CHAPTER 1

Introduction

1.1 Chapter Overview

In today's globally dispersed and fast moving economy, speed and competitive edge are major issues, which have led to information technology (IT) and associated infrastructures becoming increasingly important to organisations spanning many industries. And IT its countless applications have become key issues to both individual and business contexts as well as being integral parts of daily activities (Jacks et al., 2011). IT provides company with competitive advantages and could assists in the development of innovation. This has resulted in rapidly growing adoption of IT, and unavoidably translates into huge investment budgets (Patrakosol and Lee, 2009). The education/academic sector is no exception, especially universities, where IT plays an important role and is utilised extensively from management to academic support. IT use within universities includes, for example, IT support in a laboratory, hardware and software for IT based subjects (e.g. animation), IT support in administration, and/or IT support in organisational management (executives). Typically, a fixed portion of the overall yearly budget is assigned to accommodate IT related activities ranging from investment, to operation and maintenance. This policy unintentionally leads the organisation to focus on short-term IT policies where only the cheapest possible IT assets in the market are of interest and there is no clear direction and/or strategic plan (where and when) to optimise the overall benefits to the organisation. Eventually, this results in complexity within the IT system (diverse life cycles) and leads to significant complexity in any decision-making activities.

In an ideal situation, and with no budgetary constraints, the acquisition of IT assets should not be too problematic. Practically however, this would represent significant investment, and could potentially impose financial constraints on the organisation. According to Moore's Law, it is believed that improvements in computing performance

double, along with an associated reduction in costs every 18 months (Cavin, Lugli, and Zhirnov, 2012). Furthermore, the specific nature of the IT asset, which has no direct relation to an organisation's revenues, makes the investment typically difficult to justify. This implies the life cycle of the IT asset as well as potential risks to the organisation. Hence, with regard to IT assets, the main focus of the organisation is to achieve the 'best' or 'most suitable' utilisation and strategic investment while keeping associated costs to a reasonable level.

The objective of this research is to develop and propose an alternative framework to assist organisations in the management of their IT assets. This IT asset management framework facilitates the most suitable decision making under pre-specified constraints by optimising performance, costs and risks, while simultaneously satisfying all stakeholders. The IT asset management framework proposed in this research resolves IT related decisions by balancing between so called 'economic performance' and 'service performance' (Hook et al., 2009). Economic performance represents investment and risk associated with the IT assets, whilst the service performance focuses mainly on fulfilling stakeholder satisfaction. In this research, economic performance in the asset management framework is defined by categories of corrective, preventive, predictive and proactive maintenance (Chandarasupsang, Chakpitak, and Dahal, 2008). Knowledge associated with each previously mentioned category is captured, analysed, and modelled with the objective of translating this knowledge into costs and risks. Since the service performance in this research focuses on stakeholder satisfaction, it includes usability, availability, reliability, utilisation and security of IT assets (Franke, 2012).

In this chapter, the importance of IT to organisational management is stated. This explains the rationale behind IT investment in an organisational context, and provides the justification for this research. Then, the assumptions made and hypothesis relevant to this research are given. The outputs and contributions of this research are also stated. Finally, a brief summary of each chapter is provided.

1.2 The Information-Based Organisation

Undeniably, information technology (IT) has become increasingly essential both in an individual and organisational context (Jacks et al., 2011). As for individuals, IT provides the freedom and flexibility to connect to sources of information either for entertainment or educational purposes. In terms of the organisational context, advances in IT have resulted in its application and utilisation in many different ways. For example, business process automation where the process is done by IT instead of humans, business process reengineering, where processes can be reengineered for better business outcomes, or IT used as a medium for innovation. Consequently, it is believed that IT provides competitive advantages/edges to the organisation. This has resulted in more and more managers striving to invest in IT systems.

In the pre-World War 2 era, industry was developed and driven by the concept of Frederick Taylor and revolved around four major industrial factors. These were man, machine, material, and management. Among these four factors, 'man' was considered only as a production material similar to the other four factors. The organisation believed that humans worked according to specified manual and predefined functional procedures. In the post World War 2 era, which was supposed to be a period of significant economic growth, large companies went bankrupt, even with a sufficient supply of the four major industrial factors. Productivity was not as expected, and efficiency was low, whilst the business risks increased dramatically. This phenomenon was later described and explained by Peter Drucker utilising the newly created concept of 'knowledge worker' and 'information based organisation'. The key explanation of this phenomenon was that the success of the organisation was not directly influenced by numbers of manual workers, but depended more on the quality of the workers employed by the organisation. The quality of the knowledge workers was related to experience and how the organisation could reuse these past experiences.

Peter Drucker's explanation has been translated into the future scenario of organisational management where it is believed and universally accepted that the organisation must become what is termed the 'information based organisation'. External

pressures would force the organisation to reduce its management structure, and become hierarchically flatter, thus improving the efficiency and effectiveness of decision making activities. IT could successfully and efficiently assist in this transition, where the role of IT in the organisation is to increase its speed and precision. Furthermore, IT implementation is a significant part of process improvement and helping knowledge workers within the organisation become more efficient in what they do.

As a result, it is inevitable that some part of an organisation's annual budget is dedicated to IT investment. The amount though differs from organisation to organisation and varies across different industrial sectors. However, in the past IT investment was seen as a sunk cost of an organisation, resulting in the IT system being regarded as a cost centre (Ravichandran, Han, and Hasan, 2009). A new perspective to IT investment is presented in this research, and although it still regards IT investment as inevitable, the research tries to justify the investment and make decisions strategically.

1.3 IT Resource Management and Research Justification

An organisation's investment in IT infrastructure represents a considerable responsibility for the IT manager. The senior IT officials offer a very mixed assessment about the effectiveness of various institutional investments in IT (The Department Chair, 2013) and many environmental variable are related to IT investment strategy (Ravichandran and Liu, 2011). There is often pressure to satisfy all the organisation's expectations. One challenge is to convince the organisation of the benefits of IT by demonstrating a new business approach for management to achieve their business goals, and then securing the required budget. Today, IT resource management (including investment) is at the heart of an organisation's success. It not only enhances an organisation's efficiency, but also has potential to increase income provided IT can facilitate innovation. Typically, IT implementation in many organisations stems from destabilised factors such as not enough work experience, budgetary constraints, and human resource issues.

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Ideally, with no budgetary constraints, IT investment would be as easy as simply replacing old IT assets with new whenever needed. In the real world however, budget is an important issue and is usually limited (Li et al., 2009). This presents a dilemma, as replacement with new assets is not always an option, but IT adoption is unavoidable to maintain competitive advantage. Consequently, a strategic decision needs to be made at the right time. These decisions include, 'change function', 'relocation', 'refurbish', or 'replacement'. Not only are these decisions not easy and straightforward in terms of satisfaction, they are difficult to justify due to the short life cycle of the IT asset. One decision might satisfy top executives of an organisation in terms of economic performance, but might be less satisfactory to the IT users in terms of service performance. Hence, the main focus of the organisation in terms of managing IT assets is to achieve the 'best' or 'most suitable' utilisation and strategic investment in IT assets, while keeping associated costs to a reasonable level.

1.4 Research Questions and Assumptions

The main objective of the research is to propose an alternative decision making framework for IT asset management (ITAM) within the organisation. This ITAM framework applies the concept of asset management to balance costs, performance, and risks, and also utilises the concept of knowledge engineering, along with the associated human reasoning. Therefore, the focus of this research is primarily on the IT assets used in the organisation. As a result, this research is based on the assumption that advances in technology continue to grow at least at the current speed, and IT still plays an important role in the management of the organisation.

This leads to an attempt to answer the following research questions:

- *How can the knowledge essential for the management of IT assets be modelled?*

  As mentioned previously, the IT asset is fundamentally different to other assets due to the fact it has no direct relation to the organisation's revenues (McShea, 2009). Consequently, conventional measurement methods are not

practical to justify the investment. These include for example, net present value (NPV) or return on investment (RoI). Instead, this research opts to provide a different perspective by separating the reasoning into economic and service performance in order to make decisions regarding the IT asset.

- *How can the costs associated with the IT asset be effectively quantified?*
Not only does this research consider costs incurred through the management of the IT asset in terms of numbers, it also includes the decision making rationale from past experience. This is referred to in this research as the 'economic performance of the IT asset'. Cost incurred is categorised into activities according to the asset management framework (corrective, preventive, predictive, proactive and strategic). A knowledge engineering methodology is applied to elicit the relevant knowledge from experts (Franke, 2012).

- *How can the service performance of the IT asset be quantified?*
Together with the economic performance (representing 'costs'), the service performance of the IT asset is considered in this research in order to make the most suitable decision. This is because stakeholders (top managers, the IT manager and users) are unavoidably affected by each decision. Typically, it is difficult and sometimes impossible to please all stakeholders since their expectations are different. In this research, the service performance of the IT asset is quantified and represented by 'functions divided by requirements'.

The key assumptions made in the thesis are:

- Advances in IT continue to grow at an equal or greater rate compared to the existing state.

- IT still plays an important role in providing competitive advantage to the organisation and its adoption rate continues to grow.

- There is no direct relationship between organisational revenue and IT investment. Hence, it is very difficult to explicitly justify the IT investment.

- Stakeholder satisfaction is based on IT function and requirements, excluding bias and human feeling.

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- The ITAM framework proposed in this thesis replicates and represents the reasoning behaviour of experts when making strategic decisions regarding the IT asset.

1.5 Research Methods and Proposed Solution

The research is conducted in the following methodological sequence:

Literature review

Relevant literature has been investigated and explored in the form of journal publications, technical papers, magazines, websites and books, including both empirical studies and the application of theory. Literature is divided into key domains including IT, organisational management, asset management, knowledge management and engineering, economic and service performance measurements.

Data Collection

The research focuses on the education sector, specifically the College of Arts, Media and Technology (CAMT) at Chiang Mai University, Thailand. Consequently, CAMT represents the main source of data, which is collected from the top management (responsible for the IT investment budget), the IT manager (responsible for strategic decisions regarding IT management), and the users. Interviews and questionnaires are utilised as the key method to collect this data. The data relating to price and performance of the IT asset are received from the vendors. In this research, the data to construct the test bed (case study) comes from real cases occurring at CAMT over the past two years.

Tools and Techniques

Since the focus of this research is the management of the IT asset, the asset management approach is reviewed. After in-depth investigation, the currently available asset management standard belongs to the Institute of Asset Management in the United Kingdom. Hence, in this research, the Publicly Available Specification (PAS 55) is utilised and applied as the asset management methodology. In order to receive the

experience of experts, a knowledge engineering methodology is extensively reviewed, and CommonKADS is selected in this thesis. Finally, ISO27000 is included as part of the methodology for the overall risk management of the IT asset management approach proposed in this research.

Analysis of Data

The data analysis in this thesis is divided into two parts. The first involves data analysis from expert interviews (knowledge captured from experts). CommonKADS is used as a tool to analyse and model the expert's experience relating to the IT asset. Specifically, discourse analysis, including keyword identification and annotation are the primary techniques used. In terms of expert's experience, appropriate knowledge temples are selected for the analysis. The second part of data analysis involves the analysis of test results. Case studies are constructed and used as test beds to prove the ITAM proposed in this research. Statistical tools are applied to analyse the test results. Examples of data analysis are shown as follows:
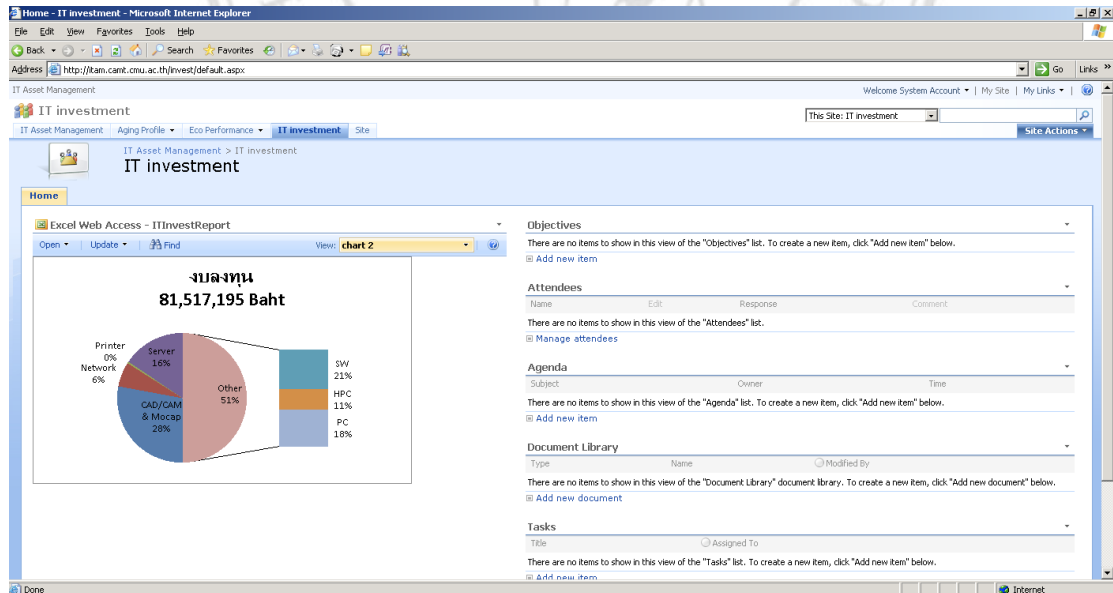

Figure 1.1 Online Supporting Information on IT Investment

Figure 1.1 shows supporting information on IT investment. This information is updated regularly and made available on decision support system. The IT investment is utilised through the online system during the executive meeting to support decision making activities regarding IT issues, finances and planning.
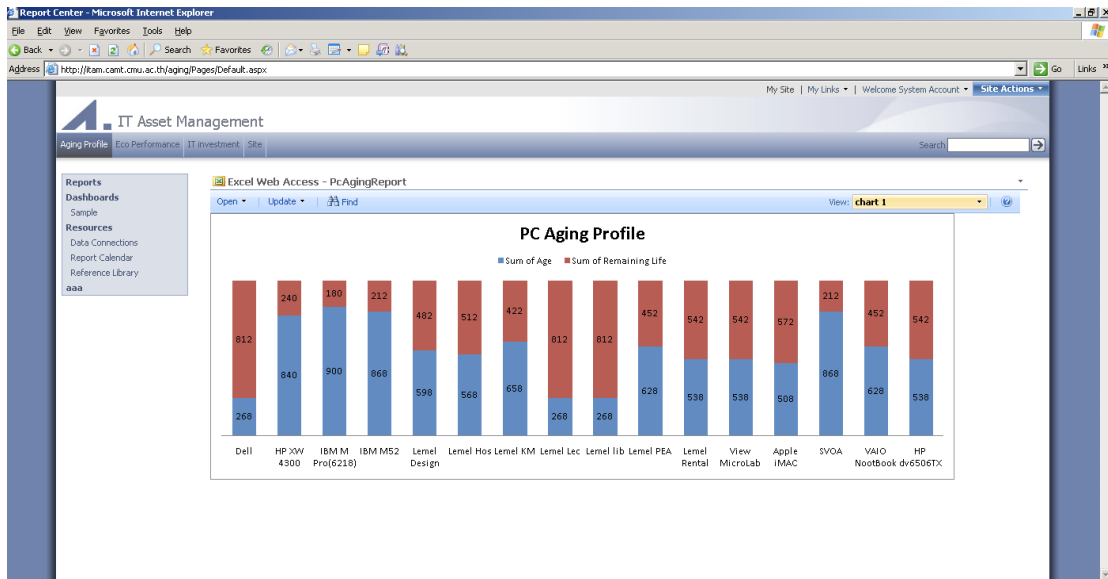

Figure 1.2 Online Supporting Information on Aging Profile

Figure 1.3 shows supporting information on aging profile. The profile of each IT assets is recorded by category. This information assists the executives in making the most suitable decision to either replace, relocation or refurbish aligning with organisation context. Moreover, this aging profile also helps the organisation to better manage anticipated risks and expected performance.

Proposed Information Technology Asset Management (ITAM) Framework

In this research, the IT asset management (ITAM) framework is proposed and tested. CAMT at Chiang Mai University is selected as the primary source of information and acts as a case study. The focus of this thesis is on the management of the IT resources within CAMT, including investment and maintenance. The concept of asset management to balance costs, performance and risks is applied to form the foundation

of the ITAM. Although PAS55:2008 provides guidelines for the implementation and a 28 point requirement specification, it leaves the 'how to' for the organisation themselves to decide.
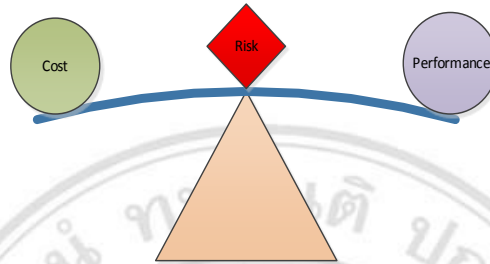

Figure 1.3 The concept of asset management to balance costs, performance and risks

Hence in order to construct the ITAM, this research constructs three decision models based on costs, performance and risks.
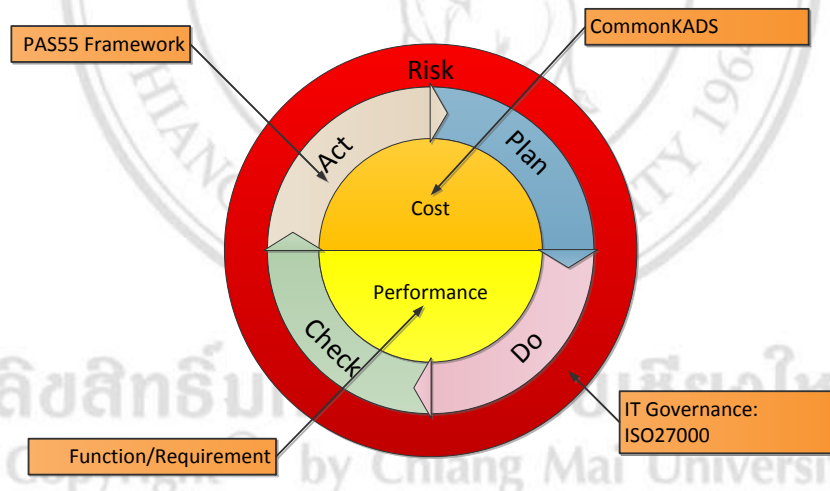

Figure 1.4 High Level concept of the Proposed IT Asset Management

The first model represents the governing factors controlling risk. ISO27000 is applied for this risk model in the ITAM. The second model assists in decision making activities regarding economic performance. As opposed to relying solely on data/information, this research utilises the knowledge and experience of experts to construct an economic performance decision model. CommonKADS based on the asset management framework is applied to elicit relevant knowledge from experts and construct a

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knowledge model. The last decision model is the IT service performance model, which indicates satisfaction among stakeholders. In this research, IT service performance is determined by 'functions divided by requirements'.
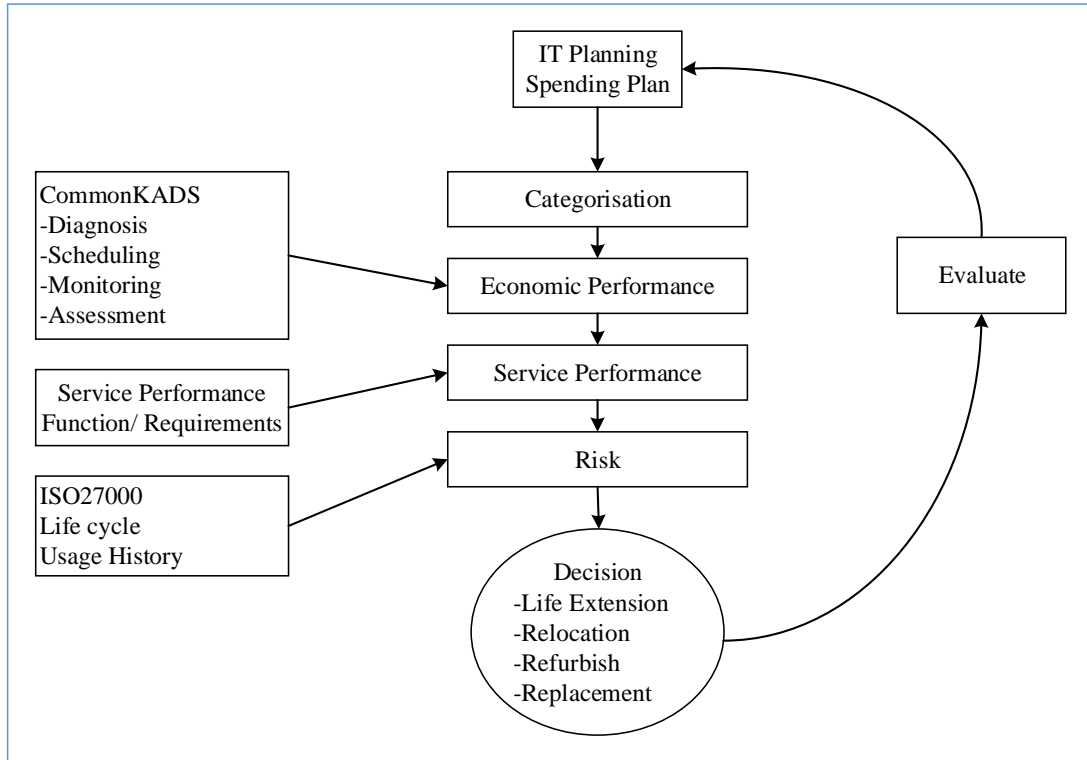

Figure 1.5 ITAM framework

1.6 Novel Contribution of Research

The novel contribution of the research can be expressed as the following:

- In an asset management context: although the main concept of asset management in terms of balancing costs, performance and risks is still applied in this research, the approach differs in the sense that the IT asset possesses different characteristics compared to other assets. Not only does the IT asset have a very short life cycle, it also has no explicit relation to the overall organisational revenue. The proposed ITAM overcomes these issues by assisting

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stakeholders to make the correct decision at the right time, while justifying the IT investment budget.

▪ In the asset categorisation context: the asset categorisation method utilised in this research provides flexibility for decisions to be made from a wider perspective and hence, with more management choices. This allows the IT asset to be moved across and utilised by different departments within the organisation.

▪ Economic performance modelling: with the specific perspective of the IT asset mentioned above, knowledge engineering provides increased understanding of the costs incurred and the rationale behind each action. Hence, rather than relying heavily on an equation for IT asset management, the decision making process presented in this thesis puts more emphasis on the reasoning behaviour of the expert.

▪ IT service performance: to satisfy all parties involved while making decisions regarding IT assets, a simple but very effective function is introduced to quantify the IT service performance. This function can be represented as 'functions divided by requirements'. Due to its simplicity, the most suitable solution can be found based on all parties' expectations.

▪ Intelligent decision making tool: the decision support system developed as part of this research provides a user-friendly environment and sufficient features to assist the organisation in decision making activities. Instead of providing only the solution, this intelligent decision making tool is developed to guide the decision maker through the available knowledge and information to find the most suitable solution according to each specific scenario and constraints.

1.7 Problem Statement/ Problem Definition

Ideally with no constraints on the budget, investment in Information Technology (IT) should be easy and straightforward. However, this indicates huge investment budget, and could put financial burden to the company. Furthermore, this is not helped by the fact that IT is regarded as cost centre and represents sunk costs of the company investment budgets. This organisational policy unintentionally leads the company to

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focus mainly on the short-term investment strategy where only the cheapest solution is of interest. Conventional method for the IT investment is adapted from the existing financial techniques which focus mainly on the returns from the assets invested. However, due to its short life cycle and no direct relations to the revenues of the organisation, financial techniques may become inappropriate. This thesis proposes the alternative modelling method for the IT asset management.

1.8 Research Objectives

- To investigate and analyze the problems faced by an organisation in the management of the IT assets.
- To explore and propose an alternative KM based framework which could assist organisation to effectively manage the IT assets. This proposed framework covers the decision making activities from investment, operation and maintenance, and replacement.

1.9 Research Hypothesis

- Instead of heavily relying on the statistical and historical data, experiences and knowledge of expert having been operating and maintaining the IT assets since its installation can be modelled systematically and utilized as the decision making engine in the proposed IT asset management framework.
- Organisational learning model of the university in the IT asset management can be constructed by applying the knowledge engineering methodology. This represents the learning curve of the organisation when managing the IT assets.
- Economics and service performance model can be constructed and represents the reasoning guidelines (concepts) in the proposed IT asset management framework.

1.10 Thesis Organisation

The thesis is organised as follows:

Chapter 2 provides reviews of relevant literatures. Firstly, this chapter gives background to the information-based organisation concepts. It begins with the development of advances in IT from the past to current state as well as possible future IT scenarios. Then, this chapter focuses on the IT investment plan and practices within the organisation. Advantages and disadvantages of current IT investment practices are discussed. Secondly, the concepts of asset management is provided. This begins with the introduction of the asset management concept and presents common terminology and frameworks. PAS 55 is also discussed in this chapter, which lays the foundation for the proposed ITAM framework. The specific nature of the IT asset is then investigated, along with a discussion of the financial calculations related to the IT asset. Finally, this chapter explores the knowledge management and knowledge engineering methodology. CommonKADS is discussed and its application to this research is presented.

Chapter 3 presents and explains the development of an alternative IT asset management framework proposed in this thesis. The conceptual framework of this research is presented. This includes the modelling of the economic and service performance which forms the decision making procedure in the proposed alternative framework.

Chapter 4 presents the case studies used in this thesis. These case studies cover possible decisions and solutions the IT manager may face. These are 'change function', 'relocation/refurbish' and 'replacement'. For each case study a general description is given as well as a presentation of results and analysis.

Chapter 5 provides conclusions to the research. Furthermore, opportunities for potential future work are provided.