcare. By way of sociological perspectives, this study identified that ‘efficiency’ of workflow redesign originated in the substitution of management functions in practice and task-integration into the work of the healthcare professional.

Moreover, through the lens of Labour Process theory (Braverman, 1974), substitution and task-integration correspond to deskilling and work intensification. This study contributes to knowledge by giving insights into how through computerised information systems, hospital management reinforced a Taylorist mode of healthcare delivery.

As discussed in Section 9.5.4, this study is not the first one to discover that nurses are required to cope with computer and printer problems in their practice. However, this
study developed the concept of “caring for computers” and identified a range of invisible activities carried out by nurses. This study further applied and developed the concept of Hidden Work (Wadel, 1979) arguing that computer technology created new types of hidden work and became a new arena extending nursing responsibilities at ward level.

Lastly, through the Duality of Technology concept (Orlikowski, 1992), this study contributes to knowledge by identifying the intended and unintended consequences of computerisation. In particular, unintended consequences are invisible in the literature promoting computerisation such as electronic patient record systems.

10.4 Implications for Practice
This study revealed that the decisions about computerisation by the top influenced the nurses’ workloads and work processes profoundly. In particular nurses’ workloads were increased through nurses’ responsibility for taking care of computers and through having to duplicate work due to the parallel implementation strategy. The decisions regarding investment in hardware equipment, such as portable computer nursing trolleys and laser printers, also influenced nursing work on a daily basis.

Top down decisions about computerisation are inevitable in large healthcare settings, such as the case-study hospital. However, it is suggested that decision makers need to consider the potential increased workload effects during the adoption process and how these can be minimised. Possible mitigating solutions are providing sufficient on-site technical support, workaround methods to manage short-periods of computer crashes or printer issues and the opportunities for user-involvement in the development and implementation regarding decision making.

Investment in sufficient portable computer nursing trolleys for front-line nurses in readiness for implementing computerised information systems is suggested as a high priority. The rigidity of desktop computers which are usually allocated in nursing stations was identified as unsuitable for nursing practice dynamics in this study. The budget for computer trolleys is high. However, it must be realised that the looking for available computers or duplicating work to cope with hardware limitations consumes costly nursing time. It also has the potential to affect patient care quality adversely which has a costly, but invisible price.
Moreover, dependence on information technology is increasing and technology breakdown is inevitable. There is a potential for computerisation to influence patient care negatively. It is suggested that the technological support at ward level, such as providing immediate maintenance and management is crucial, rather than consuming the time of healthcare professionals troubleshooting computer problems.

This study revealed the dual influences of computer technology and its unintended consequences. It is suggested that hospital management and healthcare professionals need to pay attention to this issue. Computers may not always facilitate care practice, but may take away patient care time. It is suggested that this may be a sufficient legitimate claim to request further hardware equipments, system modifications and implementation support.

This study revealed that nurse managers had limited power in influencing the development of computerised information systems for nursing purposes. Computerised information systems acted as a control mechanism reinforcing a Taylorist style of care delivery and had degradation features in relation to nursing care practice. It is suggested that the nursing profession needs to be aware that computerised information systems have the potential to deskill nurses and control their practice. The profession needs instead to, promote nursing informatics in a way that enhances the professional practice of nursing.

10.5 Recommendations for Further Research

Based on the knowledge gaps identified in Chapters 1 and 2 and findings of this study, three areas for further research are recommended in this section. Appropriate research strategies are suggested.

Firstly, the benefits of applying electronic patient records to practice needs more underpinning evidence. As reviewed in Chapter 1, the evidence regarding their benefits is inconclusive and this study also found computerisation created hidden work for nurses. Further research on the influence of computerisation on clinical care delivery is needed. Particularly, considering the dual consequences of computerisation for practice it is recommended that further research is conducted to assess its impact. It is suggested that examining the intended and unintended consequences of computerisation could be a fruitful approach to produce more conclusive and robust evidence for practice. Moreover, mixed-method research design is recommended to collect triangulated data on these issues.
Secondly, further context-oriented studies are needed. As Section 2.5 presented, successful implementation is important but difficult to achieve in healthcare organisations. Because qualitative studies are time-consuming, survey research is still valuable for its quantitative generalisation and the feasibility of approaching a large sample within a limited time frame. Instead of focusing on individual perceptions of computers, it would be useful to collect demographic data, data on computer familiarity and competence, and data on a wide range of implementation issues. These could be investigated through a carefully constructed questionnaire. The implementation issues which need investigation include the perception of hardware availability and user friendliness of software perceptions of implementation approaches, perceived helpfulness of leadership styles, opportunities for user involvement, usefulness of resources for acquiring skills and the extent of technical support.

Thirdly, conducting user involvement focused studies to investigate computer adoption is advocated, rather than individual focused studies. As Section 2.5 examined, the importance of user involvement must be emphasised. This study also found that user involvement was important to nurses by identifying a lack of such opportunities for them to be involved. However, the extent of the influences of user involvement on computer technology adoption is little known. The strategies of ethnography and action research are suggested.

In terms of ethnography, employing it to study user involvement in the computerisation process has two strengths. Firstly, this study found that the computerisation process involved a considerable amount of power relations. Ethnography involves an attempt to understand things from the viewpoints of insiders, rather than outsiders (Denscombe, 2010), such as hospital management or informatics professionals who represent power and authority. Secondly, ethnography takes a holistic approach examining processes, relations, connections and interdependency among different groups (Denscombe, 2010). Implementing computerised information systems is complex as discussed in Section 2.5 and as shown in this study. The holistic perspective of ethnography may provide a deeper level of understanding than survey or other cross-sectional research designs.

In terms of action research, applying it to study user involvement has two advantages. Firstly, what methods of user involvement will be feasible and productive for nurses and hospital management is little known, because this study has shown that the case-study hospital was a large setting and front-line care was busy. Action research links research with practice which is driven by real-world problems and is problem-solving oriented (Denscombe, 2010). The characteristics of action research may be helpful and practical for
the active participation required to improve the implementation process. Secondly, because of the numerous power issues identified in this study, adopting computerised information systems in relation to front-line nurses goes beyond technical and practical matters, but also involves organisational politics. Therefore, emancipatory action research is suggested as particularly suitable for addressing these political issues (Zuber-Skerritt, 1996). Emancipatory action research may help to understand how implementation processes could be improved through the involvement of end users.

10.6 Conclusions
This study has illuminated how computerised information systems were developed and implemented in healthcare setting and the impact of computerisation on the role and practice of nurses. The implications for practice in implementation management have been identified. Several recommendations for further research are made. It is hoped this study will contribute to knowledge of nursing practice and hospital management and understanding how implementation was experienced. Through a better understanding using sociological perspectives, it is hoped this thesis has potential to enhance the process of development and implementation and facilitate nursing practice in the computerised age.
REFERENCES


Department of Investment Services Taiwan. (2007). Department of Health Promote Electronic Patient Records Saving 10 Billion NTD Each Year in the Future.


### APPENDICES

Appendix 1: Characteristics of Nurses’ Attitudes Research conducted prior to the computerisation

<table>
<thead>
<tr>
<th>Study/Country</th>
<th>Computer technology studies</th>
<th>Use of Computer</th>
<th>Topic/Purpose</th>
<th>Data Sources</th>
<th>Sample (Size)</th>
<th>Sampling (Response Rate %)</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scarpa, et al. (1992), USA</td>
<td>Computer</td>
<td>No computers at bedsides or nursing stations.</td>
<td>1. Attitudes toward computerisation.</td>
<td>Stronge &amp; Brodt (1985) questionnaire.</td>
<td>RN (n=83), LPN (n=36) &amp; HN(n=17). Total sample (n=136).</td>
<td>Not stated (40.6%)</td>
<td>A 500-bed hospital</td>
</tr>
<tr>
<td>Lowry (1993, 1994), UK</td>
<td>Computerised nursing care plan system</td>
<td>Prior to the introduction of computerised nursing care plan.</td>
<td>2. Attitudes toward the new system. 3. Identifying correlated demographic variables.</td>
<td>Self-developed questionnaire.</td>
<td>ICU nurses (n=41). Of which, managers (n=6), FT nurses (n=18) PT nurses (n=30).</td>
<td>All selected (76%)</td>
<td>A 12-bed adult ICU.</td>
</tr>
<tr>
<td>McBride &amp; Nagle (1996), Canada</td>
<td>Computer</td>
<td>RN: No computerised information systems in place during the data collection.</td>
<td>1. Attitudes toward computers. 2. Influential factors.</td>
<td>Stronge &amp; Brodt (1985) questionnaire.</td>
<td>RN (n=362) &amp; Bachelor SN (n=299).</td>
<td>Not stated (RN: 42%) (SN: 60%)</td>
<td>RN: A large metropolitan teaching hospital</td>
</tr>
<tr>
<td>Dillon et al. (2005), USA</td>
<td>Electronic Patient Record</td>
<td>Before the implementing a new electronic patient record system</td>
<td>1. Attitudes toward the use of new system.</td>
<td>Self-developed questionnaire.</td>
<td>Full-time &amp; part-time staff nurses (n=140).</td>
<td>Not stated (22.9%)</td>
<td>A 450-bed regional hospital.</td>
</tr>
<tr>
<td>McLane (2005), USA</td>
<td>Electronic patient record</td>
<td>18 months prior to the implementation of the system.</td>
<td>1. Attitudes toward computer use in clinical practice. 2. Personal experience of computer use.</td>
<td>Self-developed questionnaire (Pilot survey).</td>
<td>RN (n=27), LVN (n=1), NA (n=4), Clerks (n=6), Specialist(n=1) Manager (n=1). Total sample (n=44).</td>
<td>All selected (33.3%)</td>
<td>A 52-bed blood and bone marrow transplant unit with 132 staff members.</td>
</tr>
</tbody>
</table>
Appendix 2: Characteristics of Nurses’ Attitudes Research conducted after the computerisation

<table>
<thead>
<tr>
<th>Study/Country</th>
<th>Computer Technology Studied</th>
<th>Use of Computer</th>
<th>Topic/Purpose</th>
<th>Data Sources</th>
<th>Sample (Size)</th>
<th>Sampling (Response Rate %)</th>
<th>Settings</th>
</tr>
</thead>
</table>
| Burkes (1991), USA | Computer charting | Computerised nursing programmes had been implemented for 4 years & the computerised charting programme was implemented for 1 year. | 1. Attitudes toward computer use.  
2. Identifying correlated demographic variables. | Self-developed questionnaire | Full-time & part-time ICU staff nurses who had used computerised charting (n=56) | Not stated (42%) | A tertiary 520-bed hospital with 4 ICUs. |
| Marasovic et al. (1997), Australia | Clinical information system | After implementing the system, in use for less than one year. | 1. Attitudes toward computer use in critical care.  
2. Identifying associated nurses’ characteristics. | Burkes (1991) questionnaire | RN & specialists in one ICU (n=43) | All ICU nurses (71%) | A 900-bed metropolitan tertiary referral hospital. |
| Liu et al. (2000), China | Hospital information system | After using the system for 1 year. | 1. Attitudes toward computer.  
2. Assessing computer knowledge & skills. | Modified Burkes’ (1991) questionnaire to reflect the Chinese background of nurses | Staff nurses in clinical units (n=196) | Stratified random (86.7%) | A university hospital. |
| Moody et al. (2004), USA | Electronic health record | Currently using the system. The duration of computerisation was unstated. | 1. Attitudes toward the use of current system.  
2. Personnel’s systems preferences | Self-developed questionnaire | RN, LPN, & nurse assistants (n=100) | Convenience (85.8%) | 23 clinical units in a large hospital. |
Appendix 2: Characteristics of Nurses’ Attitudes Research conducted after the computerisation (Cont.)

<table>
<thead>
<tr>
<th>Study/Country</th>
<th>Computer Technology Studied</th>
<th>Use of Computer</th>
<th>Topic/Purpose</th>
<th>Data Sources</th>
<th>Sample (Size)</th>
<th>Sampling (Response Rate %)</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alquraini (2007),</td>
<td>Health information System</td>
<td>Currently using the system. The duration of computerisation was unstated.</td>
<td>1. Attitudes toward the use of current system.</td>
<td>Stronge &amp; Brodt (1985) questionnaire.</td>
<td>RN (n=530)</td>
<td>Stratified random (92.3%)</td>
<td>All Kuwaiti Ministry of Health hospitals.</td>
</tr>
<tr>
<td>Kuwaiti</td>
<td></td>
<td></td>
<td>2. Identifying correlated demographic variables.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>3. Surveying computer skills</td>
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<tr>
<td>Chan (2007),</td>
<td>Clinical management system</td>
<td>Currently using the system in clinical practice. But the functionality of the system among hospitals was different.</td>
<td>4. Knowledge, attitudes and skills regarding the system.</td>
<td>Self-developed questionnaire.</td>
<td>Nurses (n=282)</td>
<td>Convenience (52.8%)</td>
<td>4 local hospitals.</td>
</tr>
<tr>
<td>Hong Kong</td>
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</tr>
<tr>
<td>Eley et al. (2009),</td>
<td>Electronic health record</td>
<td>Currently using the system in clinical practice.</td>
<td>5. Attitudes to use of IT in the workplace.</td>
<td>Self-developed questionnaire.</td>
<td>Nurses (n=4330)</td>
<td>Stratified random (43.3%)</td>
<td>A national survey.</td>
</tr>
<tr>
<td>Australia</td>
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</tbody>
</table>
### Appendix 3: Characteristics of Nurses’ Attitudes Research with **longitudinal design**

<table>
<thead>
<tr>
<th>Study/Country</th>
<th>Computer technology studied</th>
<th>Use of Computer</th>
<th>Topic/Purpose</th>
<th>Data Sources</th>
<th>Sample (Size)</th>
<th>Sampling (Response Rate %)</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murphy et al. (1994), USA</td>
<td>Patient care information system</td>
<td>1. Pre-test: After computer training completed. 2. Post-test: Using system in the working units for 3 months.</td>
<td>1. Developing and testing the questionnaire; 2. Collecting pre-test and post-test attitude data to evaluate the computer training programme and the system.</td>
<td>Self-developed questionnaire</td>
<td>RN LPN &amp; nursing assistance (n=224)</td>
<td>Simple random (78%)</td>
<td>An 800-bed tertiary care academic medical centre.</td>
</tr>
<tr>
<td>Sleutel &amp; Guinn (1999), USA</td>
<td>Clinical information system</td>
<td>1. Pre-test: After computer training completed. 2. Post-test: after using for 1 month. 3. Post-test: After using for 12 months</td>
<td>1. Attitudes at 3 different time periods during &amp; after the implementation.</td>
<td>Murphy et al. (1994) questionnaire</td>
<td>Nursing staff 1. n=72 2. n=32 3. n=24</td>
<td>1. All selected (Unstated). 2. Original participants (43%). 3. Original participants (33%).</td>
<td>A small hospital in Central West Texas.</td>
</tr>
<tr>
<td>Smith et al. (2005), USA</td>
<td>Computerised care planning and documentation programmes</td>
<td>1. Pre-test: 1 month prior to implementation. 2. Post-test: 12 months after the implementation.</td>
<td>1. Examining the impact of online documentation on staff attitudes before &amp; after the implementation of the project.</td>
<td>Quasi-experiment (Stronge &amp; Brodt, 1985) questionnaire, Observation &amp; chart audits.</td>
<td>Staff nurses Prior (n=26) Post (n=35)</td>
<td>Convenience (58%; 78%).</td>
<td>An Orthopaedic &amp; neuroscience unit (26-bed) and a pulmonary unit (18-bed) of a teaching hospital.</td>
</tr>
</tbody>
</table>
Appendix 4: Characteristics of Nurses’ Attitudes Studies with **comparative design** (two groups)

<table>
<thead>
<tr>
<th>Study/Country</th>
<th>Computer technology studies</th>
<th>Use of Computer</th>
<th>Topic/Purpose</th>
<th>Data Sources</th>
<th>Sample (Size)</th>
<th>Sampling (Response Rate %)</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getty <em>et al.</em> (1999), UK</td>
<td>Computerised nursing care plan systems</td>
<td>User group: using the system for more than 2 years.</td>
<td>1. Comparing the attitudes between two groups.</td>
<td>Modified Lowry’s (1994) questionnaire.</td>
<td>Non-user (n=15); Users (n=14).</td>
<td>All selected (100%)</td>
<td>1. Non-user group: an 18-bed Continuing Care ward for older people. 2. User group: a 26-bed Assessment &amp; rehabilitation ward for older people, in an urban hospital.</td>
</tr>
</tbody>
</table>
Appendix 5: Characteristics of Nurses’ Attitudes Studies with **Unstated Context**

<table>
<thead>
<tr>
<th>Study/ Country</th>
<th>Computer technology studies</th>
<th>Use of Computer</th>
<th>Topic/Purpose</th>
<th>Data Sources</th>
<th>Sample (Size)</th>
<th>Sampling (Response Rate %)</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simpson &amp; Kendrick (1997), UK</td>
<td>Computer</td>
<td>Unstated</td>
<td>1. Attitudes toward computers.</td>
<td>Stronge &amp; Brodt (1985) questionnaire &amp; interviews.</td>
<td>Questionnaire (n=208); Interviews (n=20)</td>
<td>Survey all nurses (54.3%) &amp; Interviewing questionnaire respondents.</td>
<td>A 500-bed British general hospital.</td>
</tr>
</tbody>
</table>
Appendix 6: The Items of Strong & Brodt’s (1985) Tool (Adopted from the study by Stricklin et al., 2003)

| 1. A computer increases costs by increasing the nurse’s workload. | 11. If I had my way, nurses would not ever have to use computers. |
| 2. Computers cause a decrease in communication between hospital departments. | 12. Computers should only be used in the financial department. |
| 3. Computers allow the nurse more time for the professional tasks for which he or she is trained. | 13. Computers make nurses’ jobs easier. |
| 4. Part of the increase in costs of healthcare is because of computers. | 14. Paperwork for nurses has been greatly reduced by the use of computers. |
| 5. The time spent using a computer is out of proportion to the benefits. | 15. Orientation for new employees takes longer because of computers and, therefore, unnecessary work delays occur. |
| 7. Only one person at a time can use a computer terminal and, therefore, staff efficiency is inhibited. | 17. Computers save steps and allow the nursing staff to become more efficient. |
| 8. Computerization of nursing data offers nurses a remarkable opportunity to improve patient care. | 18. The more computers in an institution, the fewer jobs for employees. |
| 9. Computers contain too much personal data to be used in an area as open as a nursing station. | 19. Increased computer usage allows nurses more time to provide patient care. |
| 10. Computers cause nurses to give less time to provide quality patient care. | 20. Because of computers, nurses will face more lawsuits. |
Appendix 7: Characteristics of Qualitative Studies Exploring Nurses’ Perceptions of Computerised Information Systems Use

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Computer technology studies</th>
<th>Use of Computer</th>
<th>Topic/Purpose</th>
<th>Data Sources</th>
<th>Sample (Size)</th>
<th>Sampling</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harris (1990), USA</td>
<td>Computerised nursing care planning system</td>
<td>Turnover rate was low. Nursing care delivery was primary care model.</td>
<td>To discover meanings and behaviours of computerised nursing care planning from nurses’ perspectives.</td>
<td>Semi-structured interview</td>
<td>RN (n=14)</td>
<td>Purposive (until theoretical saturation occurred)</td>
<td>6 units in a community hospital with 300-400 beds.</td>
</tr>
<tr>
<td>Lee et al. (2002), Taiwan</td>
<td>Computerised nursing care plan system</td>
<td>Care plans were required to develop and printout within 8 hours of new patient admissions. Printout plans were placed in patients’ records.</td>
<td>To explore nurses’ experiences in the use of computerised nursing care planning.</td>
<td>Semi-structured Interviews in 1999</td>
<td>ICU RN worked at study site at least for 6 months (n=12)</td>
<td>Not stated</td>
<td>3 respiratory intensive care units in a 3300-bed medical centre which had implemented computerised nursing care planning since 1998.</td>
</tr>
<tr>
<td>Timmons (2003), UK</td>
<td>Computerised nursing care plan system</td>
<td>Care plans were required to be written &amp; updated for each in-patient. At the time of data collection, no hospital had achieved their target of 100% completion rate.</td>
<td>To analyse the existence, manifestations and outcomes of resistance in the use of computerised systems in nurses and its relationships with nursing culture.</td>
<td>Semi-structured interview</td>
<td>RN (n=31)</td>
<td>Not stated</td>
<td>3 NHS hospitals where computerised nursing care planning systems were implemented for 2 to 3 years.</td>
</tr>
<tr>
<td>Darbyshire (2004), Australia</td>
<td>computerised patient information systems in general</td>
<td>Not stated.</td>
<td>To explore nurses’ and midwives’ perceptions of computerised patient information systems in everyday practice. No evaluation of a particular product or system.</td>
<td>13 focus groups in 1998</td>
<td>Nurses &amp; midwives from all areas and departments at study site (n=53)</td>
<td>Purposive</td>
<td>25 public, private hospitals and community areas across five Australian states.</td>
</tr>
<tr>
<td>Author (Year)</td>
<td>Computer technology studies</td>
<td>Use of Computer</td>
<td>Topic/Purpose</td>
<td>Data Sources</td>
<td>Sample (Size)</td>
<td>Sampling (Response Rate %)</td>
<td>Settings</td>
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<tr>
<td>Kossman (2006), USA</td>
<td>Electronic health record</td>
<td>Not stated</td>
<td>To explore how electronic health records were used in patient care by nurses and how nurses perceived their impact on nursing job performance.</td>
<td>1. Questionnaire. 2. Observation/ Interviews.</td>
<td>Nurses who used the systems at least 6 months (n=46)</td>
<td>Convenience (Questionnaire 46%)</td>
<td>1 medical- surgical and 1 intensive care units at two different types of community hospitals where the systems were implemented for two years.</td>
</tr>
<tr>
<td>Lee (2006), Taiwan</td>
<td>Computerised nursing care plan system</td>
<td>Nurses were required to developed care plan for new patient admissions &amp; obtain printouts.</td>
<td>To explore nurses’ perceptions regarding how the content design of computerised nursing care planning the documentation experiences.</td>
<td>In-depth interviews in 2002.</td>
<td>Nurses who worked at study site at least 6 month (n=20)</td>
<td>Purposive</td>
<td>3 respiratory care units of a medical centre which had piloted computerised nursing care planning and nursing records and where computerised care plans were implemented.</td>
</tr>
</tbody>
</table>
Appendix 8: Characteristics of Quantitative Studies Exploring Nurses’ Perceptions of Computerised Information Systems Use

<table>
<thead>
<tr>
<th>Study/Country</th>
<th>Computer Technology Studies</th>
<th>Use of Computer</th>
<th>Topic/Purpose</th>
<th>Data Sources</th>
<th>Sample (Size)</th>
<th>Sampling (Response Rate %)</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axford &amp; Carter (1996), USA</td>
<td>Clinical information systems</td>
<td>Not stated</td>
<td>To develop an evaluation tool, examine how clinical information systems affect nursing practice and identify the differences between users and non-users.</td>
<td>Postal questionnaire.</td>
<td>Nurses (n=291)</td>
<td>Simple random sampling (69.1%)</td>
<td>State-wide.</td>
</tr>
<tr>
<td>Torvall et al. (2004), Sweden</td>
<td>Electronic patient record</td>
<td>Not stated</td>
<td>To analyse nursing documentation based on an electronic patient record system in primary healthcare.</td>
<td>1. Postal questionnaire; 2. Nursing records audit for 1 year.</td>
<td>Nurses (n=154)</td>
<td>Stratified random selection (73%)</td>
<td>District nurses from a county council.</td>
</tr>
</tbody>
</table>
Appendix 9: Eight phases of design, implementation and upgrading  
(Adapted from Douglas and Celli, 2006)

<table>
<thead>
<tr>
<th>Phases</th>
<th>Goal</th>
<th>Steps</th>
</tr>
</thead>
</table>
| Planning              | To determine the problem scope and to rough out the entire project in order to determine the feasibility of the system and the benefits of developing and implementing a new system. | ▪ Establishing a three-tiered committee: a steering committee, a project team and departmental teams.  
▪ Definition of the problem or/and stated goal: deciding an existing need or problems may be solved by the implementation or application of a health information system. This step also needs to decide how the system will be evaluated.  
▪ Feasibility study: a preparatory analysis to decide if the proposed problem can be solved by the implementation of a health information system. This step may clarify the problem or stated goal, the information need, objectives and scope of the project.  
▪ Documentation and negotiation of project scope agreement: the agreement is developed based on the findings of a feasibility study. This project scope agreement is the internal organisational contract for the project which includes the scope of the project, the application level management requirements, the proposed activation strategy for implementing the health information systems, the technical management and personnel who will maintain the equipment.  
▪ Allocation of resources: to determine what resources are required. |
| System Analysis       | To assess the problem identified through extensive data collection and analysis, such as to examine end-user requirements, the flow of information in daily operation and processing of the required data elements. | ▪ Data collection: To collect data about the existing problem or goal.  
▪ Data analysis.  
▪ Data review.  
▪ Benefits identification: documenting the overall anticipated benefits from the system. These benefits statements may be the criteria for  
▪ System proposal development. |
| System Design/ System selection | To prepare the systems including the development of the system design and plans for implementation. | ▪ Functional specifications.  
▪ Technical specifications.  
▪ Implementation planning: To establish a detailed implementation plan. |
Appendix 9: Eight phases of design, implementation and upgrading  
(Adapted from Douglas and Celli, 2006) Cont.

<table>
<thead>
<tr>
<th>Phases</th>
<th>Goal</th>
<th>Steps</th>
</tr>
</thead>
</table>
| Testing        | To verify the computer programmes are written correctly and the system will function as planned whilst implementing in the real environment. | ▪ *Functional testing*: The databases are tested by the departmental teams.  
▪ *Integrated systems testing*: The total system is tested.  
▪ *End-users testing*: To identify unfound problems through the user interactions with the new system. |
| Document system| To develop the manuals for users, reference and operators’ maintenance. | ▪ *User’s manual*: regarding how to use the system.  
▪ *Reference manual*: for project team members’ use.  
▪ *Operator’s maintenance manual*: allowing operators to maintain, update and repair the system. |
| Training       | To train the end users to use the system properly.                   |                                                                      |
| Implementation  | **Goal**: To draw all the steps into a detailed plan for moving the new system into a live environment. | ▪ Key aspects of an implementation plan.  
▪ 14 steps for implementing a new system. |
| Evaluation     | To assess the performance of the new system and to identify the strengths and weakness of the implementation process. The author suggested evaluating the entire system based on the criteria developed in the planning and system design phases. The results of evaluation may be helpful for the system revisions. | The aspects need to be evaluated:  
▪ Documentation of care.  
▪ Nursing satisfactions.  
▪ Nursing department operations.  
▪ Technical performance, such as reliability, maintainability, use, response time, accessibility, availability and flexibility to meet changing needs.  
▪ Cost-benefit analysis. |
親愛的醫院主管（們）您好，

我名叫黃丰姿，目前就讀於英國曼徹斯特大學護理學院博士班一年級。首先，非常感謝您（們）百忙之中撥空來瞭解我博士論文研究案，我的論文題目主要是想瞭解台灣醫療院所中醫療資訊系統（或稱電子病歷）的使用情況。而這份簡介中，依序包含有自薦信、博士論文研究中文摘要與個人履歷。

運用資訊科技的幫助來提升照護品質和病人安全，乃是全球醫療產業的熱門議題。行政院亦於「挑戰 2008：國家發展重點計畫」中，揭示「網路健康服務推動計畫」乃是重要的一環，因此衛生署近年來積極推動電子病歷，以節省醫療資源浪費、落實持續照護和民眾健康管理。

相關文獻顯示醫療資訊系統的建置需投注大量的時間、資金和人力資源，由於醫療資訊仍屬新興領域，歐美先進國家近年來也紛紛投入相關研究。而此研究是希望瞭解台灣本土經驗，透過醫院主管（們）、資訊部門和臨床護理人員三方面，以整體性的角度瞭解醫院資訊系統建置的過程以及護理人員的使用情形，期望藉由貴院的經驗分享，從中瞭解醫療資訊系統建置與使用的成功因素，不但有助於其他醫療院所的學習，更有助於未來醫療資訊系統的研發、建置、整合與使用。同時，也期望研究結果有助醫院主管（們）瞭解前線醫護人員的使用經驗，發揮資訊系統的優點、提升醫療照護品質與效益。

最後，整個研究過程將按研究倫理道德之準則，以自願、保密與匿名方式來保護醫療院所與研究參與者。

學生 黃丰姿 敬上
Appendix 11: Ethical Approval Letter from the Case-study Hospital

同事宜臨床試驗證明書
Clinical Trials Approval Certificate

新案同意臨床試驗證明書
Clinical Trials Approval Certificate (New Application)

計畫編號：IRB編號：
計畫主持人：黃月姿/協同主持人：
計畫中文名稱：電腦資訊系統對台灣醫療院所臨床護理人員專業角色影響之探討
計畫書：2，2009/02/10
受試者同意書：菁英訪談受訪者同意書2，2009/02/10
焦點訪談受訪者同意書2，2009/02/10

The Institutional Review Board of the Changhua Christian Hospital has reviewed the above documents and approved the study on Mar 09, 2009. This approval is valid till Mar 08, 2010. The Institutional Review Board of the Changhua Christian Hospital reserves the right to monitor the study.

See the reverse of this form for the procedures for reporting serious adverse events and for periodic follow-up, and for other important notes.

Sincerely Yours

Chin-San Liu, M.D.
Chairman
Institutional Review Board Committee
Changhua Christian Hospital, Taiwan

The Institutional Review Board performs its functions according to written Operating procedures and complies with GCP and with the applicable regulatory requirements.
嚴重不良事件通報、後續定期追蹤之程序及應注意事項：
1. 院內發生死亡或危及生命案例應該在獲知日起七天以內通報本委員會，其他嚴重不良事件十五天以內向本委員會通報。
2. 可能危害受試者安全、影響試驗執行之新發現或影響人體試驗委員會同意試驗繼續進行之新發現，須向本委員會報告。
3. 期中報告：應於西元2009年09月09日前繳交期中報告。
   核准有效期限屆滿，若尚未通過期中報告追蹤審查，不得繼續試驗。（計畫主持人，未依規定繳交期中報告，本會得暫停受理中的審查文件，且不受理其新申請案）。
4. 結案報告：試驗完成後，應將執行情形及結果以書面報告本會核備。
5. 中止或終止計畫報告：計畫完成前就暫停或停止收案與追蹤，應與書面「計畫中止或終止摘要表」，送交本會核備。
6. 嚴重或持續不配合本委員會規範，未能遵循以上事項，可能導致您的研究計畫暫時中止或永久終止，並影響您未來送審計畫的權益。

Procedures for reporting serious adverse events and for periodic follow-up, and other important notes:
1. If a participant dies or becomes critically ill in the hospital, the IRB should be notified within 7 days of becoming aware of this. The IRB should be notified of other serious adverse reactions within 15 days.
2. If any new threat to the safety of the participants is discovered, or if anything is discovered that could affect the implementation of the study, or if any discovery is made that could influence the IRB’s decision as to whether the study should be allowed to continue, this must be reported to the IRB.
   If the interim report has not been submitted for review by the deadline, the study must be halted. (If a principal investigator fails to submit an interim report on schedule, the IRB may suspend review of other protocols submitted by that investigator for review, and may refuse to review any further applications made by that investigator.)
4. Final report: When the study has been completed, details of the study implementation and of the results obtained should be submitted to the IRB in writing for their review.
5. Reporting the suspension of termination of a study: If, prior to the completion of a study, implementation and/or follow-up are suspended or terminated, a Suspension or Termination of Study Summary Report should be submitted to the IRB.
6. Serious or repeated failure to comply with IRB regulations and with the above requirements may result in your study being suspended or terminated, and may affect your ability to submit future studies for review.
各位護理部主管您好，

我是黃豔姿，目前是英國曼徹斯特大學護理學院研究生。我的研究論文是關於健康資訊系統在台灣的使用，以及電腦化如何影響臨床護理人員的角色和護理照護工作。以下是計畫案簡單的介紹。

研究計劃名稱：電腦資訊系統對台灣醫療院所臨床護理人員專業角色影響之探討。

研究方法：個案研究（共2家醫學中心）。這個計畫案的院內共同主持人是[省略]。

資料收集：3種質性資料收集。預計每家個案資料收集時間為期4個月。

<table>
<thead>
<tr>
<th>資料收集法</th>
<th>對象</th>
<th>預計樣本數</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 菁英訪談</td>
<td>護理部：護理部負責電腦化業務的相關主管、病房單位的護理長。</td>
<td></td>
</tr>
<tr>
<td>（一對一）</td>
<td>資訊部：資訊部主任、資訊部工程師。</td>
<td>21人</td>
</tr>
<tr>
<td></td>
<td>其他和電腦化業務相關的醫院主管。</td>
<td></td>
</tr>
<tr>
<td>2. 焦點訪談</td>
<td>內科病房、外科病房、內科加護病房、外科加護病房、兒科病房單位中的護理人員。</td>
<td></td>
</tr>
<tr>
<td>（團體）</td>
<td>（排除：單位中的護理長與副護理長、兼職護理人員、處於試用期的新進護理人員、臨床專科護理師、沒有意願參加的護理人員。）</td>
<td>50人</td>
</tr>
<tr>
<td>3. 非干擾式</td>
<td>病房單位中的電腦資訊系統：內科病房、外科病房、內科加護病房、外科加護病房、兒科病房。</td>
<td>5個單位</td>
</tr>
<tr>
<td>觀察法：</td>
<td></td>
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</tbody>
</table>

預期結果：期望能有助瞭解醫護照護團隊的各個角色在資訊化和醫療照護過程的重要性和專業性。並對醫療照護實務和健康資訊系統的應用有助益，以提升醫療照護品質與效益。

若有任何疑問，歡迎您與我聯絡。
謝謝您的指教與幫忙。先預祝您新春愉快，事事順心！

豐姿敬上

2009/1/15
護理長您好，

我是黃豐姿，目前是英國曼徹斯特大學護理學院研究生。我的研究論文是關於健康資訊系統在台灣的使用，以及電腦化如何影響臨床護理人員的角色和護理照護工作。以下是在貴單位進行焦點訪談法的簡短介紹。內容有:

- 計畫案摘要.........................P2
- 焦點訪談招募流程的說明....P3
- 焦點訪談同意書..............P4
- 招募回條.........................P8
- 焦點訪談會後之匿名問卷....P9
- 焦點訪談半結構式指引......P10

若有任何疑問，歡迎您與我聯絡。

謝謝您的指教與幫忙。祝您事事順心！

豐姿敬上 2009/3/4
計畫案摘要

主旨：電腦資訊系統對台灣醫療院所臨床護理人員專業角色影響之探討

關鍵詞：電腦化、電腦資訊系統、健康資訊系統、電子病歷、護士、植人、醫療機構、醫學中心

研究目標：本提案旨在(1)檢視電腦化對台灣臨床護理人員照護工作與其專業角色的影響；(2)探索台灣醫院電腦資訊系統的建置經驗；(3)了解台灣醫院的機構脈絡。

研究背景：健康照護服務是個資訊密集的產業。為了要提升照護品質和效率並降低成本，過去十年中，歐美各國醫療機構廣泛將電腦和資訊科學融入於醫療照護(Reep and Lohman, 1998; Patterson, 2004)。健康資訊系統的使用逐漸成為全球趨勢，台灣政府也跟進推動病歷電子化。許多專家學者認為健康資訊系統能促進臨床效益，但其相關實證仍相當有限，而且，國內外文獻甚少著墨電腦化對護理人員照護實務和專業角色的影響。而目前對於電腦資訊系統植人的過程仍欠缺了解。

研究方法：採質性、嵌入式多重個案研究設計，於兩家醫學中心進行探索研究。以立意取樣法招募醫院主管、資訊部工程師和護理部相關主管進行菁英訪談，並與使用資訊系統經驗的臨床護理人員進行焦點訪談，於病房單位進行健康資訊系統的觀察。另外，預計菁英訪談其他醫學中心的護理部主任或督導。預計每家個案資料收集時間為期4個月。

預期結果：期望能有助瞭解護照護團隊的各個角色在資訊化和醫療照護過程的重要性和專業性。並對醫療照護實務和健康資訊系統的應用有助益，以提升醫療照護品質與效益。
焦点访谈招募过程的说明

之前：
- 拜访护理长。
- 招募前一天，会打电话再次向护理长确认。

第一天：
- 利用早晚交接班招募两次。研究生将会简短口头介绍（预计5分钟），发表焦点访谈同意书包裹，在护理站放置回条专用盒子。除了放假的护理人员外，大多数的护理人员将会知道这个研究的相关资讯。
- 回条专用的箱子上会写「研究题目」、「10分钟问题时间」、「收盒子的时间」。

第二天：
- 白班、小夜分别提供一次「10分钟问题时间」，方便护理人员有任何问题可直接询问研究生。在「10分钟问题时间」中，研究生会出现在护理站回条专用盒子附近，等护理人员问研究生问题（PS：研究生不会主动询问，以免护理人员觉得有压力）。时间一到研究生就会离开。

第三天：
- 同第二天行程。

第四天：
- 收回盒子。

之后：
- 按回条联络有意参与的护理人员，安排焦点访谈举行的日期。
焦點訪談研究受訪者同意書

我們邀請您參加本研究，此份同意書提供您本研究相關資訊，計畫主持人或研究人員將為您詳細說明並回答相關問題。

<table>
<thead>
<tr>
<th>計畫編號</th>
<th>IRB 編號</th>
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</thead>
<tbody>
<tr>
<td>計畫名稱</td>
<td>電腦資訊系統對台灣醫療院所臨床護理人員專業角色影響之探討</td>
</tr>
<tr>
<td>研究執行期限</td>
<td>4個月</td>
</tr>
<tr>
<td>委託單位/藥廠</td>
<td>無</td>
</tr>
</tbody>
</table>

| 計畫主持人 | 黃丰姿 |
| 機構名稱 | 英國曼徹斯特大學 |
| 部門/職稱 | 護理助產暨社工學院/博士研究生 |
| 電話/分機 | 04-8333038 |
| 手機 | 0922-555857 |

| 院內共同主持人 | 財團法人彰化基督教醫院 |
| 部門/職稱 | 護理部/主任 |
| 電話/分機 | 04-7238595 轉 1255 |
| 手機 | 0921-042242 |

| 院內共同主持人 | 財團法人彰化基督教醫院 |
| 部門/職稱 | 護理部/督導 |
| 電話/分機 | 04-7238595 轉 1255 |
| 手機 | 0917-160-951 |

| 研究助理 | 財團法人彰化基督教醫院 |
| 部門/職稱 | 環境與發展學院/博士研究生 |
| 電話/分機 | 04-8326636 |
| 手機 | 0928-905329 |

| 二十四小時緊急聯絡人 | 黃丰姿 |
| 機構名稱 | 英國曼徹斯特大學 |
| 部門/職稱 | 護理助產暨社工學院/博士研究生 |
| 電話/分機 | 04-8333038 |
| 手機 | 0922-555857 |

1 研究背景

近年來，越來越多的護理工作需藉由電腦科技來完成，然而分析目前文獻後，發現下列三個方向需要更多實證研究。

1.1 健康資訊系統對於促進臨床效益和效率，需要更多實證支持。
1.2 目前國內外文獻中，甚少深入探討使用電腦科技對於照護實務、護理品質和護理人員專業角色所產生的影響。
1.3 對於醫療機構植入健康資訊系統的過程仍欠缺了解。
研究目的

希望透過團體的討論，了解您個人使用電腦科技完整護理工作的經驗。希望研究結果有助於瞭解護理帶來的各個角色在資訊化醫療照護過程的重要性與專業性，提供其他醫療餐廳學習，並進步未來資訊系統的應用，充分發揮科技所帶來的效益。

受訪者之篩選條件

3.1 納入條件(符合下列條件者，適合參加本研究)：

3.1.1 臨床護理人員中凡是有使用電腦科技來完成護理照護者，均被邀請。

3.1.2 同意並參與焦點訪談完全是自願性質。

3.2 排除條件(若有下列情況者，不能參加本研究)：單位中的護理長與副護理長、兼職護理人員、處於試用期的新進護理人員、臨床專科護理師、非病房單位的護理人員。

研究方法與程序

4.1 收案地點：本院中使用電腦科技、資訊系統來完成護理照護的病房單位。

4.2 收案人數：預計進行5組焦點訪談，每組約10位成員。預計一共招募40~50位護理人員。

4.3 取得同意書方法：研究者將到病房單位給您簡短口頭說明，並給予二到三天充分的時間考慮。為了避免讓您感受到壓力或有强迫參加的感覺，若您有意願參與，請利用「回條」留下您的聯絡方式，裝入專用信封後投入於護理站的專用信箱。研究者將會聯繫您，並給予充分時間討論任何疑問，確定您瞭解焦點訪談同意書內容、匿名與保密的相關議題，以及對於焦點訪談內容需要被錄音的感受。再與您約定訪談地點及日期。若您不同意錄音，將不會把您納入研究中。

4.4 焦點訪談分組：將會依照病房單位進行招募和分組，因此焦點討論的團體成員將會是單位同事彼此。

4.5 焦點訪談過程：研究者黃祖姿將會是焦點訪談主持人，另有一位院內研究助理在場擔任觀察者，但不參與討論。訪談進行地點將會是醫院的某會議室。預計訪談持續九十分鐘。為了要有一個正確的訪談內容以利日後進行資料分析，團體訪談內容將會錄音。訪談結束後將會有份簡短的匿名問卷，邀請您留下基本資料，並歡迎寫下任何想表達但卻未在團體訪談中說出口的想法或意見。

4.6 討論將以開放的方式來瞭解您使用電腦資訊系統的經驗談。訪談主題有資訊系統植入過程的經驗、電腦化對護理人員的影響，以及各部門間的合作關係和經驗。

可能產生之不適及處理方法

5.1 本研究將以團體討論進行，沒有涉及醫療行為，不構成生命健康的危害。

5.2 焦點訪談表示您在一群人面前討論自己的觀感與意見，包括團體成員們、主持人及觀察者。因為研究者無法控制團體成員於訪談結束後向他人揭露內容，使得研究者無法向參加者確保絕對的保密，但訪談主持人會在討論一開始，說明希望在討論結束後，請焦點訪談的成員不要向未參加者揭露其他團員的討論內容。

5.3 焦點訪談的過程有可能會影響團體成員的自尊。主持人將依當時情境徵詢受訪者繼續進行討論的意願或是提供片刻休息的機會，亦或視情況停止焦點訪談討論。您若因參與本研究或因團體討論而造成心理方面的不適，您可以隨時拒絕參與或退出討論，不會引起任何不愉快或影響日後主管對您的升遷或考核。

研究預期效益

6.1 預期本研究對於健康資訊系統的發展及護理實務有實質的幫助，同時也期望建果
能有助醫院主管們瞭解前線醫護人員的使用經驗，使他人認識護理人員在資訊化和醫療照護過程的重要性和專業性。

6.2 期望研究結果有助於醫療照護之實務和醫療資訊系統未來的發展與應用，充分發揮科技所帶來的效益，以提升醫療照護品質與效益，達到病患為中心的照護目標。

7 研究進行中受訪者應配合之事項:
7.1 進行團體討論時，建議一次一個人講話。而且每位成員的意見都很重要。
7.2 希望參加焦點團體的各位成員在討論結束後，請不要向未參加者揭露其他團員的討論內容。

8 機密性
8.1 對於醫學中心的特徵與您的身份或訪談的結果將保密，並以研究的號碼取代您的姓名。除了有關機構依法調查外，計畫主持人會確保您的隱私。
8.2 錄音內容將會打成逐字稿。錄音資料和逐字稿將按照曼徹斯特大學的資料保護法，由研究生黃丰姿鎖於研究室櫃中保存。一旦完成正確的逐字稿後，錄音檔案將會銷毀。
8.3 只有研究生黃丰姿能使用錄音內容和訪談逐字稿，共同主持人：張淑真及陳美珠無法獲得任何可辨識您的資料。研究成果最後將會以博士論文方式公開呈現，曼徹斯特大學圖書館將會有館藏。

9 補助與損害賠償
9.1 訪談後將會贈與一份購自癌症研究慈善機構、等值約70元的小禮物，表達對您撥冗參加的感謝。若於訪談中途退出者，仍然有這份小禮物。
9.2 如因本研究而發生非預期之傷害，由財團法人彰化基督教醫院依法負損害賠償責任。

10 受訪者權利
10.1 如果您現在或研究期間有任何問題或狀況，請不必客氣，歡迎與黃丰姿聯絡(24小時聯繫電話：0922-555857，E-mail：fzh555857@gmail.com)。

11 研究之退出與中止
這個研究的參與是自願性質，您可自由決定是否參加本研究；並有自由在任何時間退出研究，無需給任何理由，且不會引起任何不愉快或影響日後主管對您的升遷或考核。研究主持人亦可能於必要時中止該研究之進行。

12 簽名
12.1 解釋同意書人（於本計畫中擔任：□主持人）
本人已詳細解釋本計畫中上述研究方法的性質與目的，及可能產生的危險與利益，並已回答受訪者之疑問。
<table>
<thead>
<tr>
<th>解釋同意書人簽名：</th>
<th>簽名日期：年月日</th>
</tr>
</thead>
</table>

12.2 受訪者

經由說明後本人已詳細瞭解上述研究方法及可能產生的危險與利益，有關本研究計畫的疑問，亦獲得詳細解釋。本人同意並自願參與本研究，且將持有同意書副本。

<table>
<thead>
<tr>
<th>受訪者簽名：</th>
<th>簽名日期：年月日</th>
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<table>
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<tr>
<th>計畫主持人簽名：</th>
<th>簽名日期：年月日</th>
</tr>
</thead>
</table>

本同意書一式二份，雙方完成簽署後，各執一份留存。
焦點訪談受訪者招募回條

研究計畫名稱：電腦資訊系統對台灣醫療院所臨床護理人員專業角色影響之探討

若您願意參加焦點訪談，請寫下您的聯絡方式，並將回條裝入備好的專用信封，投入至於護理站的專用信箱。研究生黃丰姿將進一步與您聯繫。

非常感謝您撥空閱讀這份焦點訪談研究受訪者同意書，並考慮參加這個研究。

姓名：
E-mail：
電話：
手機：
希望的聯絡方式 □都可以 □電話 □手機 □E-mail □其他(請留下資訊)________________________
焦點訪談會後之匿名問卷

1. 單位：

2. 職稱：
   □護理師  □組長  □其它

3. 年齡：

4. 性別：
   □男  □女

5. 教育程度：
   □專科  □大學/二技  □研究所以上

6. 在職進修：
   □無  □大學/二技  □研究所以上  □計畫中

7. 護理生涯年資：

8. 彰基服務年資：

9. 生活中使用的電腦科技(可複選)：
   □不使用  □PDA  □智慧型手機(具有PDA功能的手機)
   □iPhone  □iPod/MP3  □桌上型電腦  □筆記型電腦
   □其它

10. 歡迎您寫下，任何想表達，卻未在討論中說出口的意見或想法？（本題是自願，非強迫性作答）

_____________________________________________________________________
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焦點訪談半結構式指引

開場

- 解釋。
  - 研究目的。
  - 錄音目的。
  - 匿名、保密原則。

- 團體討論原則：
  - 建議每次一個人講話及原因。
  - 每個人的意見都很重要。

使用健康資訊系統經驗

- 哪些部份已電腦化？
- 單位中使用健康資訊系統有多久？
- 電腦化植入策略。
  - 是如何開始推行的，
  - 由誰推動，方法(由上而下？)。
  - 策略：大樂隊法、平行法、漸進式。
  - 領導。
  - 參與度。
  - 進展。
  - 有無任何問題。
  - 有何後續改變。

- 學習過程。
  - 需要的技能為何。
  - 如何獲得該技能。

- 如何適應電腦化。
- 使用資訊系統的經驗：選擇，焦慮。

電腦化對護理人員的影響

- 描述利用電腦完成護理工作的常規過程(Routine)。
- 電腦化對護理照護工作影響的感知。
  - 帶來什麼樣的改變，優點，缺點。
  - 使用電腦系統提供照護有無任何困難。
  - 如何適應，多久適應。

- 效率：
  - 照護病患與使用電腦時間的分配。
  - 品質。

- 電腦化對護理角色影響的感知。
  - 電腦系統支持護理工作需求的程度。
  - 反映病患狀況的程度。
  - 個別化護理照護的提供。
  - 臨床判斷。
  - 批判性思考。
  - 護理的自主性：治療或護理措施安排、完成的順序。

- 期望
  - 希望電腦資訊系統對於護理照護帶來什麼改變？

電腦化過程的合作關係

- 電腦化過程的角色扮演。
  - 主管：醫院，資訊部，護理部。
・工程師。
・護理人員。

・彼此聯絡和合作的程度。
・合作模式。
・溝通。
・臨床護理人員的參與空間。
・經歷特殊問題。
・改進的點子。

・對電腦化決策的看法。
・領導。
・主管領導風格。
・精神支持：鼓勵。

・電腦系統對醫院主管、護理主管、資訊部工程師和護理人員影響的感知。

正式、非正式支持資源的有無與使用

・正式的支持資源。
・教育訓練課程。
・使用手冊。

・使用支持資源的頻率。
・特殊支持：誰，經驗，看法。
・資源：時間，金錢。
・資源實用與否的感知。
・什麼最有用，最有幫助。

・對電腦化的任何建議或意見看法。
・什麼能使得電腦化過程更上手，更有效率？

尾聲

・自由提出任何尚未討論的相關議題。
・填寫基本資料，單一開放式問題之問卷。
・簡短解釋將如何使用訪談內容資料。
護理長您好，

我是黃丰姿，目前是英國曼徹斯特大學護理學院研究生。我的研究論文是關於健康資訊系統在台灣的使用，以及電腦化如何影響臨床護理人員的角色和護理照護工作。以下是在貴單位進行觀察法的簡短介紹。內容有:

- 計畫案摘要...............................P2
- 觀察病房電腦系統的相關說明......P3
- 觀察法半結構式指引...............P4

若有任何疑問，歡迎您與我聯繫。

謝謝您的指教與幫忙。祝您事事順心！

豐姿敬上 2009/3/4
計畫案摘要

主 題: 電腦資訊系統對台灣醫療院所臨床護理人員專業角色影響之探討

關鍵詞：電腦化、電腦資訊系統、健康資訊系統、電子病歷、護士、植入、醫療機構、醫學中心

研究目標：本提案旨在(1)檢視電腦化對台灣臨床護理人員照護工作與其專業角色的影響；(2)探索台灣醫院電腦資訊系統的建置經驗；(3)了解台灣醫院的機構脈絡。

研究背景：健康照護服務是個資訊密集的產業。為了要提升照護品質和效率並降低成本，過去十年中，歐美各國醫療機構廣泛將電腦和資訊科學融入於醫療照護(Reep and Lohman, 1998; Patterson, 2004)。健康資訊系統的使用逐漸成為全球趨勢，台灣政府也跟進推動病歷電子化。許多專家學者認為健康資訊系統能促進臨床效益，但其相關實證仍相當有限。而且，國內外文獻甚少著墨電腦化對於護理人員照護實務和專業角色的影響。而目前對於電腦資訊系統植入的過程仍欠缺了解。

研究方法：採質性、嵌入式多重個案研究設計，於兩家醫學中心進行探索研究。以立意取樣法招募醫院主管、資訊部工程師和護理部相關主管進行菁英訪談，並與使用資訊系統經驗的臨床護理人員進行焦點訪談，於病房單位進行健康資訊系統的觀察。另外，預計菁英訪談其他醫學中心的護理部主任或督導。預計每家個案資料收集時間為期4個月。

預期結果：期望能有助瞭解醫護照護團隊的各個角色在資訊化和醫療照護過程的重要性及專業性。並對醫療照護實務和健康資訊系統的應用有助益，以提升醫療照護品質與效益。
觀察病房電腦系統的相關說明

觀察性質：
- 純觀察，不參與。

觀察目標：
- 病房單位中支持臨床功能的資訊系統。
- 主題有電腦硬體、軟體、週邊設備配置、系統維護模式。

時間：
- 白班。

天數：
- 約3天。

服裝：
- 便服、識別證。（ICU隔離衣？）

紀錄方式：
- 純粹用紙筆紀錄，沒有拍照。

觀察的流程

觀察之前：
- 拜訪護理長。
- 視察前一天，會打電話再次向護理長確認。

觀察當天：
- 第一天，一開始會向護理人員簡短介紹。
- 每天觀察結束後要離開前，會告知護理長和護理人員。
- 視察約需3天。

觀察完成：
- 全部完成後，會告知護理長和護理人員。
觀察法半結構式觀察指引

- 單位
  - 屬性
  - 病床數
  - 電腦化階段
  - 護理人員數
  - 醫師人員數
  - 其他職員數
  - 病房平面圖

- 電腦硬體
  - 種類：桌上型/筆記型/PDA
  - 數量
  - 用途
  - 位置：可親
  - 環境
  - 與病人距離
  - 護理人員路徑
  - 使用程度
  - 運作：故障數

- 隨處設備
  - 擺設：可親
  - 設備：螢幕、CD 讀取、USB、滑鼠、列印機、墨水、紙張、掃描器。
  - 網路連線
  - 使用手冊：位置、內容(範圍、易讀、實用)
  - 運作：故障數

- 電腦軟體
  - 如何進入系統
  - 系統介面：空白/勾選
  - 速度：系統/網路
  - 安全：如何保護、存取
  - 防毒
  - 病患基本資料
  - 生命徵象：功能和介面
  - 檢驗單張：功能和介面
  - 給藥紀錄：功能和介面
  - 病程記錄：功能和介面
  - 護理紀錄：功能和介面
  - 護理計畫：功能和介面
  - 運作：故障
  - 問題、困難、限制
  - 紙本病歷：位置、角色

- 合作模式
  - 平時維護：軟、硬體
· 報修：程序、方法、誰
· 修復：時間、方法、誰
· 故障配套措施
· 設備需求評估：誰、程序、方法。
· 耗材管理
· 問題、困難、限制
1. 研究計畫名稱

電腦資訊系統對台灣醫療院所臨床護理人員專業角色影響之探討
The Impact of Computerised Information Systems on Clinical Nurses’ Role in Healthcare Organisations in Taiwan

2. 摘要

目標：本研究旨在(1)檢視標準化的電腦資訊系統如何影響台灣醫療院所臨床護理人員的實務工作與其專業角色的發展；(2)探索電腦資訊科技對台灣醫療機構的影響；(3)探討資訊時代中，醫療院所對於電腦資訊系統實施的決策過程。

背景：大量文獻提倡資訊科技具有提升醫療照護品質的潛力。過去十幾年來，歐美各國廣泛應用電腦資訊系統於醫療照護，以節省醫療資源、增加照護的品質與效益，台灣行政院衛生署也於 2002 年推動醫療服務的資訊化。護理人員身為醫治院所中使用電腦資訊系統最主要的族群，文獻卻甚少著墨該系統對於照護實務、護理品質和專業角色的影響。同時，護理人員的使用經驗研究也顯示電腦化對護理照護與專業角色有潛在的影響。再者，針對系統的成效亦欠缺整體性的角度進行評估，包括電腦資訊系統軟硬體、使用者和機構社會文化因素。

方法：將選擇實施電子病歷之醫學中心進行個案研究，研究對象為醫院職員（不涉及病患），以收集質性資料為主。將採非隨機抽樣法針對醫院主管、醫療資訊科技部門員工、護理部主管進行菁英訪談，以隨機抽樣法對護理人員進行焦點會談。其餘預計採用的資料收集法有問卷調查法與觀察法。整個研究過程將按研究倫理道德之準則，以自願、保密與匿名方式保護參與者。預計資料收集時間為 2008 年 10 月，為期 2 至 3 個月。

預期結果：期待研究結果能增進下列知識：(1)電腦化對護理人員的影響；(2)電腦資訊系統對醫療院所的社會、文化層面之影響；(3)深入瞭解護理專業的特性與資訊科技系統之間的關係。並期望結果能作為日後電腦資訊系統發展之參考依據，促進資訊科技應用以提升照護品質，充分發揮科技所帶來的效益，提供以病人為導向的專業照護。
Appendix 15: Schedule for Unobtrusive Measure of Computer Technology

Ward:
  Characteristics
  Healthcare professionals
  Other staff members
  Floor plan

Hardware:
  Type
  Numbers
  Purpose
  Location: Accessibility
  Environment
  Distance
  How nurses access computers?
  Usage
  Out of order?

Software:
  How to log in the system
  System interface
  Security
  Operation? Any computer crashes?
  The role of paper-based patient charts

Technical Support
  Maintenance
  Reporting
  Coping strategies
親愛的護理同仁您好，

我是黃豐姿，目前是英國曼徹斯特大學護理學院研究生。我的研究論文是關於健康資訊系統在台灣的使用，以及電腦化如何影響臨床護理人員的角色和護理照護工作。

這份文件的目的是要向您簡單介紹焦點訪談，同時徵求有意願參加焦點訪談的護理人員，一群人共同討論電腦化後如何影響臨床護理人員的照護和角色。內容有：

■焦點訪談受訪者同意書
■焦點訪談受訪者招募回條

1. 何謂焦點訪談？屬於團體訪談的一種。也就是想找一群人，一起討論、分享彼此使用電腦完成護理工作和照護的經驗、想法。
2. 訪談需要的時間：預計討論約 1 小時，但建議預留 1 小時 30 分鐘來進行團體討論。
3. 進行次數？將在貴單位舉行 1 次。
4. 別單位也要嗎？是的，全 ______ 將進行 5 組焦點訪談，預計內科加護、外科加護、兒科、內科病房和外科病房各 1 組。
5. 除了護理人員，有別人參與嗎？除了護理人員的焦點訪談之外，將會找醫院、護理部、資訊部主管進行一對一訪談，並且也會在病房單位進行觀察法。
6. 除了 ______ ，有別家醫院參與嗎？有的，南部某醫學中心。
7. 做完焦點訪談後呢？研究結果最後將採匿名、保密的方式撰寫成博士論文，也將會在國際研討會、學術期刊發表。若醫院許可，我也很樂意向各位進行口頭報告研究結果。

祝身體健康，事事順心

研究生黃豊姿 敬上
Appendix 17: Semi-Structured Guide for Focus Group Discussions

Opening

Experiences of using computerised information system
Implementation strategies
Learning process
How to adapt to it

Influences of computerisation on nurses
How to use computer to complete the practice
Perception about practice and nursing role

Process of implementation
Role of managers
Role of informatics staff
Role of staff nurses
How to cooperate with each other

Resources for implementation process
Official
Unofficial

Ending
Appendix 18: Computer Allocation and Floor Plan (Ward-1)
Appendix 19: Computer Allocation and Floor Plan (Ward-2)
Appendix 21: Computer Allocation and Floor Plan (Ward-4)
Appendix 22: Computer Allocation and Floor Plan (ICU-1)