# A Framework for Information Technology Investment Process: Integrating Theories and Practices

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# กรอบสำหรับกระบวนการลงทุนในเทคโนโลยีสารสนเทศ
# การบูรณาการภาคทฤษฎีและภาคปฏิบัติ

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วิทยานิพนธ์นี้ เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรดุษฎีบัณฑิต
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จิตราภรณ์ บุญกิตติเจริญ : กรอบสำหรับกระบวนการลงทุนในเทคโนโลยีสารสนเทศ การบูรณาการภาคทฤษฎีและภาคปฏิบัติ (A Framework for Information Technology Investment Process: Integrating Theories and Practices) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: รศ. ดร. กมเลศน์ สันติเวชชกุล 174 หน้า.

ปัจจุบันการลงทุนในเทคโนโลยีสารสนเทศได้กลายเป็นหัวข้อที่องค์กรต่างให้ความสนใจ แต่ทว่า จากผลการศึกษาวิจัยที่ผ่านมาพบว่าการลงทุนในเทคโนโลยีสารสนเทศนั้ นอาจไม่ก่อให้เกิดผลต่อการพัฒนาประสิทธิภาพการดำเนินงานขององค์กรเสมอไป โดยที่ผ่านมาพบว่าสาเหตุหนึ่งของปัญหาได้แก่ กระบวนการตัดสินใจลงทุนในเทคโนโลยีสารสนเทศที่ไม่ครอบคลุม อันเนื่องมาจากกระบวนการในการประเมินมูลค่าของเทคโนโลยีสารสนเทศนั้ นไม่ชัดเจน ด้วยเหตุดังกล่าว งานวิจัยฉบับนี้ จึงทำการศึกษาบทความและงานวิจัยที่เกี่ยวข้องกับการตัดสินใจลงทุนในเทคโนโลยีสารสนเทศ เพื่อระบุถึงกระบวนการลงทุนในเทคโนโลยีสารสนเทศจากผลการศึกษาตามภาคทฤษฎี และนอกจากนี้ ยังทำการเก็บรวบรวมข้อมูลที่เกี่ยวข้องจากสภาพการทำงานขององค์กรที่เกิดขึ้ นจริง เพื่อที่จะอาศัยแบบแผนการดำเนินงานที่พบในการศึกษาจากภาคปฏิบัติมาปรับปรุงรายละเอียดของกระบวนการตามทฤษฎีให้มีประสิทธิภาพมากยิ่งขึ้ น งานวิจัยฉบับนี้ดำเนินการตามกระบวนการวิจัยเชิงคุณภาพ โดยเก็บข้อมูลจากกรณีศึกษาขององค์กรในประเทศไทย 4 องค์กร ซึ่งสิ่งที่ได้พบจากการศึกษาจะถูกนำไปเป็นข้อมูลสำหรับการจัดทำกรอบกระบวนการลงทุนในเทคโนโลยีสารสนเทศ เพื่อเป็นประโยชน์แก่ผู้ที่มีอำนาจในการตัดสินใจใช้เป็นแบบแผนในการดำเนินงาน หรือเพื่อเป็นเครื่องมือในการช่วยเตือนถึงจุดอ่อนภายในกระบวนการที่ดำเนินการอยู่

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IT investment has become an important issue in every organization adopting IT. Previous research has demonstrated the inconsistency in the relationship between IT investment and an organization's productivity. A lack of foresight in the IT investment decision process has been cited as one of the major factors contributing to the problem, due to the fact that the process of justifying the value of an IT investment remains unclear. In an attempt to investigate and solve this problem, this study has explored the relevant literature with a particular focus on IT investment decision-making process, to identify the typical IT investment process captured in prior research. It has sought empirical IT investment process data from selected organizations in order to make use of the contributions from the data patterns since they can theoretically enhance the IT investment process framework. Empirical IT investment process data for four organizations in Thailand were collected using an interpretive case study methodology. The findings from the data interpretation were used to delineate the IT investment process framework for decision makers so it could be used to both uncover gaps in their own processes, and to guide them in their IT investment processes.

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# Chapter I Introduction

## 1.1 Background and Problem Review

Information technology (IT) has been accepted as one of the major enablers and facilitators of business changes, which endow organizations with tactical advantages (M. Butler, 1997; Farbey, Land, and Targett, 1993; Willcocks, 1994). If a business was warfare, IT would be a weapon helping an organization to survive. Acquiring the right weapon to match a strategy would be a vital process.

The image of IT as a competitive tool often makes people believe that the greater the investment in, and implementation of, IT projects, the greater the productivity (Wernerfelt, 1984). There are an increasing number of organizations which are adopting more IT projects that, in turn, require each organization to allocate more money for their IT budget (*GMA Information Technology Investment and Effectiveness Study*, 2008). The expansion of IT usage means that the investment required in new IT projects is becoming a significant matter of concern.

However, organizations have not always been content with the results from their investments in IT. Previous research has demonstrated the inconsistency in the relationship between IT investment and an organization's productivity (Barua, Kriebel, and Mukhopadhyay, 1995; Belcher and Watson, 1993; Böckle, et al., 2004; Brynjolfsson, 1993; Brynjolfsson and Hitt, 1996; Brynjolfsson and Hitt, 2000; Lim, Richardson, and Roberts, 2004; Lin and Shao, 2006; Mo Adam Mahmood and Mann, 1993; Rai, Patnayakuni, and Patnayakuni, 1997; Santos, Peffers, and Mauer, 1993) The term 'IT productivity paradox' has been used by Brynjolfsson (1993) to explain the absence of a positive relationship between IT investment and its contribution to the organization's productivity, or, more succinctly, the situation where IT fails to deliver the expected benefits.

There have been many attempts to study and explain this productivity paradox (Peppard and Ward, 1999; Rai, Patnayakuni, and Patnayakuni, 1997; Ward and Griffiths, 2002; Weill, 1992). Among the many explanations, a lack of foresight in the IT investment decision process has been cited as one of the major factors contributing to the problem (Holme, 1997; Small and Chen, 1995). This does not mean that executives are unaware of the importance of IT investment process planning; it is due to the fact that the method of justifying the value of an IT investment remains unclear. If executives define the desired benefits from IT projects in intangible terms, they will be difficult to justify. Alternatively, when traditional financial measurements which are considered to be more concrete, tangible, and easy to calculate, are used, they still cannot measure an IT investment's true value because those models might fail to capture the strategic benefit of IT (Mohanty and Deshmukh, 1998). Many frameworks and techniques of IT investment evaluation have been offered to provide a clearer method for IT value justification.

Researchers continue to propose frameworks for IT investment decision making and evaluation by the claim that there is a gap needed to be improved. Some frameworks utilize an overview of the desired processes and practices (Demirhan, 2004; Lederer and Salmela, 1996; McFarlan, 1981; Sanjeev and Michael, 1998) while other frameworks use very complicated calculations (real option, modified ROI) to provide values so that the practitioners can see the costs or benefits that the IT projects will generate (Benaroch, Lichtenstein, and Robinson, 2006; Böckle, et al., 2004; Verhoef, 2004) although these are difficult to determine and apply in real life due to the specific conditions at different firms. Many of these efforts have been focused on prescribing how to carry out an investment appraisal, rather than taking a holistic view of the IT investment process. This makes some certain topics are omitted from the scope of interest.

In practitioner aspect, a concern for IT investment has become an important issue in every organization adopting IT, including organizations in Thailand. Thailand is a country which has intensive IT investments. Its national policy also supports the development of IT. Since 1992 the importance of information and

communication technology in the development of the Thai economy and society has been understood by the Thai government. Thailand has a national IT policy framework called IT-2010 covering five application domains in which IT should be utilized including e-government, e-commerce, e-industry, e-education, and e-society.

Besides the support of the government sector, the competition in business in Thailand also drives organizations to make large IT investments. During the worldwide economic recession, many organizations have had a difficult time and could not spend much money on their IT investments. It would be unfavorable if an investment in IT could not deliver its value as expected due to a drawback in the IT investment process.

Sustaining innovative research and development in this area will encourage greater investment in technology in Thailand and support the country's economic stability and growth.

## 1.2 Statement of Problem

IT is becoming inseparable from the business functions of organizations, and thus IT investment turns out to be a critical process for them (Bacon, 1992; Farbey, Land, and Targett, 1992). As previously mentioned, the literature details the attempts by researchers to develop techniques which justify IT value so information can be provided to decision makers such as chief information officers (CIO), IT managers, or authorized staffs that make decisions on IT investments. However, so far they have been unsuccessful in selecting and applying IT value justification techniques in their organizations. The application by practitioners of the IT investment techniques that were developed by researches is still limited, especially in organizations in Thailand. From the researcher experience as IT consultant, most CIOs and IT managers in Thai organizations make decisions on IT investment by using conservative techniques or even by relying only on their intuition.

The current IT investment situation in Thailand reveals the need for improvements in the research on IT investment as follows: (1) the current IT assessment theories and techniques enhanced by researchers are not fully applied by Thailand organizations, (2) the lack of empirical evidence about what evaluation methods are used by Thailand organizations and how the organizations apply the methods in their context, and (3) much research effort has been focused on prescribing how to carry out investment appraisals, rather than taking a holistic view of the evaluation process. These limitations have led to the research question for this study:

*"What is the framework for the IT investment process that is applicable and practical in the real-life context of an organization?"*

This study has sought empirical data on the IT investment process in the context of organizations in order to use the patterns in the data to enhance the IT investment process framework from a theoretical basis. This study suggests an IT investment process framework for decision makers at different stages so they can identify gaps in their processes, and can use it as a guide for their IT investment processes.

## 1.3 Objectives of the Study

In order to respond to the research question for this study, the research objectives are defined as follows:

Objective 1 : To explore the literature with a particular focus on IT investment decision-making processes so as to identify the typical IT investment process determined by prior research.

Objective 2 : To understand the actual practices of the IT investment process.

Objective 3 : To determine whether formal IT evaluation techniques or frameworks are being used by organizations in their IT investment processes.

Objective 4 : To identify the important internal and external criteria that influence IT investment decision making and evaluation practices in organizations.

Objective 5 : To integrate the relevant decision-making criteria and IT investment procedures in order to provide clear and sufficient information for supporting the IT investment decision-making process.

Objective 6 : To propose a framework that offers a logical ordering of tasks in the IT investment process, including IT project portfolios (IT projects in the pipeline), which decision makers can then use as a guide for their IT investment process. The steps of the framework will help the decision makers to undertake IT investment decision-making in a more consistent manner.

## 1.4 Scope of the Study

The research was conducted by adopting a qualitative methodology for providing contextual data in order to gain insights into the research problem (Creswell, 2003). To satisfy research objectives, data was collected and analyzed from two sources including the relevant literature and through observation. An extensive literature review was undertaken to determine the frame and scope in previous research and in theoretical approaches. For the practical aspects, data was gathered through empirical evidence by applying a case study strategy. This case study was employed in the context of medium to large organizations in Thailand.

Cases were selected using the criteria of data richness. The Thai context can be a good representative of IT investment in a developing country because of the size of investments, the level of IT maturity, and the level of IT management. Many organizations in Thailand have made intensive IT investments to help them compete in

their businesses. They have also faced the problem that their IT does not deliver the expected value due to difficulties in the IT investment process.

## 1.5 Terms and Definitions

This section provides definitions for the terms used in the study and the proposed conceptual framework.

The Information Technology (IT) terminology used in this study was adapted from the classification of Wanda Orlikowski and Suzanne Iacono (2006). This study views IT as tools that are expected to generate value such as labor substitution, productivity enhancement, information processing, and improved social relations. IT value can be captured by using sets of surrogate measures as a proxy view of human understanding in IT such as perception and attitudes towards information technologies, measures of diffusion and penetration of a particular type of IT within a specific context, investment or capital expense in IT.

When focusing on the interaction between people and technology, IT is viewed as a development project, a production network, an embedded system, and a structure seen in an ensemble view to demonstrate the development and use of IT. When firms invest in IT, the scope of IT acquired by the firms may cover the components of technology, including hardware, software, and networks, processes involved with those components such as design, implementation, training, or management, and people who participate in the system (Gray, 2006).

IT investment is one of the key IT decisions made in order to encourage desirable behavior in the use of IT which is consistent with an organization's mission, strategies, values, etc. (Weill, 2004).

The activities of IT investment include decisions on how much and where to invest in IT, IT project prioritization, approval, and justification.

An IT portfolio is used to invest in a set of IT projects for optimal benefits, identifying and eliminating low value-added and redundant projects while maximizing the efficiency in resource allocation at acceptable levels of risk (McFarlan, 1981).

The chance of the occurrence of a negative outcome can be identified as risk (Rescher, 1983).

Business-IT alignment refers to applying Information Technology (IT) in an appropriate and timely way, in harmony with business strategies, goals and needs. Mature alignment evolves into a relationship where IT and other business functions adapt their strategies in concert (Luftman, Lewis, and Oldach, 1993).

IT provider in this study refers to the groups of people or companies, which provide IT products and services, including hardware vendors, software firms, IT consulting firms, system integrators, and implementers.

## 1.6 Research Contribution

This research provides benefits to both IS researchers and practitioners in the following ways:

(1) Adopting investment theory from economics and decision making theory from psychology in the context of the IT investment decision-making process would enable the researcher to provide a description of the IT investment based on evidence, and to extend the scope of economic and psychology theories into the IS research field.

(2) The study expanded the area of IT investment research to the specific context of Thailand by focusing more on real IT investment practices, and by determining the optimal way to improve the quality of IT investment in Thailand. An understanding of the IT investment decision-making process from a real business perspective, rather

than a theoretical perspective, allowed the shifting of the focus from traditional finance theory to applicable practices for organizations.

The patterns revealed in the IT investment process found in this study will make practitioners aware of the existing process's shortcomings. Moreover, the study has proposed a framework for the IT investment process which captured a holistic view of the process. The framework offers a way to provide clear and sufficient information for supporting IT investment decision-making. It utilizes the concept of maximizing decision-making behavior so that the decision maker will make a choice by selecting the alternative with the highest positive utility for the decision maker. This assumes that the decision maker's objectives can be translated into a preference function represented in quantitative terms, by the value, or utility, of a set of alternatives.

## 1.7 Dissertation Outline

This dissertation consists of five chapters beginning with the Introduction (Chapter 1). The literature review (Chapter 2) provides the theoretical reasoning for this study and the proposed preliminary IT investment process framework. The research processes and methods used in this study are presented in the research methodology section (Chapter 3). The results of the data collection and a further analysis of the four cases, performed to modify the preliminary framework in the light of the empirical results, are located in the data analysis section (Chapter 4). Finally, a summary of the main findings and the modification of the IT investment process framework are presented together with suggestions for future research (Chapter 5).

# Chapter II Literature Review

The material presented in this chapter will highlight issues which are the rationales for the study. This chapter will also review the contributions made by previous researchers, and then formulate a conceptual framework. The topics in this chapter include:

(1) The conceptualization of information technology for this study: This is to identify the scope of IT.

(2) The psychology of decision-making: This includes the background for decision-making theory relevant to investment decision theory, strategic decision-making by considering IT investment decision-making as strategic decision-making, an illustration of the nature and typology of strategic decision-making as a guide for IT investment decision-making, and decision quality, namely the desired outcome of the decision-making process. This section will provide criteria for decision quality which can be used to qualify IT investment decision-making

(3) Investment decision-making: This links the concept of financial investment and IT investment

(4) IT business value: This provides a definition and indicates the importance of IT value, to suggest to researchers in this field how to justify IT business value.

(5) Evaluation techniques of IT investment: This provides examples and an explanation of IT investment evaluation techniques that have been proposed by many researchers.

(6) IT investment process: This suggests the steps and activities in a standard IT investment process which are necessary for an IT investment process framework.

(7) IT project portfolio: This provides a definition, and elucidates the characteristics of IT project portfolios so they can be used as a frame or rationale for investment in a way that focuses on the relationship between IT projects in a portfolio rather than on considering each IT project separately.

(8) Risk: This provides a definition and an examination of the risks in IT investment evaluation techniques.

(9) Factors influencing IT investment requirements: This illustrates the relevant factors that could affect an initiative to invest in an IT project, so that these factors can be used as criteria in a framework.

(10) Business-IT alignment: This provides a definition, and suggests the importance of an alignment between business and IT.

(11) Conceptual framework: This illustrates the conceptual framework of this study

## 2.1 Information Technology

Understanding the conceptualization of Information Technology (IT) will provide the necessary specifications for researchers to identify the scope of their IT investment. The study provides an overview of the literature on the definition of IT, the perspective of IT in IS research, and the view applied in this study.

IS researchers have offered alternative conceptualizations of information technology which extend beyond the view of hardware and software (Kling, 1980). The

study of Wanda Orlikowski and Suzanne Iacono (2006) examined the conceptualizations of information technology in the 188 articles published in the past decade in ISR, and classified IT artifacts into 5 categories: (1) tool view, (2) proxy view, (3) ensemble view, (4) computational view, and (5) nominal view.

The first view of IT is mainly based on technical matters which view IT as an engineered artifact expected to generate value such as labor substitution, productivity enhancement, information processing, and improved social relations. This view is frequently used in research that studies variables which are affected or altered by IT such as IT business value (Barua, Kriebel, and Mukhopadhyay, 1995) and organizational performance (Staehr, 2010).

In the proxy view, IT represents the value of information technology as defined by human understanding of technology use, focusing on technology as viewed by individual users, which can be captured by some set of surrogate measures such as perceptions and attitudes towards information technologies, measures of diffusion and penetration of a particular type of IT within a specific context, and the investment in, or the capital expense of, IT, defined in financial units. This category of IT is grounded in the economics discipline which has often been used in research studies on the 'productivity paradox,' a phenomenon recognized in the early 1990s as organizations increasingly invested in IT with little apparent return on their investments (Brynjolfsson, 1993).

The ensemble view of technology focuses on the dynamic interactions between people and technology in both the development and use of IT. Research using IT conceptualization tends to scope IT as a development project, a production network, an embedded system, and a structure, such as in the study by Brynjolfsson and Hitt (2000) which explores how firms use IT to generate value.

In the computational view of technology, researchers develop algorithms or use computational capabilities to demonstrate the computational power of the

technology applied to, or simulated in, a particular context. Less research in the IT investment area applies this view.

The last view, a nominal view of technology, treats IT as either incidental or uses it as background information. IT artifacts in this view are neither conceptualized nor theorized, and constitute neither an independent nor a dependent variable.

In IT investment research, researchers have applied IT conceptualization according to the purpose of the research. For example, in the case of the research which examined the criteria or objectives that made companies invest in IT, IT was viewed as an object for investment. Companies acquired that object in order to generate something for the company. The expected output from investing in IT such as companies' performance would be one of the constructs in the research (Bacon, 1992; Chau and Tam, 1997; Demirhan, 2004; Pires and Aisbett, 2003). The definition of IT used in those studies corresponds with the tool view, whilst IT value researchers would use a proxy view for their conceptualization of IT (Borenstein and Betencourt, 2005; Matlin, 1979; Ryan and Harrison, Spring 2000; Torkzadeh and Doll, 1999). Another group of researchers covering the scope of IT management and implementation relating to IT investment have adopted the notion of an ensemble view (Bandyopadhyay, Mykytyn, and Mykytyn, 1999; Marshall and McKay, 2004). The last two views, computational view and nominal view, were rarely applied in the IT investment research area.

The current study investigated all aspects of IT in order to cover the scope of IT in different observed situations. Decision makers viewed IT as tools composed of the components of technology such as hardware, software, and networks. They established IT projects in order to acquire those tools to deliver value to their organizations. IT projects provide IT systems which include hardware, software, networks, processes, and people who are involving in design, implementation, training, and management (Gray, 2006). Organizations will justify the benefits and costs of IT by

using some set of surrogate measures such as revenue generated from the IT project, user satisfaction, and IT spending.

## 2.2 The Psychology of Decision-Making

An investment decision is one of the major decisions that are capable of creating value for organizations. With the purpose of understanding the IT investment decision-making process, this research commenced with a study of decision-making theory.

Decision making has been characterized as a sequence of events including diagnosis, action selection, and implementation (Beach and Connolly, 2005). Decision makers diagnose anomalous events by using sensory cues and information received to frame or to give meaning to those events, which allows them to decide what to do based on their previous experience, to determine whether they can use their experience to deal with the events, or whether they need to formulate a new action plan to deal with situations they have never encountered before. After decision makers have generated a set of potential action plans, they will choose the best from amongst them. Then the plan has to be implemented, that is, to be used to guide behavior. Decision makers monitor the progress and the results of the decision until the project either comes to an end or it requires re-examination.

### 2.2.1 Framing

A frame is a combination of the beliefs, values, attitudes, mental models, etc., which decision makers use to perceive a situation. The frame significantly affects how decision makers infer meaning, and hence how they understand the situation. Tversky and Kahneman (1986) defined a decision frame as the decision makers' conception of the act, outcomes and contingencies associated with a particular choice. Framing provides the context within which new information is used, and different frames put the focus on different kinds of information, as for example in the study by Wagenaar

and Keren (1986). They instructed half of a group of individuals to a frame a decision from the viewpoint of a public official and the other half to a frame it from the viewpoint of a parent. The decision they had to make was on whether to impose a law requiring children to wear seatbelts when traveling in an automobile. Half of each framing group received statistical information and half received anecdotal information about accidents in which children were hurt. It was found that participants using the parental frame were more likely to favor the law when presented with anecdotal information, and participants using the public official frame were more likely to favor the law when presented with statistical information.

### 2.2.2 Prescriptive (Normative) Models

Prescriptive decision theory views a decision maker as an expected value maximizer. It assumes that the decision maker will select the choice that will provide the best result, with the assumptions that an ideal decision maker is one who is fully informed, able to compute with perfect accuracy, and is fully rational (Beach and Connolly, 2005). In this ideal situation, the decision makers will know their payoffs and the future values of their chosen solution, or they are in a situation of certainty. In the real world, a situation of certainty rarely occurs, and some decision makers may not behave in ways consistent with axiomatic rules. Therefore, the prescriptive researcher would aim at finding the tools and methodologies that could help decision makers to make better decisions. A related area of study, called a descriptive discipline, attempts to predict what people will actually do (Weber and Coskunoglu, 1990). Table 1 lists examples of decision-making behavior research.

Table 1 Theories of decision-making behavior

| Theory | Description | References |
|---|---|---|
| Ambiguity Effect | A cognitive bias where decision-making is affected by a lack of information, or "ambiguity". The effect implies that people tend to select options for which the probability of a favorable outcome is known, over an option for which the probability of a favorable outcome is unknown. | (Ellsberg, 1961) |
| Availability Heuristic | Situations in which people assess the frequency of a class or the probability of an event, by the ease with which instances or occurrences can be brought to mind. Availability is a cognitive heuristic in which a decision maker relies upon knowledge that is readily available rather than examining other alternatives or procedures. | (Tversky and Kahneman, 1974) |
| Bias Blind Spot | The cognitive bias of failing to compensate for one's own cognitive biases. Decision makers will consider themselves as being relatively unbiased compared with others. | (Pronin, Lin, and Ross, 2002) |
| Confirmation Bias | A tendency for people to favor information that confirms their preconceptions or hypotheses regardless of whether the information is true. Therefore, people gather evidence and recall information from memory selectively, and interpret it in a biased way. | (Snyder and Cantor, 1979) |

| Theory | Description | References |
|---|---|---|
| Focusing Effect | A cognitive bias that occurs when people place too much importance on one aspect of an event, causing an error in accurately predicting the utility of a future outcome. When making judgments, decision makers tend to weigh attributes and factors unevenly, putting more importance on some aspects and less on others. | (Schkade and Kahneman, 1998) |
| Illusory Correlation | The perception of a relationship between two variables when only a minor or absolutely no relationship actually exists. People tend to assume that certain groups and traits occur together, and frequently overestimate the strength of the association between the two variables. | (L. J. Chapman, 1967) |
| Information Bias | A type of cognitive bias, which involves, for example, a distorted evaluation of information. Information bias occurs due to people's curiosity and the confusion of goals when trying to choose a course of action. They seek facts when making decisions, even when they are irrelevant. | (Baron, Beattie, and Hershey, 1988) |
| Neglect of Probability Bias | The tendency to ignore probabilities when making decisions involving uncertain outcomes. | (Baron, et al., 1993) |

| Theory | Description | References |
|---|---|---|
| Overconfidence Barrier | People usually have too much confidence in the accuracy of their judgments; people's judgments are usually not as correct as they think they are. Confidence also tends to increase if decision makers are given incentives to perform well, but the accuracy of their judgments may well not increase. Overconfidence is greatest when accuracy is near chance levels, and reduces as accuracy increases from 50% to 80%. Once accuracy exceeds 80%, people become *under*-confident. | (Fischhoff, Slovic, and Lichtenstein, 1977) |
| Path Dependency | This theory explains how the set of decisions one faces for any given circumstance is limited by the decisions one has made in the past, even though past circumstances may no longer be relevant | (Mahoney, 2000) |
| Prospect Theory | A theory that people value gains and losses differently and, as such, will base decisions on perceived gains rather than perceived losses. Thus, if a person were given two equal choices, one expressed in terms of possible gains and the other in terms of possible losses, people would choose the former, or they would value certain gains and try to avoid certain losses. | (Kahneman and Tversky, 1979) |

| Theory | Description | References |
|---|---|---|
| Sunk-Cost Effect | A tendency to continue an endeavor once an investment in money, effort or time has been made. This is problematic because it often leads to emotional rather than rational decision-making. People are often reluctant to pull out because of the loss that they will make, even if continuing will lead to even more losses. | (Arkes and Blumer, 1985) |

### 2.2.3 Strategic Decision Making

In organizations, managers have to make decisions from among alternatives for a particular purpose such as investing in IT projects. The intent of an IT investment decision-making process is to decide whether an IT project proposal should be accepted or rejected. IT investment is one of the key IT decisions that can be used to encourage desirable behavior in the use of IT in a manner that is aligned with the organization's mission, strategy, values, etc. (Weill, 2004). When considering the IT investment process as a strategic decision process, researchers have suggested that they are characteristically complex and dynamic because they involve decisions with uncertain outcomes (Mintzberg, Raisinghani, and Théorêt, 1976; Schwenk, 1984).

Thompson and Tuden (1959) defined the decision-making mode as having two major dimensions (1) belief about cause and effect relations, and (2) preferences about possible outcome, as shown in Figure 1.

| | | Preferences About Possible Outcomes | |
|---|---|---|---|
| | | **Certain** | **Uncertain** |
| **Beliefs About Cause and Effect Relations** | **Certain** | Computational decision-making | Bargaining decision-making |
| | **Uncertain** | Judgmental decision-making | Inspirational decision-making |

Figure 1 Thompson and Tuden typology

Computational decision-making is made when the problem is well-structured and can be solved via standard operating procedures or various calculations; for example a firm can predict the increased sales from a tentative investment project. Tools that can support the decision might involve the use of basic financial techniques such as discounted cash flow, net present value, return on investment, payback period, internal rate of return, etc. (R. Butler, et al., 1991).

Judgmental decision-making occurs when decision makers deal with a semi-structured, unpredictable problem (outcome preferences are clear but cause and effect relationships are uncertain), for example, when a firm decides to increase its sales by 10 percent but it is not clear how much the IT projects in the pipeline will contribute to this target. In this case, the decision maker would require expertise to make a judgment regarding the causes and effects of the decision (Basi, 1998).

Bargaining decision-making occurs in a situation where there is certainty about the cause and effect relationships but uncertainty about outcome preferences. For example, while it could be established that the sales of a company would increase after investment in an e-Commerce project, there might be disagreement about goals for the increase in sales. This type of decision is made by negotiating the various opinions with different parties, such as in a meeting of the board, or in a session that is arranged to discuss the investment and the budget. Tools which help in decisions of this type would be practical approaches that accommodate the conflict, and which include compromise or bargaining techniques (Thompson, 1964). Moreover, there are some specific techniques which can be applied to facilitate decisions in this particular situation such as multi-objective, multi-criteria methods (Farbey, Land, and Targett, 1992; Renkema and Berghout, 1997) and analytic hierarchy processes (AHP) (Saaty, 1990; Schniederjans and Wilson, 1991).

Inspirational decision-making occurs when there is uncertainty about both cause and effect relationships and outcome preferences. For example, a firm may not be sure about its goals and which projects should be considered. In this situation, decision makers may make decisions based on their intuition and historical data together with future perspectives (Basi, 1998). The strategy for an unstructured problem is to transform the problem into a semi-structured problem by obtaining a greater understanding of causality or outcome preference, which then allows the problem to be solved more easily (Wu and Hsu, 2009).

Strategic decision-making can be viewed as a particular kind of decision-making under conditions of uncertainty which involve the activities of goal formulation, problem identification, alternatives generation, and evaluation/selection (Mintzberg, Raisinghani, and Théorêt, 1976; Schwenk, 1984). This kind of decision may fall into judgmental decision-making, bargaining decision-making, or inspirational decision-making. While decision makers may prefer a well-structured problem, it rarely happens in the case of IT investment decisions. The examples presented for each mode of decision-making suggest that decisions are made under conditions of uncertainty

because of conflict and lack of information. If a tool existed that could provide relevant information to decision makers and could enable involved parties to view the problem more clearly, and thus lead to compromising on the issue, an unstructured problem could be converted into a well-structured one.

### 2.2.4 Decision Quality

The desired outcome of a decision-making process is to select the best choice to solve a problem, but, on account of the decision characteristics in highly ambiguous settings as described in the "garbage can model" of Cohen et al., (1972), decision makers may not have high-quality alternative solutions in their decision-making processes.

In order to determine the quality of choice Payne et al., (1993) used several criteria as follows:

(1) Principle of coherence: e.g., not selecting dominant alternatives or not displaying intransitive patterns of preferences.

(2) Consistency: the extent to which the decision maker makes the same choice when faced with essentially the same decision situation at different points in time.

(3) Conformance to normative models of decision-making, such as conforming to the expected utility principle, the expected value principle, the weighted additive rule, etc.

(4) Decision outcome: the decision outcome (a choice) is optimal, both in an objective and subjective sense.

Mathesons (1998) suggested that there are six dimensions to decision quality and illustrated them in the form of links in a chain of decision quality as shown in Figure 2.

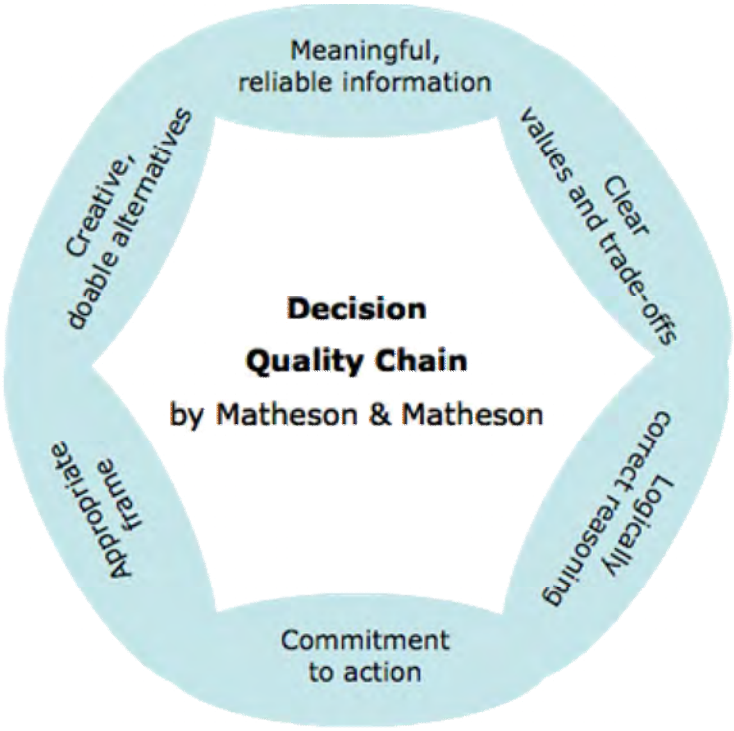



Figure 2 The decision quality chain (Matheson and Matheson, 1998)

An appropriate frame is the correct background for a decision. This dimension is about scoping the problem and includes the question, the assumptions, the business purpose, and the people involved. The right frame helps decision makers avoid solving the wrong problem and guides decision makers to breakthrough thinking.

Creative and doable alternatives are preconditions for decisions. A decision requires alternatives or choices from which to select a solution for a problem. This dimension is about identifying and evaluating alternatives in order to reveal, as much as possible, any unrecognized alternatives to the problem.

Meaningful and reliable information is required for a decision. This dimension concerns the provision of information that can permit a valid answer to the question.

Clear values and trade-offs are found by establishing criteria for measuring the value of alternatives and how the decision maker will make rationale trade-offs among them.

Logically correct reasoning requires bringing together the inputs of the previous dimensions to determine which alternative will create the most value. This dimension validates the rationale behind the decision from among the various alternatives.

Commitment to action means to transfer the decision to activities. This dimension encompasses the implementation of the decision to bring about a solution to the problem, since the best decision will be useless if the decision maker does not implement it.

Some researchers have suggested that in order to achieve decision quality, it is necessary to adopt the technique of decision process since it will support the user in the task environment and enhance the quality of the decision maker's condition (Kasper, 1996; Wu and Hsu, 2009).

## 2.3 Investment Decision Making

Organizations invest in order to generate additional value in the future. Investment, which is one of major functions of finance, involves maximizing shareholders' wealth (Horne and Wachowicz, 2000):

$$\textit{Maximizing Shareholder Wealth} = f(I, F, D);$$

where I= investment, F= financing, D= dividend policy. It can be seen that the core of investment decision-making theory is based on prescriptive decision theory, where the decision-making is focused on the alternatives for investment solutions, and where expected value is monetary value.

Traditionally, organizations would invest in financial and fixed assets. The former refers to purchasing or obtaining units of securities such as stocks, bonds, etc. Securities investment decision-making mainly discusses how to avoid risk from the securities on the basis of maximizing the return on investment (Markowitz, 1952). The later would directly affect the scale of production and operation of enterprises, and has a long investment recovery period. The investment decision making for fixed assets is made by selecting the best or the most reasonable proposal, and mainly uses net present value (the NPV), payback period, or other project financial evaluation methods.

In the conceptualization of IT, there is an intersection between the definition of a fixed asset and the IT tool view. Organizations invest in fixed assets and IT in order to leverage value from those assets. They are worth acquiring if they will increase the net profit for the owners of the company or increase the value of the owners' equity.

It may be possible to combine the processes and the criteria of fixed asset investment decision-making with those of IT investment decision-making. However, due to the scope of IT, its value extends beyond the price of hardware and software, and includes the business value and management issues. Therefore, IT investment decision-making might need additional processes and criteria beyond those in traditional investment decision-making.

## 2.4 IT Business Value

CIOs and IT managers have always faced difficulty in responding to the question “What is the value of the company’s investment in information systems?” (Matlin, 1979). Unlike fixed assets or other properties whose value is unanimously accepted based on specific calculations, IT comprises tangible elements such as hardware, software licenses, etc., and intangible elements such as processes, knowledge, information, etc., that cannot be easily justified by calculating costs and benefits using basic calculations of financial ratios. Thus it is the responsibility of

decision makers to justify the value of IT in order to make proper decisions on whether to invest or not in IT projects.

The term 'business value' refers to the organizational performance that is gained from adoption of IT, and includes profitability improvement, cost reduction, productivity enhancement, etc. (Devaraj and Kohli, 2003; Hitt and Brynjolfsson, 1996).

In the early stages of the research on the value of IT investments, some researchers attempted to apply ROI (return on investment) and some conservative financial measures to justify the value of IT. However their research revealed that those measurements could not capture most of the value of IT (Mo Adam Mahmood and Mann, 1993; Rai, Patnayakuni, and Patnayakuni, 1997; Santos, 1991). Consequently, it is difficult to find traditional ROI analyses for major IT investments for real situations (Verhoef, 2004).

The traditional IT investment performance analysis was not very successful in the past because of the over-reliance on financial data. For example, Brynjolfsson and Hitt (1996) conducted a study to identify the hidden costs and benefits that were typically not included in a traditional analysis of IT investment in relation to organizational performance and productivity, and finally concluded that the ROI for computer capital, which was calculated by including the identified hidden costs and benefits, was higher than the ROI for non-computer capital. May (1997) supported the idea that traditional ROI is no longer appropriate for justifying and measuring the value of IT investments, and also cautioned that organizations should be more concerned about the unjustified value assigned to their IT projects since this could lead to dysfunctional management practices. Moreover, IT investments are not liquid like financial securities. They might need other criteria to justify the value of those investments beyond a purely financial view.

The literature contains many studies of IT value justification which presented different techniques to justify IT value including quantitative and qualitative techniques, calculating tangible and intangible costs and benefits, and using financial

and non-financial measures (Belcher and Watson, 1993; Brynjolfsson and Hitt, 1998; Rai, Patnayakuni, and Patnayakuni, 1997).

In order to cover all the components considered in the IT investment justification process, Irani, Ezingeard and Grieve (1998) presented a functional model that conceptualized the phenomena of investment justification, and focused on a number of key justification criteria: value, project benefits, project costs, financial appraisal, and project risks. They represented their model with the following expression:

$$JC = f [V, FA, RR]$$

where JC is the justification criteria, V is the project value, FA is the financial appraisal of the project, and RR is the risk review for the project.

This model summarizes the aim of many justification processes by identifying the relationship between the expected value of an investment, and providing a quantitative analysis of the project costs, benefits and risks.

Evaluating IT investments has become a challenging issue for researchers and practitioners. A lot of effort has been dedicated to finding ways to evaluate IT investments in order to provide the proximal true value of IT. The next section will highlight the evaluation techniques for IT investments that have been proposed by academic researchers.

## 2.5 Evaluation Techniques for IT Investments

There have been many methods and techniques proposed for evaluating IT investments. Those methods and techniques range from traditional financial methods to complex methods that incorporate both financial and non-financial criteria, and which originated from various fields such as accounting, management, and finance (Chan, 2000; Farbey, Land, and Targett, 1992; Renkema and Berghout, 1997).

Schniederjans et al., (2004) classified the various IT investment evaluation techniques into four groups: (1) financial techniques; (2) operations research / management science techniques; (3) specific techniques for IT investment evaluation; and (4) other techniques for IT evaluation.

### 2.5.1 Financial Techniques for IT Investment Evaluation

The primary techniques that CIOs use to evaluate their IT projects are financial methods. Some companies still use financial measurements to roughly determine the status of their IT projects. The financial techniques used for IT investment evaluation originated in the fields of finance and accounting. Table 2 shows some of the financial techniques that are used in IT investment evaluation.

Table 2 Sample of financial techniques used in IT investment evaluation

| Technique | Description | Types of Criteria |
|---|---|---|
| Net present value (NPV) | The calculation of the difference between the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to analyze the profitability of an investment or project. | Tangible |
| Internal rate of return | The calculation of the discount rate used in capital budgeting that makes the net present value of all cash flows from a particular project equal to zero. The higher a project's internal rate of return, the more desirable it is to undertake the project. | Tangible |
| Payback period | The calculation of the time required to recover the cost of an investment. | Tangible |

| Technique | Description | Types of Criteria |
|---|---|---|
| Accounting rate of return | The calculation of the ratio that expresses the earnings before interest and taxes (EBIT) as a percentage of the capital employed at the end of an accounting period. | Tangible |
| Return on investment | The calculation of the ratio or percentage that is the result of the benefit (return) of an investment divided by the cost of the investment. It is used to evaluate the efficiency of an investment, or to compare the efficiency of a number of different investments. | Tangible |
| Cost/benefit analysis | The comparison of costs and benefits that can be directly and indirectly attributed to the project, and which are estimated into monetary terms. | Tangible and intangible |

### 2.5.2 Operations Research / Management Science Techniques for IT Investment Evaluation

This group of IT evaluation techniques is based on mathematics, engineering, algorithms, heuristics and other methods which incorporate intangible or subjective criteria into evaluation methods (Schniederjans, Hamaker, and Schniederjans, 2004). The techniques were designed to solve problems in the decision-making process. Thus, researchers and practitioners apply them in IT investment evaluations. Since CIOs have to solve problems (make a decision to invest in an IT project) by selecting the optimal solution from a collection of alternatives, operations research / management science techniques were developed to supply information as rational alternatives for decision makers to select the best alternative. Table 3 shows a

sample of operations research / management science techniques for IT investment evaluation.

Table 3 Sample of operations research / management science techniques for IT investment evaluation

| Technique | Description | Types of Criteria |
|---|---|---|
| Analytical hierarchy process | A systematic method for comparing a list of objectives or alternatives by calculating the score of a decision makers' pair wise comparison | Tangible and intangible |
| Multi-factor scoring method | A method to provide the criteria for a decision maker to judge and score the projects. | Tangible and intangible |

### 2.5.3 Specific Techniques for IT Investment Evaluation

Due to the unique nature of IT investments, some researchers have argued that there should be a technique that fits each type of IT investment and the particular organizational management style (Cumps, Viaene, and Dedene, 2006; Maizlish and Handler, 2005; Schniederjans, Hamaker, and Schniederjans, 2004). Some techniques were developed that required complex calculations of financial data to complement the traditional financial methods, while other techniques were developed to cover the intangible aspects of IT. Table 4 shows a sample of techniques specially designed for IT evaluation.

Table 4 Sample of techniques specially designed for IT evaluation

| Technique | Description | Types of Criteria |
|---|---|---|
| Real option analysis | The calculation of the total value of an IT project based on value in a range of possible options that could happen with those IT projects. | Tangible and intangible |
| Ward's portfolio approach | A method of IT investment evaluation which considers IT benefits, IT costs, and IT risks by determining the different categories of IT projects in a portfolio based on the different nature of IT projects that serve the strategy of the organization. | Tangible and intangible |
| Investment mapping | A method of IT investment evaluation which plots the investment alternatives on a grid to compare with prior IT projects in that portfolio. | Tangible and intangible |

### 2.5.4 Other Techniques for IT Investment Evaluation

Table 5 shows a sample of other techniques that are used for IT investment evaluation. These techniques are frequently used in the management field and have been adapted for use in IT evaluation and selection.

Table 5 Sample of other techniques for IT investment evaluation

| Technique | Description | Types of Criteria |
|---|---|---|
| Balanced scorecard | Techniques applied from management concepts are used to evaluate an investment by providing a measurement of IT projects based on the objectives of the organization from financial, customer, internal process, learning, and growth perspectives. | Tangible and intangible |
| Critical success factors | Techniques applied from management concepts used to evaluate an investment by comparing and ranking factors critical to business success. | Tangible and intangible |

## 2.6 IT Portfolio

In business, investors might not invest in only a single project. Horne (2002) defined a portfolio as a collection of investments held by the same individual or organization. Markowitz (1952) laid down the basis for Modern Portfolio Theory (MPT) by formulating a theory of optimal portfolio selection in the context of trade-offs between risk and return, focusing on the idea of portfolio diversification as a method of reducing risk. The relative risk of related securities in a portfolio will be diversified. An efficient portfolio is one with a combination of securities with the highest expected returns and the lowest risks.

Whereas MPT was initially developed for financial investments, McFarlan (1981) provided the basis for the modern field of portfolio management for IT projects. According to McFarlan, management should employ a risk-based approach to the selection and management of IT project portfolios. As an analogous concept to a financial portfolio, the aim of an IT portfolio is to invest in a set of IT projects for optimal benefit by identifying and eliminating low value-added and redundant projects while

maximizing the efficiency in resources allocation at acceptable levels of risk (McFarlan, 1981). Riskier strategic investments are balanced with more conservative investments, and the mix is constantly monitored to assess which projects are on track, which need help, and which should be cut off.

Schniederjans et al. (2004) defined an IT investment portfolio as a set of IT projects which require investment based on a portfolio management technique for selecting, prioritizing, and evaluating a set of IT projects.

In general, companies can manage their IT investments by evaluating a single IT project, but without an understanding of other IT projects in the pipeline, they will not have a holistic view of IT projects across the enterprise, or an appreciation of how they align with corporate strategy. If they move to focus on their IT investment portfolio, the problem will abate. A report by AMR Research (Bonasera, 2002) revealed that about 75 percent of IT organizations have little oversight over their project portfolios, and employ non-repeatable, and chaotic planning processes. It also showed that companies undertaking portfolio management reported saving 2 to 5 percent annually in their IT budgets.

In reference to various IT projects in a pipeline, Bardhan et al. (2004) stated that there are dependencies among subsequent projects in a portfolio which can be classified as hard or soft dependencies. Hard dependencies between two projects exist when a capability developed for one project is required by another project. Soft dependencies exist when a capability from one project supports or enhances capabilities required by other projects. Angelou and Economides (2008) extended the model by adopting negative dependencies among projects where the implementation of one project may result in a value reduction in another.

There are many IT portfolio methodologies developed by researchers which view individual IT projects in different ways by using different criteria. For example, Bedell's method (1985) prioritizes IT investment by using the importance of an activity to the organization, the importance of IT to the activities, and the quality of IT in

terms of effectiveness and efficiency. The method of Berghout et al., (1992) evaluates IT investment proposals on three criteria: their contribution to the business domain, their contribution to the technology domain, and the financial consequences. The Ward (1990) portfolio approach views the organization's IT investment as belonging to different categories in a portfolio of IT investments. Different evaluation techniques should be used for each category of IT investment. The investment mapping methodology of Peters (1988) was designed to plot investment proposals against two main evaluation criteria: the investment orientation, and the benefits of the investment. Ward (1990) categorizes IT investments, including high potential investments, strategic investments, key operational investments, and support investments, by the role they play in the organization, and the expected contribution they will make to business performance.

Since the implementation of a project may result in an increase or a decrease in the value of another project, considering all IT projects in the pipeline as a portfolio can bring benefits to the organization such as (1) maximizing the value of the IT investments while minimizing the risk, (2) allowing planners to schedule resources more efficiently, (3) reducing the number of redundant projects, and (4) making it easier to kill projects.

## 2.7 Risk

The investment decision-making process is naturally a process of decision-making in circumstances of uncertainty. This uncertainty will affect the result of the investment. Uncertainty can be considered as the probability of providing insufficient information about the occurrence of any event that has an effect on the outcome. The phenomenon of uncertainty can be brought about by a number of factors such as a lack of clarity in structuring the problem, an inability to identify alternative solutions, and the futuristic nature of decision making (Merna and Al-Thani, 2008).

The chance of the occurrence of a negative outcome can be identified as “risk” (Rescher, 1983). Many IT projects have failed, were late, or were over-budget. McFarlan (1981) suggested that one of the major reasons for this is that these organizations did not assess the risk of their IT investments. Neglecting risk may prevent organizations from identifying the hidden costs.

According to Chapman and Ward (1997)

> *“All projects involve risk* – the *zero risk project is not worth pursuing. Organizations which better understand the nature of these risks and can manage them more effectively can not only avoid unforeseen disasters but can work with tighter margins and less contingency, freeing resources for other endeavors, and seizing opportunities for advantageous investment which might otherwise be rejected as too risky.”*

McFarlan (1981) summarized the factors influencing the risk associated with IT projects as the three dimensions of risk: (1) project size, (2) experience with technology, and (3) project structure. Project size may be defined in terms of the total expense of the IT project, time to fully implement the IT project, the number of staff needed for the project, or the number of departments affected by the investment. Experience with technology involves the degree of familiarity people in the organization have with the technology. Project structure is the degree of management and the control procedure for the IT project. A highly structured project has easily defined outputs and is not sensitive to change during the life-cycle of the investment. These dimensions of risk are combined and presented in a grid in Figure 3.

| | | High Structure | Low Structure |
|---|---|---|---|
| High experience with technology | Large size | Low risk | Low risk |
| | Small size | Very low risk | Very low risk |
| Low experience with technology | Large size | Medium risk | Very high risk |
| | Small size | Medium-low risk | High risk |

Figure 3 A McFarlan (1981) project risk grid

The treatment of risk is one of the functions included in Irani et al.'s model (1998) which conceptualizes the phenomena of investment justification. Risks are involved in the planning and development of IT, and investing in IT often carries some degree of risk and uncertainty. Clemons and Row (1991) categorized the components of risk in IT investment as financial, technical, project, functionality, and system risk.

The objective of risk management is to protect IT assets such as data, hardware, software, personnel, and facilities from threats so that the costs of losses resulting from the realization of threats are minimized (Gottfried, 1989). The treatments of risk in this study are embedded in IT investment evaluation techniques. Many evaluation techniques considered risk factors as criteria for evaluation, for instance, risk was included in an evaluation calculation as a variable in the formula, such as for discount rate or cost, in terms of its potential impact on IT projects (Horne and Wachowicz, 2000).

Some evaluation techniques which employ qualitative methods consider risk issues as management issues since some risk factors are difficult to assign monetary values. Although these risks are difficult to justify, they can be controlled. The risk management concept was included in the IT investment process in order to minimize the risks that could occur in IT projects.

## 2.8 IT Investment Process

In order to scope the area of the IT investment process exploration in a research field, the good practices from the de facto framework relating to IT investment process can be the starting point of the study.

According to IT Information Systems Audit and Control Association or ISACA, to ensure that investments in IT deliver the required business value and that risks associated with IT are mitigated, a specific focus on IT governance is required (ISACA, 2009). Sambamurthy and Zmud (1999), in their research on multiple contingencies that influence IT decision making, refers IT governance to the patterns of authority for key IT activities. Aiming for IT governance, some frameworks are published to provide good practices supporting IT governance such as COBIT, Val IT, and Information Technology Investment Management (ITIM). In the processes and activities in those frameworks, they also include the IT investment process as one of the key activities.

COBIT framework is released by IT Governance Institute (ITGI) which the current version is COBIT 4.1 and is being updated into COBIT 5. The purpose of COBIT is to provide executives and management a way to ensure that the enterprise's information technology (IT) is helping them achieve their goals and objectives (ITGI, 2007). COBIT consists of linking business goals to IT goals, providing metrics and maturity models to measure their achievement, and identifying the associated responsibilities of business and IT process owners in each process. The process focus of COBIT is illustrated by a process model that subdivides IT into four domains (1) Plan and Organize, (2) Acquire and Implement, (3) Deliver and Support and Monitor and (4) Evaluate. There are 34 generic processes defined in COBIT, whereas, the activities of IT investment are described in Plan and Organize domain. The figure of overall COBIT framework is in Appendix A

Plan and Organize domain has 10 processes includes, (PO1) Define a Strategic IT Plan, (PO2) Define the Information Architecture, (PO3) Determine

Technological Direction, (PO4) Define the IT Processes, Organization and Relationships, (PO5) Manage the IT Investment, (PO6) Communicate Management Aims and Direction, (PO7) Manage IT Human Resources, (PO8) Manage Quality, (PO9) Assess and Manage IT Risks, and (PO10) Manage Projects. Focus on (PO5) Manage the IT Investment control objective, it is about effective and efficient IT investment and portfolio decisions, and by setting and tracking IT budgets in line with IT strategy and investment decisions (ITGI, 2007).

While the primary focus of COBIT domains is on delivering the technology capability that enterprise need, ITGI had issues Val IT framework which the primary focus of Val IT is on delivering business value on 2008. Val IT extends and complements COBIT, which provides a comprehensive control framework for IT governance. Specifically, Val IT focuses on the investment decision (are we doing the right things?) and the realization of benefits (are we getting the benefits?), while COBIT focuses on the execution (are we doing them the right way, and are we getting them done well?) (ITGI, 2008).

The current version of the framework is The Val IT Framework 2.0. Val IT framework is organised around 22 IT-related business processes and corresponding key management practices, and focuses on business decisions integral to maximising the value from IT-enabled business investments. It covers (1) value governance, (2) portfolio management and (3) investment management processes and activities. First, the Value Governance process is about establishing governance framework and control, and also strategic direction for investments. Second, Portfolio Management process is about managing investment profiles, evaluating, prioritizing, deferring and rejecting investments. Third, Investment Management process is about developing business cases, manage the execution of IT programs or projects, and actively manage the realization of benefits (ITGI, 2008). The figure of Val IT domains and processes is provided in Appendix B.

Another framework provided for supporting IT governance, which has mentioned about the IT investment process in its framework is Information Technology Investment Management (ITIM). The United States General Accounting Office (GAO) developed an Information Technology Investment Management (ITIM) framework which could be used to assess the stages of maturity that an agency can achieve in its IT investment management capabilities (GAO, 2004). The report provided details of the three fundamental phases in the IT investment management process which are selection, control, and evaluation (Figure 4).

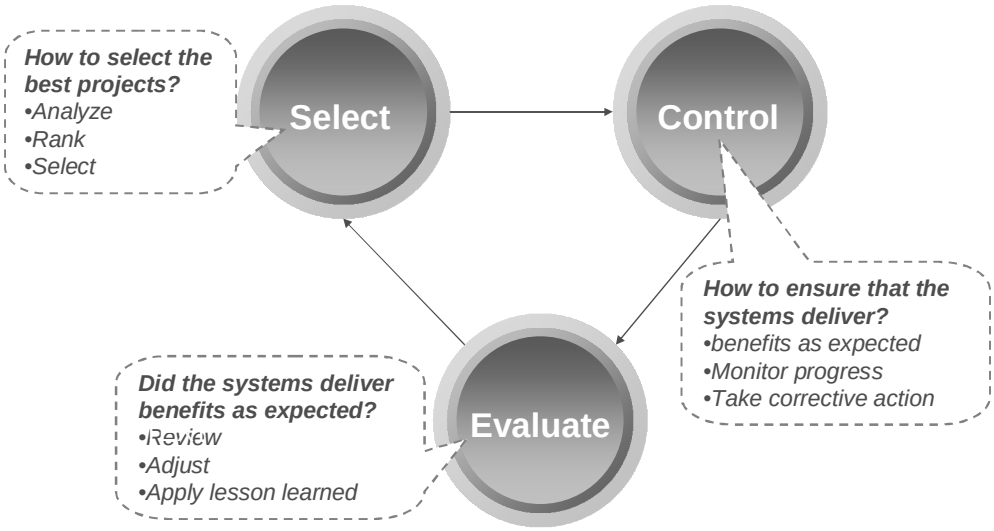



Figure 4 Fundamental phases in the IT investment management process (GAO, 2004)

The selection phase is the initial step of the IT investment management process. The activities in this phase are concerned with the method to select the best projects for the portfolio, which is dependent on the criteria used in each organization. This phase contains important activities including analysis and planning, evaluating IT value and prioritizing IT projects, and selecting IT projects for investment and implementation. The organization has to determine its own criteria such as commitment, necessity, constraint, or strategic issues, and the essential information such as costs, benefits, and the risks of the projects, in order to select and prioritize a proposed IT project.

After the organization has selected the projects for their portfolio, the budget has been allocated, and the projects are being implemented, the process will move into the control phase. In the control phase, the organization has to undertake activities to ensure that the project will be developed and will deliver value as predicted in the selection phase. Monitoring, modifying, and correcting action will need to be performing in this phase. As Farbey et al. (1992) explained in their article, the organization may also need to evaluate IT projects during development and implementation as it enables early detection of potential problems and provides a mechanism for quality control.

The last phase is the evaluation phase. When the project has been fully implemented, the organization must evaluate the actual results and compare them to the expected results in order to examine the project's performance, to identify problems or constraints that needed to be resolved, and to revise the effectiveness of the investment. The function of post-implementation evaluation is to ensure that the projects have met their goals, and to enable organizational learning (Farbey, Land, and Targett, 1992).

## 2.9 Factors Influencing IT Investment Requirements

Organizations initiate their IT projects when there are requirements that need to be fulfilled by adoption of IT, for example, a firm invests in an e-Commerce project in order to accomplish a strategic goal (Pires and Aisbett, 2003). Another example is when a firm does not invest to gain a competitive advantage but in order to acquire the ability to compete with a competitor and thus survive in the industry.

Tornatzky and Fleischer (1990) suggested in their framework that the three elements influencing technology adoption by organizations are (1) the organizational context which describes the status of an organization, (2) the technological context which relates to the availability of technology to an organization, and the ability of an organization to acquire that technology, and (3) the external

environmental context which includes the competitors in the industry, customers, suppliers, and regulations.

The primary requirements for investment in IT projects come from internal needs. Weill (1992) suggested that different management objectives are served by different IT investment types. For example, in order to achieve an organization's strategic goals, decision makers may invest in strategic IT, whereas they may invest in transactional IT when the objective of IT projects is to run the operational functions of an organization more effectively, or to cut costs.

The advance of technology drives organizations to invest in IT. The availability of the technology reduces the acquisition costs of IT and also enables new business functions such as when an organization is able to bring integrative functions to the business due to the availability of ERP system technology. More problematically, the emergence of new technology might tempt an organization to invest in cutting-edge technology. On the other hand, the ability to acquire technology for an organization is also one of the criteria that allows an organization to implement and run a system successfully. The major factors influencing the ability to acquire IT are the cost and the complexity of IT. If the technology available in the market is too expensive or difficult to understand, there would be a risk of failure in the investment since the organization cannot deliver the value to cover the high cost of IT.

The last sources of requirements for investments in IT projects are external requirements that affect the organization. Ward and Griffiths (2002) defined the factors that involved management of an organization as three layers which are (1) the external environment, (2) pressure groups and stakeholders, and (3) internal business strategizing and planning.

Internal business strategizing and planning are considered to be internal factors, but the external environment, and pressure groups and stakeholders can be identified as external sources of requirements that affect IT planning.

Ward and Griffiths' framework provides examples of the external environment which include the economy, politics, society, laws, etc. Fluctuations in the external environment require decision makers to take this into consideration when they generate IT plans for their organizations. Careful monitoring of these factors may lead to significant business opportunities or the identification of potential threats in time to take action to mitigate their effects. Pressure groups and stakeholders are referred to as competitors, customers, suppliers, etc. All these external parties increasingly require businesses to provide more information to address their interests and hence become more accountable. Equally, following 'privatization', many public sector organizations now have to accommodate these external pressure group and stakeholder perspectives as well as internal preferences in their strategies (Ward and Griffiths, 2002).

## 2.10 Business-IT Alignment

As stated in an earlier section, organizations invest in IT in order to achieve their business objectives such as increasing revenue, reducing costs, and improving their performance. In reviewing past research, Weill (1992) commented that not all IT investment can achieve its goal, and the context of the organization is important for converting IT investments into productive outputs. In the same way, Rai, Patnayakuni and Patnayakuni (1997) emphasized that although IT is likely to improve organizational efficiency, its effect on administrative productivity and business performance might depend on the quality of management processes and IT-strategy links.

The strategic use of information technology is a fundamental issue in most organizations. The efficient utilization of information technology requires the alignment of business strategy and IT strategy. Therefore, business-IT alignment has been considered as one of the critical factors that have an influence on the return on IT investment. Business-IT alignment refers to applying Information Technology (IT) in an appropriate and timely way, in harmony with business strategies, goals and needs.

Mature alignment evolves into a relationship where IT and other business functions adapt their strategies in concert (Luftman, Lewis, and Oldach, 1993).

Luftman (2000) presented a model for business-IT alignment maturity which could be used as a guide for organizations to assess their business-IT alignment status, and improve it so as to be in a better alignment. The six criteria which were used to identify the level of alignment in Luftman's model are as follows:

(1) Communications Maturity was defined as the effective exchange of ideas, and having a clear understanding between business and IT strategies.

(2) Competency/Value Measurement Maturity is the ability to measure the value of business and IT, and the quality of that measurement.

(3) Governance Maturity is where there is a concern about appropriate business practices, and where IT participants formally discuss, manage, and review the priorities and allocation of IT resources.

(4) Partnership Maturity refers to the role of the partnership between business and IT that exists in the organization.

(5) Scope and Architecture Maturity is the maturity of information technology in the organization.

(6) Skills Maturity is a consideration of the capacities and abilities of the human resources.

Henderson and Venkatraman (1993) argued that the competitive advantage of IT comes from the ability to exploit the functionality of IT to achieve business goals. They further add that the inability to achieve these goals is due to the lack of alignment between business strategy and IT strategy. Clearly, business organizations should seek ways to achieve a successful alignment between IT and business strategies.

## 2.11 Conceptual Framework

This section will discuss the conceptualization of the conceptual framework of this study. Each component in the framework is framed from the exploration of research and academic articles which is then refined by the findings from the empirical data obtained during the process of research.

### 2.11.1 IT Investment Process

In the prior section, 2.8 IT Investment Process, all frameworks offer enterprises practical guidance in the domain of enterprise governance of IT, assuming that its adoption will lead to higher organizational performance. However, there is also the study about the IT investment process in an academic area. To explore the current status of IT investment study in the IS research field, the researcher had reviewed 88 articles relating to the IT investment field. The detail of research source is presented in Table 6 of Chapter 3.

As stated earlier, the researcher adopts the scope of IT investment activities from the framework presented in section 2.8 as an area of exploration. Focusing on the IT investment process in each framework, it can be seen from Figure 5 that the activities of each framework have the analogous boundary, starting from the occurrence of IT investment requirements until the end of the investment project. While COBIT framework has the scope extend to cover the whole cycle of the IT management, Val IT and ITIM rather focus on the IT investment process. Even so, Val IT classifies its processes into three domains, and the processes in each domain consist of the activities that starting from requirement establishment until project retirement. It can be seen that the fundamental phases of ITIM framework provide the distinct border line that the researcher can use as a scope of academic article exploration. Even though there are the differences in the terms of processes, criteria, and details found in articles, the researcher still believes that the fundamental phases of ITIM framework are standard

processes that almost every organization investing in IT has to perform, and they must be reflected in the articles.

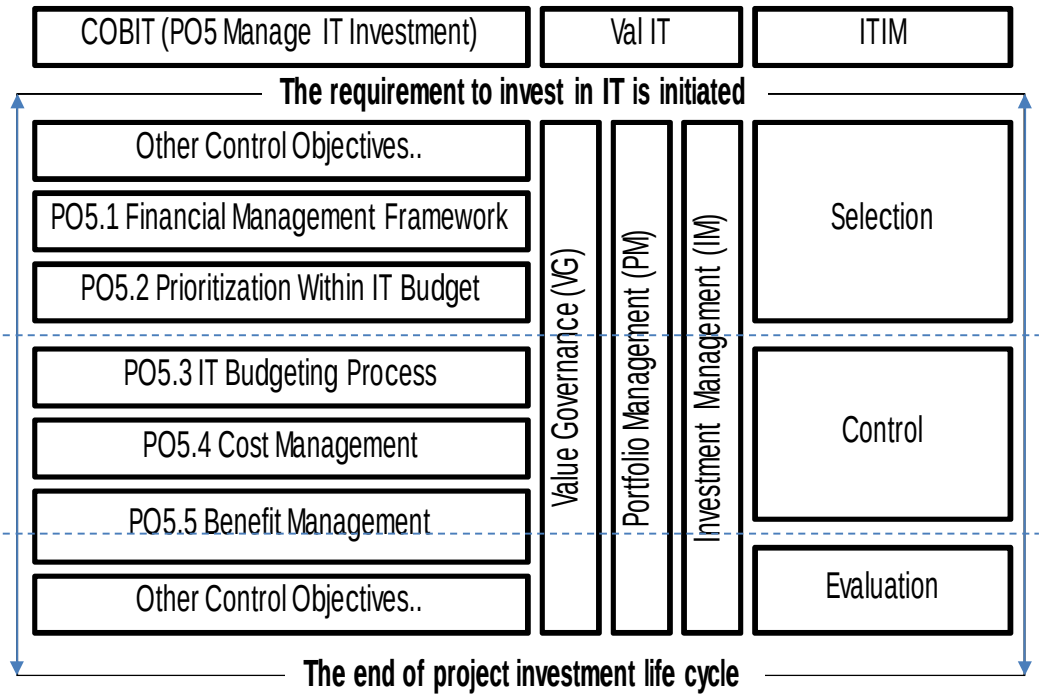



Figure 5 IT investment process boundary from COBIT, Val IT, and ITIM

Therefore, the scope of IT investment process which the study reviews in the literature bases on the fundamental phases in the IT investment management process defined by the United States General Accounting Office (2004) including the selection phase, the control phase, and the evaluation phase.

After reviewing the literature of IT investment process, the researcher found that the IT investment process has several steps that need to be undertaken in order to complete the mission of acquiring IT for an organization. The main processes in IT investment involve decision-making activities. Deriving from the literature on IT investment processes (Angelou and Economides, 2008; Bacon, 1992; Bardhan, Bagchi, and Sougstad, 2004; Farbey, Land, and Targett, 1992; Marshall and McKay, 2004), the activities in IT investment involving in IT selection phase include (1) analysis and planning, and (2) assessment and selection. The most of literatures proposed

frameworks and methodologies for assessing IT cost and benefit in order to provide choices for decision makers to select the IT project which delivers the most value to the organizations. The analysis and planning activities are mentioned in those literatures in either the introduction section or the literature review section, as the prerequisite step to be performed before the assessment and selection process.

In the scope of the control phase, the literatures mention about the activities and process frameworks to ensure that the IT project will be implemented and will achieve the goals of the project (Benbasat, Goldstein, and Mead, 1987; David, Schuff, and Louis, 2002; Jie, Mingjie, and Jinjun, 2006).

In the scope of the evaluation phase, the literatures mention about the activities of this phase in the last part of the article. They suggest that the organization must evaluate the actual results and compare them to the expected results in order to examine the project's performance, to identify problems or constraints that needed to be resolved, and to revise the effectiveness of the investment. The function of post-implementation evaluation is to ensure that the projects have met their goals, and to enable organizational learning (Belcher and Watson, 1993; Benaroch, 2002; Böckle, et al., 2004; Irani, Ezingeard, and Grieve, 1998; Verhoef, 2004).

According to Bacon (1992), IT investment should be a structured process involving pre-investing planning and post-investment evaluation activities. However, most IT investment research pays attention to the assessment activities rather than to the whole IT investment process. The issues of implementation and control are in the literature relating to IT management (Benbasat, Goldstein, and Mead, 1987; David, Schuff, and Louis, 2002; Jie, Mingjie, and Jinjun, 2006) rather than IT investment decision-making research. Although others activities are presented in the literature of IT investment, they are not included in the main scope of the study. The analysis and planning issue is presented in the assumption of the study that accurate analysis and planning should be undertaken before the assessment and selection step, while post-investment evaluation is the part of suggestion for the practitioners or future study

(Belcher and Watson, 1993; Benaroch, 2002; Böckle, et al., 2004; Irani, Ezingeard, and Grieve, 1998; Verhoef, 2004).

Besides the IT investment process, to obtain a list of the IT projects that require investment, and manage them until they deliver their value, each phase of IT investment requires information as an input to generate an output in terms of other information or solutions. The crucial information affecting the IT direction of an organization is derived from internal requirements, IT availability, and external requirements.

### 2.11.2 Factors Affecting the Requirement to Invest in IT

Based on Tornatzky and Fleischer's framework (1990), the three elements which influence the adoption of IT by an organization are (1) the organizational context which refers to the internal requirements, (2) the technological context which relates to the availability of IT, and (3) the external environmental context which is concerned with the external requirements.

#### *Organizational Context*

CIOs or IT managers have to generate an IT plan to serve the objectives of the organization which are classed as internal requirements. The requirement to invest in a certain IT project is initiated by two sources in an organization. The first is a strategic requirement which comes from a business strategy. Marchand and Horton (1986) stated that a firm using IT in strategic ways could compete effectively and flourish in the information age. Remenyi (1993) highlighted the problem of underestimating the importance of strategic requirements. Considering the importance of strategic requirements, an organization should provide strategic direction and guidelines for the management of an organization's information resources (Buchanan and Gibb, 1998). IT planners should be given a strategic direction by executives, and then should look for IT that could support the strategic requirement. The list of potential IT projects should then go through the process of decision making for IT investments.

The second is an operational requirement which may not be included in a strategy but may need to be considered for investment such as maintaining IT, upgrading infrastructure, or improving operational functions. In the total quality management (TQM) era, an organization focuses on maintaining the quality of business functions to deliver quality products and services to its customers. IT not only serves the strategic requirements but also serves the operational requirements in order to perform core business functions, and to improve or maintain the continuity of the system to meet the specific quality level of services (Madu, 1999).

***Technological Context***

Besides the requirements from an internal context, an organization may decide on a direction in an IT plan due to the availability of technology in the market. The emergence of a new technology or a decline in IT costs may stimulate demand in an organization. Tornatzky and Fleischer's (1990) framework showed that the technological context can influence the IT adoption process. Adoption of new technology by an organization leads to innovation. Chau and Tam (1997) stated that different organizations may face very different innovation opportunities. The technological aspects of the internal and external environment could affect the decision to adopt IT innovations (Chau and Tam, 1997).

***External Environmental Context***

The Ward and Griffiths (2002) framework suggests that the direction of planning can be influenced by the external environment and by external pressure groups. The status of social and regulatory change can define an IT project that requires investment.

External pressure groups are stakeholders in an organization who have influence on the direction of the organization. There is empirical evidence that intense competition in the industry stimulates the rapid spread of an innovation (Mansfield, et al., 1977). Customers and suppliers are part of the value chain of an organization. To

maintain the relationship between them, an organization may have to adopt IT in order to satisfy the requirements of customers and suppliers.

Organizations invest in certain IT projects in order to gain value. The value of IT can be identified by it fulfilling the requirements of business. To provide the right IT solution to answer business needs (Henderson and Venkatraman, 1993), alignment will be a critical component (Luftman, Lewis, and Oldach, 1993).

### 2.11.3 Alignment

While the IT investment process requires a baseline in order to scope the area of investment, alignment with business requirements is viewed as the frame to filter irrelevant IT projects from the list of potential projects. A study by Child and Mansfield (1972) showed that technologies performed poorly in the absence of proper alignment with business. The state of alignment would appear to draw upon a variety of company-specific capabilities and practices, involving an assessment of current structures and processes, diagnosis of IT requirements, and a fundamental realignment of structure and processes in conjunction with the introduction of new IT (Boar, 1994). Alignment is not only the outcome of a process but also a process in, and of, itself. By ensuring an alignment with the IT investment process, a decision maker can be certain that all IT projects in the pipeline can deliver value to the requirements with which they align.

According to the literature, the major components in IT investment as a whole are (1) the IT investment process itself, (2) the factors affecting the requirement to invest in IT, and (3) the component that is used to link the requirement and IT, called alignment.

Figure 6 is the proposed conceptual framework for the study which broadly illustrates associations between those components. This figure is depicted by capturing the elements and processes found in the literatures based on the major components in IT investment.

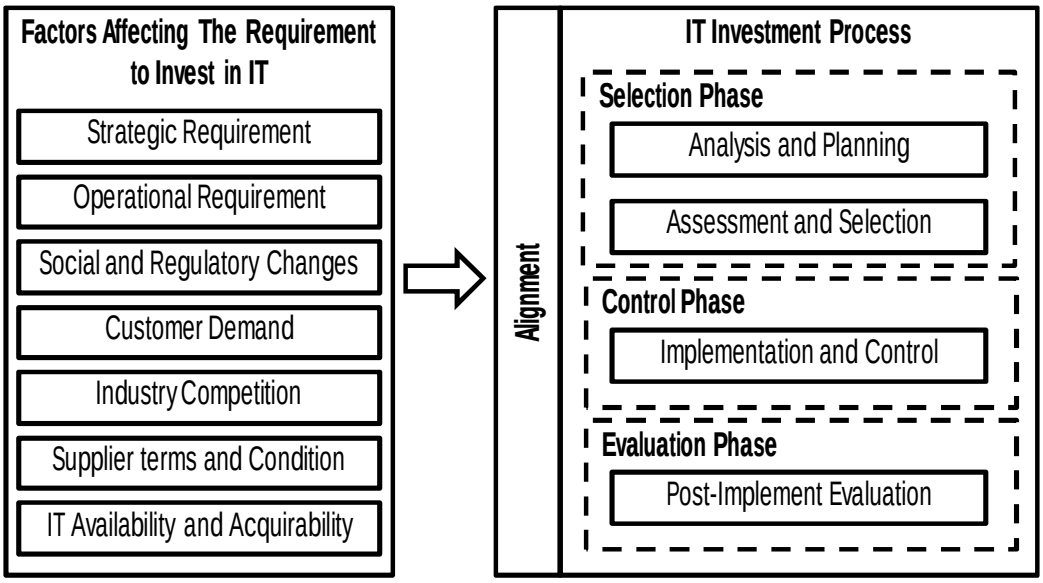



Figure 6 The proposed conceptual framework

The proposed conceptual framework will be refined further using input from the practical aspects of the study. The process of framework improvement will be discussed in next chapter.

### 2.11.4 The Application of the Framework

Based on the proposed conceptual framework, a process flow diagram for the IT investment process has been developed for use as a guide for decision makers investing in IT. As shown in Figure 7, the process flow illustrates an IT investment process which has four main stages covering three phases including a selection phase, a control phase, and an evaluation phase. These stages are not necessarily sequential. Some stages could be performed iteratively depending on the complexity and the nature of the project, to obtain a more effective result.

The process flow begins with the analysis and planning stage. In order to list all the potential IT projects in the organization, decision makers will be provided with a list of questions for each aspect including factors affecting the requirement to invest in IT such as:-

- "What are the IT projects supporting the strategic requirements of the organization?"
- "Which existing systems need to be maintained?"
- "What innovations should be adopted?"
- "What regulations need to be complied with?"
- "Do the existing systems support the customers' demands?"
- "What terms and conditions for suppliers need to be supported by IT?"
- "What are the trends in IT in the industry and the IT status of competitors?"

After answering those questions, decision makers should have adequate information for inputting in the analysis and planning step. The result of this step would be a list of IT projects that have potential for investment by the organization.

However, only those projects that can satisfy the criteria in the assessment and selection stage will be in the IT plan for the organization and hence suitable for investment. In this stage, decision makers will be assisted by several types of evaluation covering financial and non-financial assessment such as calculation of the project's ROI and TCO, scoring of IT benefits, assessment of risk, trade-off analysis, etc. The output of this stage is a list of the initially selected IT projects

A projection of implementation and control activities should be performed in order to view the IT projects thoroughly throughout their cycle. The advanced planning in this phase will enable the early detection of potential problems and provide a mechanism for quality control. In this stage, decision makers will be provided with a list of standard metrics that need to be measured during the implementation. The monitoring and control processes will be continued until the IT

projects are deployed. Decision makers could simulate or forecast the possibility of project success as the criteria to select IT projects in the pipeline.

However, the investment process does not come to an end with the completion of implementation. A post-implementation review should be performed to ensure that the project has met the planned goals and has delivered the anticipated benefits. A list of standard metrics will also be provided during this stage. Similar to the control phase, the prediction of the post-implementation evaluation will provide the expected results of the IT projects, and the result will be feedback for the planning team, thus leading to the continuing improvement of the combination of IT projects in the pipeline. All steps of IT investment will be performed based on the logic of alignment to ensure that the benefits of IT will match with the desired outcome for the organization.

This process flow will be improved and refined during the research process. The ultimate goal of the study is to elaborate this process flow until it can illustrate the steps needed to be performed in the IT investment process. At each stage, there will be some tools in the form of tables, spreadsheets, and questionnaires to assist decision makers.

The elaboration of the process flow will be a result of the study on the real IT investment practices in Thailand. A study of the possibility of adopting the proposed IT investment process framework for real business practice will be performed by considering the organization structure and policy, the availability of information needed as the input for each stage in the framework, and the capability of the IT department in the organization.

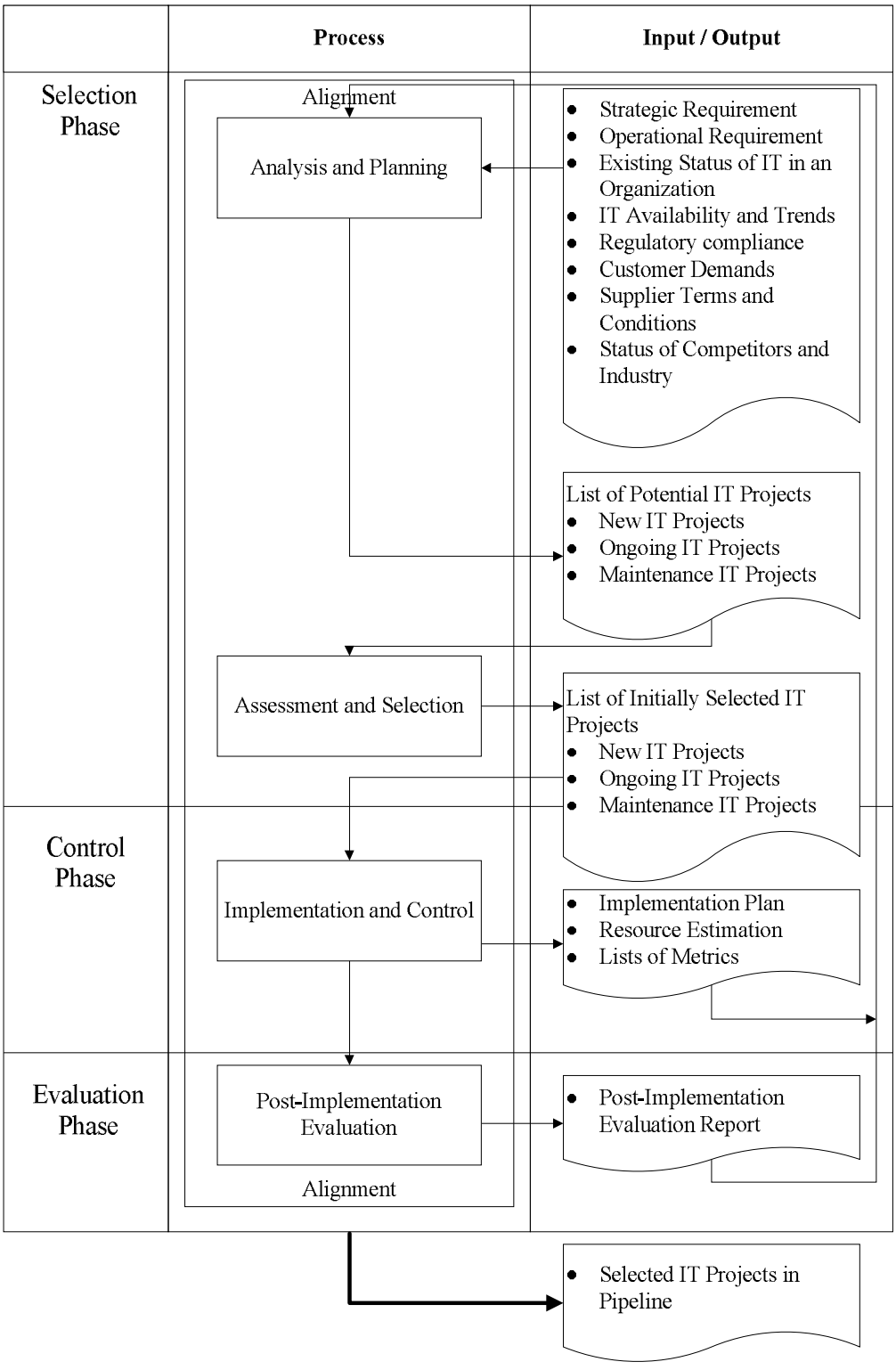



Figure 7 The process flow deriving from conceptual framework

# Chapter III Research Methodology

This chapter describes the research approach used in this study starting with an exposition of the research process and approach. Then it proceeds to a detailed explanation of the research methodology adopted in the study including the method, the data source, the data collection, and the data analysis technique used to acquire relevant and meaningful data that satisfies the research objectives and finally answers the research question for this study.

## 3.1 Research Process

The approach of this study is based on an investigation of the IT investment processes of the firms, and of the components relating to the processes such as the types of IT projects in which the firms had invested, the strategic vision of the firms, the conditions of the decision makers, and the involvement of staff in the process, in order to combine them with the core IT investment process derived from the literature.

Since the processes, environment, and judgment of decision makers cannot be easily quantified nor easily gathered in a laboratory or a controlled experimental environment, focusing on “why” and “how” the IT investment decision makers of the company make decisions in their IT investment process, requires use of some aspects of qualitative approaches. One particular area of concern is the nature and scope of insights that can be generated from qualitative research such as case study, narrative inquiry, conversation analysis, as well as within quantitative research paradigms, especially when specific cases are involved (Neuman, 2006). Therefore, this research was conducted by adopting qualitative methodology to provide contextual data in order to gain insights into the research problem following Creswell’s (2003) qualitative study definition :

*"Qualitative research is an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyzes words, report detailed views of informants, and conducts the study in a natural setting."*

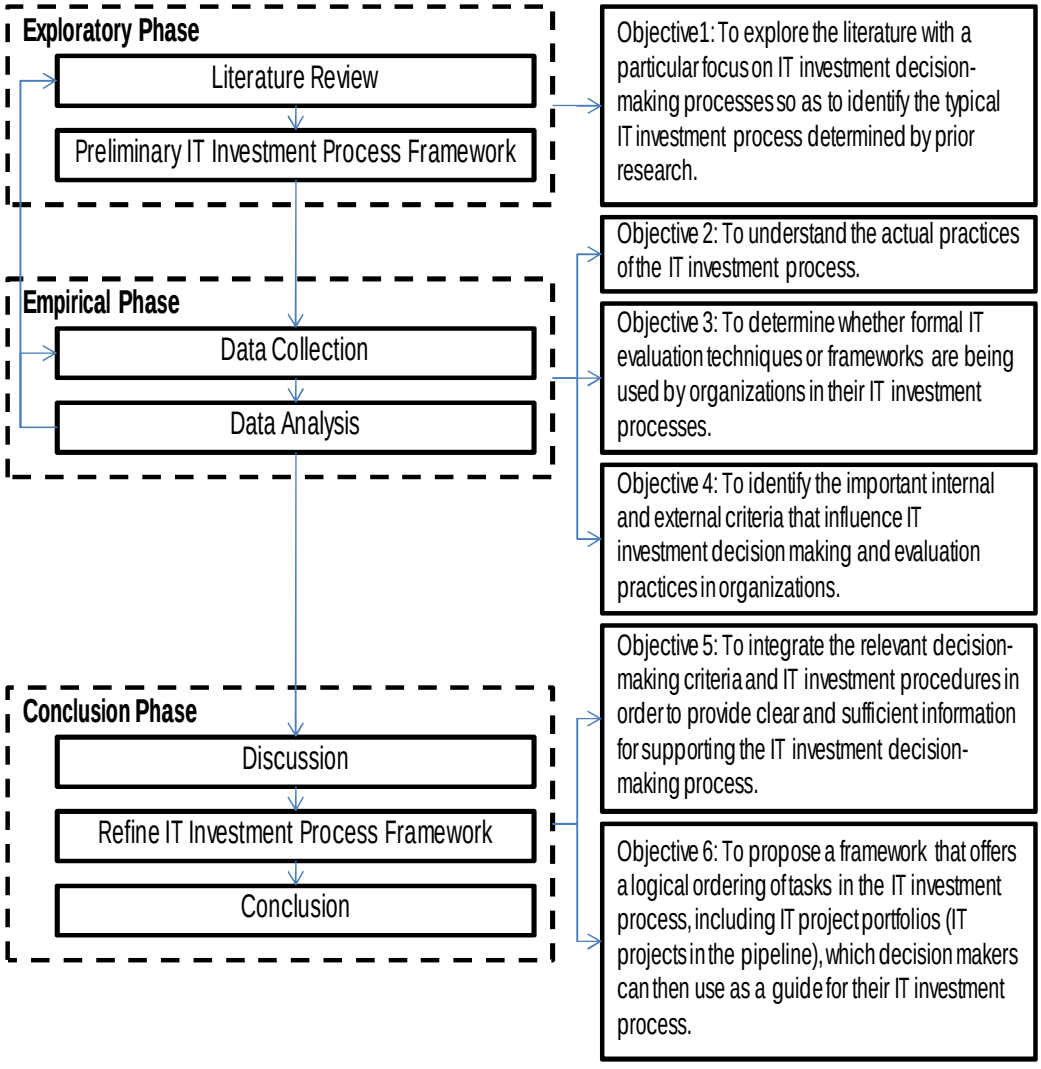



Figure 8 Research process and research objectives

The research process used in this study is described linearly, though it was a cyclical process that aimed to investigate the IT investment process in its natural

settings. The research process has three main phases. All phases of the research process were performed in order to satisfy the research objectives as shown in Figure 8. This led to an analysis of the compatibility and incongruence of empirical evidence and theory.

As illustrated in Figure 8, the “Exploratory Phase” refers to the research activity performed to develop an IT investment process framework determined by prior research. The process began with a literature review based on the objectives of the main research question. An iterative process was performed between the main research question that started broadly, and the new questions that emerged during the process to progressively narrow and then focus on the concepts and relationships discovered (Berg, 2001). A preliminary framework was then proposed. The “Empirical Phase” is related to the empirical setting design, and data collection and analysis where the empirical data was analyzed and supplemented with explanations from associated theories which were then used to refine the preliminary framework of the IT investment process. The “Conclusion Phase” provides a discussion and summary of the study. The modification of the framework was also performed in this phase. The details of each phase will be elaborate on in subsequent sections.

## 3.2 Exploratory Phase

According to the first research objective, the process of this dissertation began with the study of theory and previous research so as to formulate a conceptual framework for the IT investment process. The research and theory for IT investment and the related fields that can be applied to IT investment was obtained from textbooks, research articles, and published documents.

The literature and published documents in various fields such as finance, management, and IS research, were reviewed to frame and scope the IT investment process framework from both research and theoretical viewpoints. This study attempts to capture the processes and variables that have been used in past research to

describe the IT investment process in academic research. Once a clear retrospective analysis of the literature was completed, the framework could be generated from a solid background. Table 6 shows some sample topics covered in the study framework.

Table 6 Sample of inquiry topics in the study

| Topic | Number of Articles | References |
|---|---|---|
| IT investment planning and management | 14 | (Bedell, 1985; Benaroch, 2002; Benbasat, Goldstein, and Mead, 1987; Earl, 1993; Grover, Teng, and Fiedler, 1998; Jorgenson, 1973; Lederer and Salmela, 1996; Marshall and McKay, 2004; Matheson and Matheson, 1998; Mohanty and Deshmukh, 1998; Peters, 1988; Remenyi and Sherwood-Smith, 1999; Sanjeev and Michael, 1998; Ward and Griffiths, 2002) |
| IT value | 5 | (Alpar and Kim, 1990; Barua, Kriebel, and Mukhopadhyay, 1995; Chan, 2000; Denison, 1989; Mooney, Gurbaxani, and Kraemer, 1996; Ramakrishna and Lin, 1999) |

| Topic | Number of Articles | References |
|---|---|---|
| IT investment evaluation | 21 | (Böckle, et al., 2004; Borenstein and Betencourt, 2005; Davern and Kauffman, 2000; David, Schuff, and Louis, 2002; Dehning and Richardson, 2002; Farbey, Land, and Targett, 1992; Farbey, Land, and Targett, 1993; Irani, Ezingeard, and Grieve, 1998; Jones, 2000; Keil and Kuhrmann, 2006; Li and Johnson, 2002; Mo Adam Mahmood and Mann, 1993; May, 1997; Michel and Robert, 2000; Peters, 1988; Renkema and Berghout, 1997; Santos, 1991; Small and Chen, 1995; Stockdale, Standing, and Love, 2006; Verhoef, 2004; Wen, Yen, and Lin, 1998) |
| Decision making | 15 | (Beach and Connolly, 2005; R. Butler, et al., 1991; Eisenhardt and Zbaracki, 1992; Harrison and Pelletier, 1998; Janczak, 2005; Mintzberg, Raisinghani, and Théorêt, 1976; Payne, Bettman, and Johnson, 1993; Saaty, 1990; Simon, 1955; Thompson, 1964; Thompson and Tuden, 1959; Tversky and Kahneman, 1986; Wagenaar and Keren, 1986; Weber and Coskunoglu, 1990) |
| Decision quality | 2 | (Kamis and Davern, 2005; Wu and Hsu, 2009) |

| Topic | Number of Articles | References |
|---|---|---|
| Other theories of decision behavior | 12 | (Arkes and Blumer, 1985; Baron, Beattie, and Hershey, 1988; L. J. Chapman, 1967; Fischhoff, Slovic, and Lichtenstein, 1977; Frisch and Baron, 1988; Kahneman and Tversky, 1979; Mahoney, 2000; Pronin, Lin, and Ross, 2002; Schkade and Kahneman, 1998; Snyder and Cantor, 1979; Tversky and Kahneman, 1974) |
| IT investment process | 2 | (GAO, 2004; Schniederjans, Hamaker, and Schniederjans, 2004) |
| IT portfolio | 6 | (Angelou and Economides, 2008; Bardhan, Bagchi, and Sougstad, 2004; Berghout and Meertens, 1992; Maizlish and Handler, 2005; McFarlan, 1981; Ward, 1990) |
| Risk | 4 | (Benaroch, Lichtenstein, and Robinson, 2006; C. Chapman and Ward, 1997; Merna and Al-Thani, 2008; Rescher, 1983) |
| Factors influencing IT investment requirements | 7 | (Bacon, 1992; Child and Mansfield, 1972; Demirhan, 2004; Reich and Benbasat, 1990; Sanjeev and Michael, 1998; Teo, Wong, and Chia, 2000; Ward and Griffiths, 2002) |
| IT adoption | 2 | (Pires and Aisbett, 2003; Tornatzky, 1990) |

| Topic | Number of Articles | References |
|---|---|---|
| Business-IT alignment | 10 | (Boar, 1994; Broadbent and Weill, 1993; Cumps, Viaene, and Dedene, 2006; Henderson and Venkatraman, 1993; Hu and Huang, 2005 ; Luftman, 2000; Luftman, Lewis, and Oldach, 1993; Sabherwal and Chan, 2001; Sabherwal and Kirs, 2007; Sledgianowski, Luftman, and Reilly, 2006) |
| IT investment and business performance | 21 | (Brynjolfsson, 1993; Brynjolfsson, 1994; Brynjolfsson and Hitt, 1996; Brynjolfsson and Hitt, 1998; Brynjolfsson and Yang, 1996; Byrd and Marshall, 1997; Dehning, Richardson, and Stratopoulos, 2005; Denison, 1989; Devaraj and Kohli, 2003; Hu and Plant, July - September 2001; Lim, Richardson, and Roberts, 2004; Lin and Shao, 2006; M. Adam Mahmood and Mann, 2005; Maimbo, 2001; Melville, Kraemer, and Gurbaxani, 2004; Mitra, 1996; Peppard and Ward, 1999; Rai, Patnayakuni, and Patnayakuni, 1997; Santos, Peffers, and Mauer, 1993; Sircar, Turnbow, and Bordoloi, Spring 2000; Weill, 1992) |

| Topic | Number of Articles | References |
|---|---|---|
| Financial Management | 4 | (Goetzmann, 1997; Graham and Harvey, 2001; Horne, 2002; Horne and Wachowicz, 2000) |

Then the framework will be tuned by the integrated data from academic and business sources. Interactive tuning between theory and practice will be continued until the framework covers the major aspects of IT investment that practitioners can adopt in their organizations along with applicable guidelines based on theoretical approaches.

## 3.3 Empirical Phase

While the exploratory phase aims to enquire into the data from academic source, the empirical phase aims to collect the data from practical source. Data was gathered empirically from the observation of four organizations in Thailand to satisfy the research objective 2 to 4. It was analyzed to extract patterns from the IT investment process which was then compared to the framework from exploratory phase. Topics that lay beyond the factors in the conceptual framework were studied further in related research fields.

### 3.3.1 Data Collection

Empirical data for the IT investment processes of organizations in Thailand were collected by following the interpretive case study methodology for investigating complex social phenomena in real-life contexts (Orlikowski and Baroudi, 1991). Case study research is the most common qualitative method used in information systems research (Alavi and Carlson, 1992). The case study is the method of choice especially when the boundaries between phenomenon and context are not clearly evident, and when they can be a manifestation of the values, culture, and behavior of stakeholders within that context (Yin, 2008).

One of the case study research pioneers, Robert Yin, stated that case studies can have single or multiple-case designs, where a multiple design follows replication rather than sampling logic. He also pointed out that generalization of results from either single or multiple designs is employed with theories, but not with populations. Multiple cases strengthen the results by replicating the pattern-matching, thus increasing confidence in the robustness of the theory. This dissertation utilized a multiple-case design. A literature review of case study research by Yin is presented in Appendix C.

***Cases Introduction***

Four organizations in Thailand which have intensive IT investments were selected following the logic of intensity sampling in the context of medium-to-large organizations which have an IT investment process. Intensity sampling is one of the purposeful sampling techniques based on member characteristics relevant to the research problem. It is the process of selecting or searching for rich or excellent examples of the phenomenon of interest which are not , however, extreme or deviant cases (Patton, 1990). This technique allows the researcher to select a small number of rich cases that provide in-depth information and knowledge of the phenomenon of interest. As Patton (1990) pointed out, intensity sampling requires prior information and exploratory work to be able to identify intense examples. The criteria used to select the case are (1) that all cases examined in this study have made intensive IT investments, (2) they have undertaken IT investment processes which are in the fundamental phases of the IT investment management process, and (3) these organizations should offer rich explanations and evidence that can reveal the pattern of the IT investment process under real conditions.

The opportunity to work as a member of an IT planning team in selected organizations for a period of time, helped provide this researcher with information about the IT investment processes of the organizations for use in this research. The selected organizations were termed (1) HOSPITAL1, (2) ENERGY1, (3) ENERGY2, and (4) UNIVERSITY1.

HOSPITAL1 is a medium-large company in the healthcare industry which has intensive IT investments. The mission of the organization is “To provide the healthcare service with quality, efficiency, and morality. With on-going continuous development, we aim for high potential”. In order to achieve service quality, the firm has adopted IT systems, such as a hospital information system, a laboratory information system, an incident report system, a queuing system, and a document management system, to support its core business functions. It also plans to invest more on IT to enhance its ability in healthcare services such as through the implementation of e-medical records and a call center project. The scope of investigation involves a selection phase, a control phase, and an evaluation phase.

ENERGY1 is a government enterprise in the energy industry. Its objective is to improve its electric energy provision and distribution services for customers, and to optimize its business and operations to achieve its financial goals. In 2006, the organization generated its IT master plan that focused on the themes of modernity, intellect, and intelligence. Afterwards, the executives of the organization altered the IT vision of their organization to include smart-grid computing. Then during the period of observation, the organization revised and developed a long-term and short-term plan for IT. The investigation was mainly concerned with IT analyzing and planning which is in the selection phase.

ENERGY2 is also a state enterprise in Thailand in the energy industry. Its main operations focus on electricity generation and the transmission business as well as power purchasing from domestic and foreign power producers. Its mission is “to create and improve the quality of life and strengthen the country’s competitiveness through reliable and affordable energy and services while giving due care to society and the environment”. The organization has implemented an ERP system to run its core functions. The IT investment plan in the following years was concerned with ERP systems maintenance focusing on system scalability, training, acquiring specialists, and developing a disaster recovery plan. The phases that can be observed in this organization are the selection phase, the control phase and the evaluation phase.

UNIVERSITY1 is a large educational institution. Its mission is to produce quality graduates, who can cooperate and compete on equal terms in national and world arenas, by continuing the development of education. During the observation period, the organization had an intensive IT investment in integrating core systems under the theme “unified ERP”. The observation covered the selection phase to the evaluation phase.

The observation of HOSPITAL1 took place during 2009-2010. The observation of ENERGY2 began in April 2008 and continued until May 2009. The observation of ENERGY1 covered the period from August 2009 to January 2010. The study of UNIVERSITY1 was derived mainly from documents from the period 2004-2008 which was the time when there was intensive IT investment by the organization.

***Source of Data***

Data for the four cases were collected from six sources of evidence as in the case studies identified by Yin (2008) including documents, archival records, interviews, direct observations, participant-observations, and physical artifacts. The main sources of this study were documents, archival records, and participant observations.

The researcher participated in IT investment activities in each organization as a part of the IT planning team, and had responsibilities for requirement gathering and information provision when required by the decision makers or when assigned by the supervisor. The researcher did not influence or alter any of the processes during these IT investment activities. Table 7 shows the situations in which the researcher participated or observed. Field notes and voice recordings were taken (when permitted). Transcriptions of voice recordings were used to validate field notes in order to ensure the trustworthiness of the study (Shenton, 2004). The observations were performed in all cases except UNIVERSITY1 which mainly was studied from the documents as mentioned in previous section.

Table 7 Details of observations

| HOSPITAL1 | ENERGY1 | ENERGY2 | UNIVERSITY1 |
|---|---|---|---|
| - Weekly meeting with IT manager<br>- Monthly meeting with executives<br>- Meeting with functional managers<br>- Meeting with IT vendors or external IT consultants | - Executives' requirement gathering (Deputy-Governor) meeting<br>- Meeting with IT departments under ICT business line<br>- Functional requirement gathering workshop<br>- Consultant internal meeting | - Steering Committee meeting<br>- Project management office meeting<br>- Team leader meeting<br>- Ad hoc meeting | - There was no direct observation or participant-observation in this case study<br>- The study of this case based on documents and archival records presented in Table 8 |

For the case of HOSPITAL1, ENERGY1 and ENERGY2, the other sources of data were documents and archival records. They were used to determine the reasons for, and the results of, decision making in IT investment activities such as project planning, selecting, and prioritizing. Table 8 lists the types of documents used as the source of data for this study.

Table 8 Source documents

| HOSPITAL1 | ENERGY1 | ENERGY2 | UNIVERSITY1 |
|---|---|---|---|
| - Field Notes<br>- Strategic Plan<br>- Project Plan<br>- Minutes of meetings<br>- E-mails<br>- Archive of project's documents | - Field Notes<br>- IT Master Plan 2008-2017, and Revised Plan<br>- Strategic Plan<br>- Risk Management Plan<br>- Project Plan<br>- TOR<br>- Minutes of meetings<br>- E-mails<br>- Archive of project documents | - Field Notes<br>- ERP implementation contract<br>- Minutes of meetings<br>- Presentation slides from meetings<br>- Progress reports<br>- E-mails<br>- Archive of project documents | - ICT Master Plan<br>- Strategic Plan<br>- Project Plan<br>- TOR<br>- Minutes of meetings<br>- Summary Reports<br>- Archive of project documents |

The first task was observation of the IT investment processes of the cases. The second task was observation of the input and the factors affecting the requirement for investment in IT by each organization. The third task focused on the existing IT evaluation techniques of each organization. The fourth task was to observe the status and the relevant issue of business-IT alignment in each organization. The last point was to determine whether formal IT evaluation techniques or frameworks were being used by these organizations in their IT investment processes, since any shortfall in the evaluation technique application could be used as criteria for refining the conceptual framework.

The current status of system and architecture of four organizations were collected from the documents such as system architecture, system specification, and IT plans. Then they were verified by the real systems of the organizations. In the cases of unclear evidences or the interpretation in sensitive issues such as the interpretation of judgment based on personal insight, financial policy, organization's regulation and

culture, the unstructured interviews were performed to verify the interpretation of the researcher.

### 3.3.2 Data Analysis

Once the necessary information for the research has been gathered, the next step is data analysis. Minichiello et al. (1990) suggested that data analysis can be achieved by processing data in order to obtain a selection of the most significant aspects, and then factoring them into general or unique sequential patterns.

Qualitative data analysis refers to the range of processes and procedures used by researchers to interpret the data that have been collected, so as to formulate some form of explanation, understanding or interpretation of the people and situations that are being investigated. Qualitative data analysis is usually based on an interpretive philosophy where the aim is to examine the meaningful and symbolic content of qualitative data.

Following the strategy of Yin (2008) for multiple-case studies, the description of each case and the themes within each case was determined to satisfy within-case analysis requirements. In addition, a thematic analysis across the cases was also provided in an across-case analysis.

The data analysis for this study was guided by the application of the productive qualitative research methodology proposed in Miles and Huberman's (1994) general approach as shown in Figure 9. The figure covers the cycle from data collection to conclusion drawing and verification which is in the step of conclusion phase.

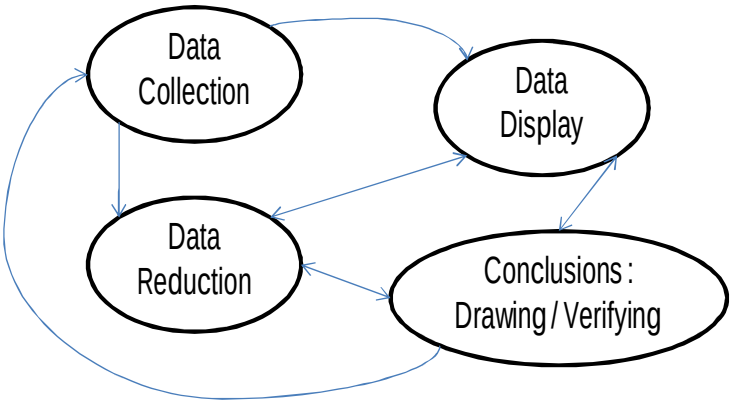



Figure 9 Component of data analysis (Miles and Huberman, 1994)

After the data has been collected, the irrelevant data is eliminated in the step of data reduction. Data reduction involves the discarding of non-vital information and the reorganization of the data collected. The process also extends further and encapsulates additional aspects such as selection of the relevant conceptual framework through which to analyze and direct the focus of the research question. The researcher has to make decisions on how to code the categories, and group and organize them so that conclusions can be reasonably drawn and verified.

Data display refers to the structured presentation of information in a manner which allows the reader to draw conclusions. The use of matrices such as charts and graphs and other similar tools which can present the data in a structured manner, allows for an immediate focus on a particular salient point from which the research can be extended. And the conclusion drawing and verification step will be performed in conclusion phase.

In the steps of data reduction and data display, it needs a software tool to facilitate the researcher to deal with a volume of data. There is a limitation of a general qualitative data analysis software package that it does not support Thai language. The researcher used Microsoft Excel to facilitate data interpretation such as coding, grouping sentences, filtering words or phrases, highlighting and capturing the pattern in the documents.

### 3.3.3 Trustworthiness

Patton (1990) states that validity and reliability are two factors should be concerned in conducting any research, while Healy and Perry (2000) assert that the quality of a study in each paradigm should be judged by its own paradigm's terms. For example, while the terms reliability and validity are essential criteria for quality in quantitative paradigms, in qualitative paradigms the essential criteria for quality is trustworthiness (Lincoln and Guba, 1985).

The objective of trustworthiness in a qualitative research is to response the question that “How can an inquirer persuade his or her audiences that the research findings of an inquiry are worth paying attention to?" (Lincoln and Guba, 1985)

There are four issues of trustworthiness demand attention: credibility, transferability, dependability, and confirmability. Credibility is an evaluation of whether the research findings represent a “credible” conceptual interpretation of the data drawn from the participants’ original data. Transferability is the degree to which the findings of this inquiry can apply or transfer beyond the bounds of the project. Dependability is an assessment of the quality of the integrated processes of data collection, data analysis, and theory generation. Confirmability is a measure of how well the inquiry’s findings are supported by the data collected. (Lincoln and Guba, 1985)

Transferability was enhanced by contrasting observation from different sectors (public and private sector). According to the emerging theory, samples were selected and studied in order to confirm or disconfirm aspects and conditions under which the framework holds by making use of theoretical sampling, “which means that the investigator examines individuals who can contribute to the evolving theory”(Creswell, 2003). Subsequent unstructured interviews were conducted with IT managers or IT planner to complement the finding pattern in order to strengthen credibility and confirmability. To address the issues of dependability, triangulation strategy was adopted. The study triangulates the method with the combinations of observation and document analysis. Triangulation of sources was performed by

checking the consistency of the data collected from IT investment and planning process and the final result of IT plan.

## 3.4 Conclusion Phase

In this phase, conclusion drawing and verification step is performed. It refers to a process of developing an initial proposition to explain the patterns for the findings, and then verifying them. It is through such processes that the validity of the data is established and the meanings of the findings can emerge.

After the data had been analyzed, the findings were discussed. The results of the data analysis were used as input to refine the conceptual framework and the steps in the process flow diagram.

# Chapter IV Data Analysis

This chapter presents the results of the data collection and analysis. Inductive qualitative analysis was used to characterize patterns, themes and categories as they emerged from the data. The codes used in this part of the analysis were derived directly from the three dimensions of the conceptual framework which are (1) the IT investment process, (2) the factors affecting the requirement to invest in IT, and (3) IT-business alignment. Table 9 outlines the situation observed using the dimensions of the conceptual framework.

The content starts with the within-case analysis, to elaborating environment, the background, the process, and the situation within the case. Then there is a case comparison that illustrates the across-case analysis.

Table 9 Observing situations utilizing the dimensions of the conceptual framework

| Dimensions | HOSPITAL1 | ENERGY1 | ENERGY2 | UNIVERSITY1 |
|---|---|---|---|---|
| **Analysis and Planning** | Observed in the IT roadmap and year plan formulation | Observed in the IT master plan revision and formulation | Due to the timeframe and scope of observation, the researcher could not collect evidence of any IT planning situations | Studied from historical documents relating to the IT strategic plan |
| **Assessment and Selection** | Observed in project phasing and IT provider selection | Observed in project prioritizing | Observed in decision making about change requests and the selection for e-learning and EIS solutions | Studied from historical documents relating to IT provider selection |

| Dimensions | HOSPITAL1 | ENERGY1 | ENERGY2 | UNIVERSITY1 |
|---|---|---|---|---|
| **Implement and Control** | Observed in IT project implementation in phase1 | Could not be observed | Observed in ERP project implementation | Studied from historical documents relating to project implementation: unified ERP, activity transcripts, EDMS, IT infrastructure, CUBIC |
| **Post-Implementation Evaluation** | Studied from historical IT division's reports | Could not be observed, but there were KPIs for IT strategy in the IT master plan | Although there was an initial meeting about benefit realization for the ERP project, the project was still in pending at the end of observation period. | At the end of project, there was an acceptance approval process, but there was no evidence of post-evaluation |
| **Factors affecting the requirement to invest in IT** | Observed in the IT roadmap and year plan formulation | Observed in the IT master plan formulation | Observed in the criteria used in decision-making about change requests and the selection for e-learning and EIS solutions | Studied from historical documents relating to the IT strategic plan |
| **IT-business alignment** | Observed in the IT roadmap and year plan formulation | Observed in the IT master plan formulation | Observed in decision- making about change requests and the selection for e-learning and EIS solutions | Studied from historical documents relating to the IT strategic plan |

## 4.1 Case study

This section elaborates on the details of the four cases, and presents an extensive description of the study setting including the data and findings. There are two

cases involving state enterprises, one from a public organization and the other from a private organization. All cases are classified as having a large organization base using the criteria in the definition of small and medium-sized enterprises in Thailand (Source: Ministerial Regulation of Ministry of Industry, Thailand, 2002).

### 4.1.1 HOSPITAL1

The observation of this case took place from January 2009 to December 2010. Following closely with the IT manager of the hospital, the researcher participated in the IT assessment project, IT plans formulation, IT consolidation project, e-medical record (EMR) project, and the requirement gathering session with functional managers. The processes investigated were long-term and short-term planning, business and system requirement gathering, vendor selection, and IT project implementation, all of which will be elaborated on in this case description.

#### *Background*

HOSPITAL1 is a case of a private company which continuously invests in IT. It is a large firm in the healthcare industry, which began operation in 1981. Up until the present, HOSPITAL1 has provided medical services including a specialized medical center, clinic, and supporting services. It has specialized medical staff from all fields, competent supporting staff, and state-of-the-art medical equipment and technology. It is equipped with 208 beds to accommodate in-patients, while the 90 examination rooms for out-patients enables it to service up to 2,000 out-patients each day. The mission of the organization is “to provide a healthcare service with quality, efficiency and morality. With on-going continuous development, the hospital aims for high potential”. The hospital has annual revenue of about 1,000 million baht and is considered to be in the growth stage. In the future, HOSPITAL1 aims to apply for Joint Commission International (JCI) Hospital Accreditation which signifies an international quality standard in this industry.

The firm needs to build on its current success by satisfying the high expectations of both existing and prospective customers and by providing a high-level service within their profession. To provide continued and sustained growth, the firm also needs to maximize revenue from customers and its network. Although the current customers can perceived some quality in the current services provided by the firm, there are growing expectations from its customers and pressure from competitors in the same industry that exceed the current IT capability of the company.

In order to achieve the goals of the company, it has adopted IT systems such as a hospital information system, a laboratory information system, an incident report system, a queuing system, and a document management system, to support its core business functions. Moreover, the hospital plans to invest more in IT to enhance its ability in healthcare services and to improve the productivity of its operations through the installation of an electronic medical records (e-MR) system, an electronic medication administration records (e-MAR) system, server consolidation, and an access control and security system (CCTV and access control). The hospital has an IT division which takes care of all IT issues in the organization include planning, implementation, purchasing, training, and support.

***IT Division***

As shown in Figure 10, the IT division of HOSPITAL1 is headed by an IT manager who reports directly to the CEO. There are approximately fourteen staff in the division, which is composed of four departments: (1) System Administration, (2) Application Development, (3) Management Support, and (4) User Support. The System Admin Department takes care of IT availability and capacity at the hospital. It provides hardware, software utilities, and network services. The Application Development Department is responsible for software application upgrades, system delivery, and system development. The Management Support Department provides information services and reports for executives, functional managers, and operations staff. The User Support Department provides a Help Desk for users.

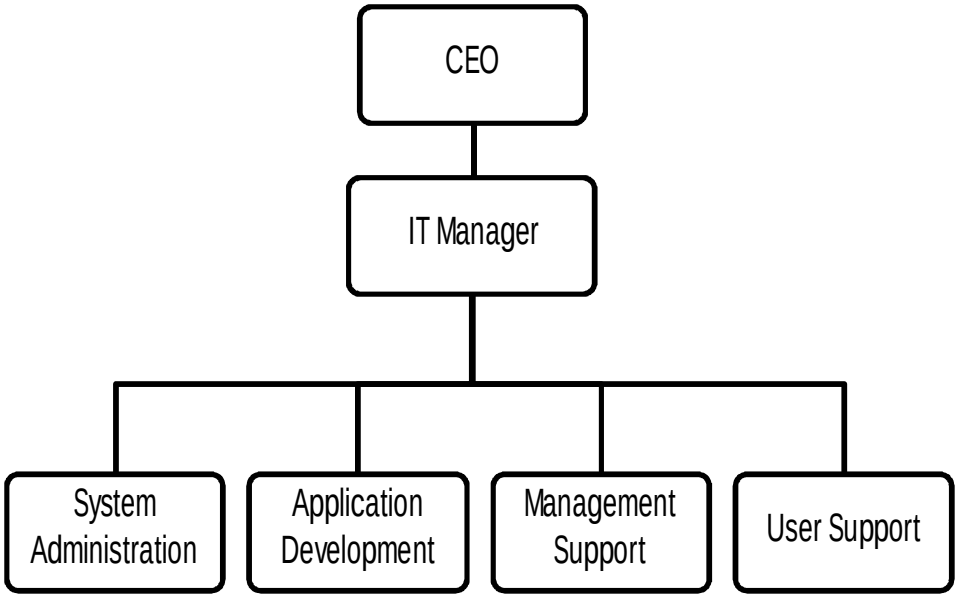



Figure 10 HOSPITAL1's IT division organization chart

***IT Planning***

The new age of IT in the hospital arrived along with high competition in the industry. The executives of HOSPITAL1 perceived the importance of applying IT in the hospital and assigned an IT manager to formulate an IT plan for the next 3-5 years. Through a connection with a well-known IT company which provides a total solution for enterprise customers, HOSPITAL1 engaged IT consultants and system analysts to work with their IT manager and staff on an IT assessment project to assess, plan and design an enterprise-wide IT strategy and architecture that supported the companies' business goals. The output from this project was a strategic road map and technical design for an effective implementation using the expertise and proven methods of the IT provider. The consultants were also asked to propose products and recommend services for the solution provided in the roadmap.

The principle criteria for the projected IT plan for HOSPITAL1 were system integration, and a design based on best practice and innovation. The activities included data gathering, system analysis, and system design. Data gathering was the process of studying the existing IT servers as well as the infrastructure environment at

HOSPITAL1, and the existing workload of the data center to determine if there was any potential to run a consolidated environment.

The IT assessment project was divided into two parts, one dealt with application systems, while the other dealt with hardware and infrastructure. The pre-existing application system at HOSPITAL1 is illustrated in Figure 11. This figure was drawn from the unstructured interview of the IT manager and the system administrator in the initial period of the IT assessment project. The rectangular boxes represent the system at the hospital. The arrows with solid lines represent the interfaces of the system, while the arrows with dotted lines represent data or systems connected with manual process and which needed to be improved with system interfacing. The gray boxes were the systems considered to have critical problems that needed to be solved.

From Figure 11, the core systems of HOSPITAL1 were systems serving the medical and core functions of the company including supporting the work of the Front Office. These systems were composed of a laboratory information system (LIS), a picture archiving communication system (PACS), a queue system, an incident report system (IR), and a hospital information system (HIS) which also included some back office functions such as the accounting and payroll systems. The systems supporting the marketing functions of the hospital were the call center and the hospital website. A management information system and a decision support system were implemented to serve the needs of the management level through the provision of relevant information from all systems, and the integration and analysis of the data. Systems supporting the communication functions of the hospital consisted of an electronic document management system (EDMS), an internal website, and a mail system. The IT service level included hardware and software utilities, networks, and system administration. The problems of the systems, representing by gray boxes in Figure 11, were system obsolescence, system capacity had reached its limit, and there was no system owner.

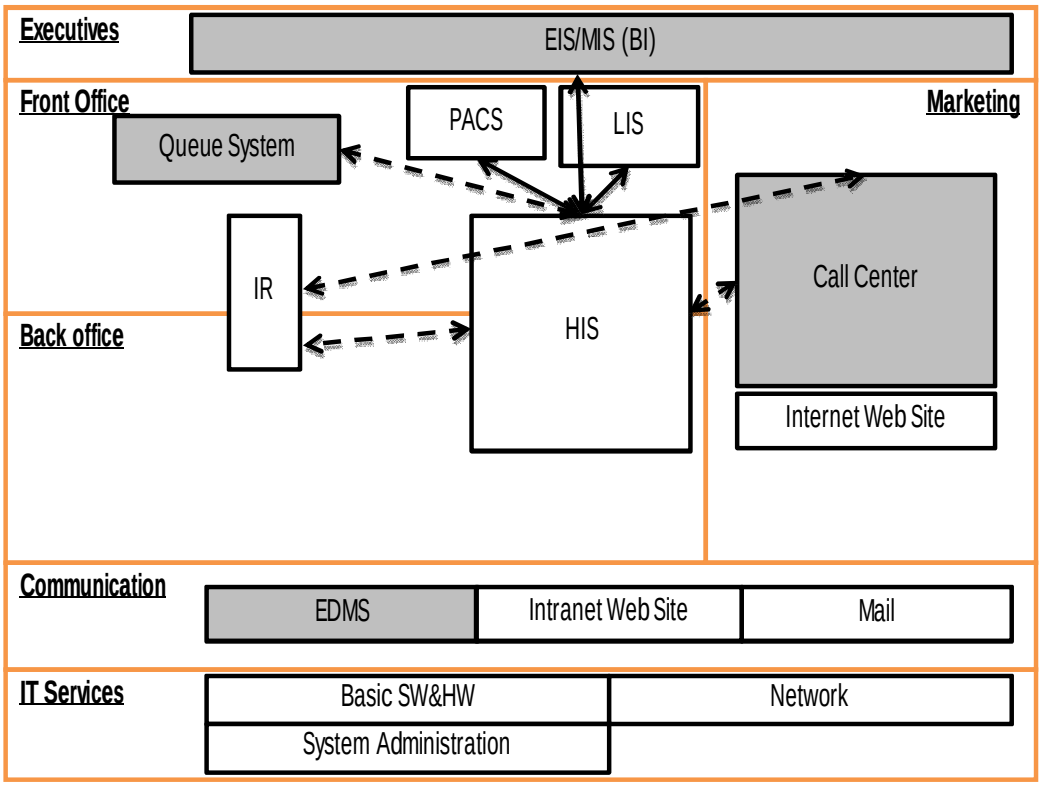



Figure 11 Existing IT system at HOSPITAL1 (Initial Stage)

In addition to the problem of the deficient systems (represented in gray boxes) that needed to be resolved, the IT Manager combined the business requirements with the system requirements that were necessary, as shown in Figure 12. This figure was drawn from the discussion among the IT manager, functional managers, and CEO, which later was used as a requirement for the hospital's IT roadmap. The gray boxes represent the systems that required upgrading within the next 3-5 years. With the aim of reducing manual processes and paper usage, an electronic medical records system and an IPD system, which included an IPD system for doctor and nurse activity, was proposed. For the business marketing functions, the hospital needed a customer relationship management system (CRM) which could integrate with a call center system and an internet website. An asset management system was required to manage all the assets of the hospital including IT assets, physical assets, and medical assets. The systems supporting communication functions would be enhanced by the features of a web portal, and would also be upgraded to serve the knowledge management model of

the organization. In order to ensure the availability of critical technological infrastructure, a disaster recovery system was necessary for the site.

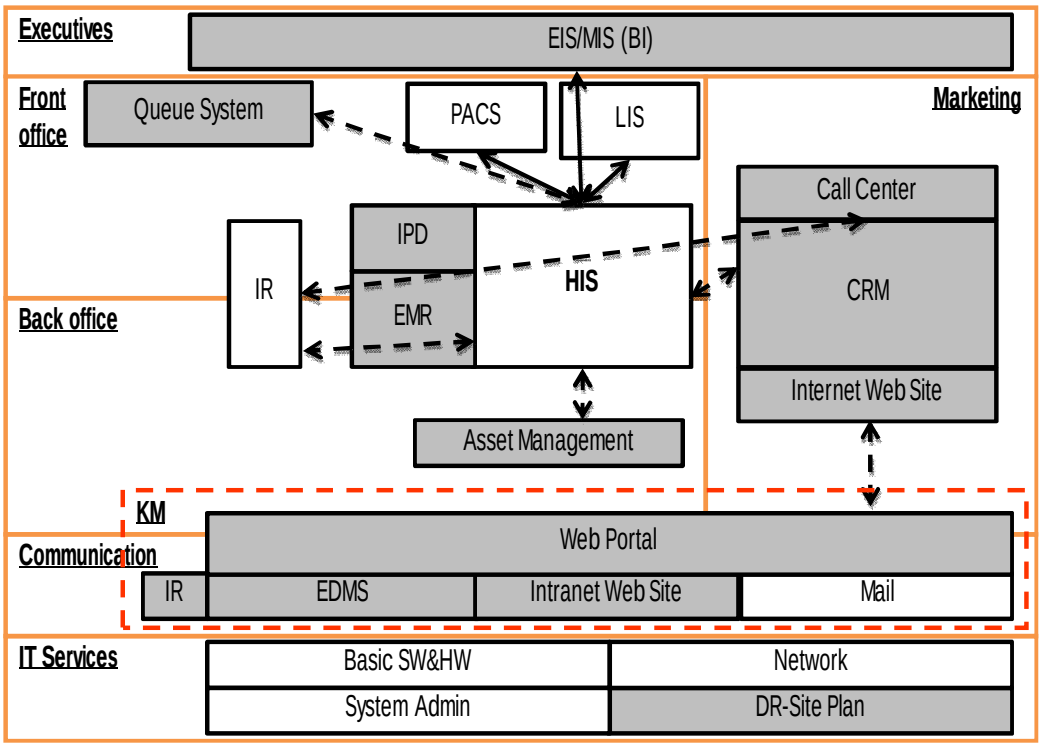



Figure 12 IT systems that required upgrading and implementation

The survey of hardware and infrastructure by the external IT consultants from the IT assessment project showed that there were 50 servers in the hospital, 25% of which had been active for more than 3 years, while 30% of all servers had specifications that were similar to a personal computer. It was found that the hospital faced additional problems such as system stability, physical space for hardware, system administrator man power, and maintenance costs.

The IT systems that required upgrading and implementation are shown in Figure 12, together with the results of the hardware and infrastructure survey by the consultants from the IT firm who were engaged to analyze and formulate the IT roadmap for the hospital.

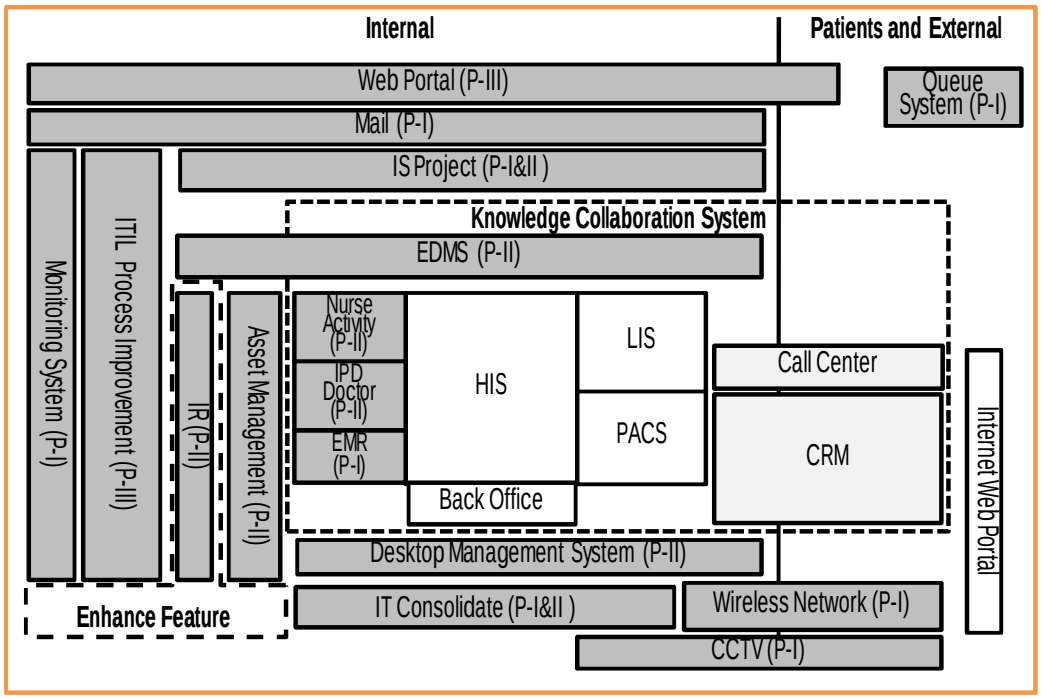



Figure 13 IT roadmap for HOSPITAL1

Figure 13 displays the IT roadmap for HOSPITAL1 based on the results of the IT assessment project proposed by the external IT consultants. Gray boxes represent the systems requiring investment. P-I, P-II, and P-III are the abbreviation for phases 1-3. The projects appended from Figure 12 were the result of the hardware and infrastructure survey. For example, the IT consolidation project was suggested by the consultants to implement server virtualization and consolidation through replacement of the old servers to support the optimization of the IT infrastructure. The light gray boxes represent the systems requiring IT implementation although the status of the systems was uncertain because there was no current project owner.

Due to the co-operation between the consultants and the IT Manager, the projects, phasing, and estimated budget were specified. The priority of projects was determined on the basis on their essentialness to the business process and the readiness of the users and processes. The IT projects were categorized into 3 types: (1) IT projects to support business requirements with the IT division as an owner, (2) IT

projects to support business requirement with the IT division providing support, and (3) the IT maintenance project as shown in Table 10.

Table 10 IT project categories for HOSPITAL1

| **IT Project (Support Business Requirement)** | | **IT Maintenance** |
|---|---|---|
| **IT as Owner** | **IT as Supporter** | |
| - IT Consolidation<br>- Mail<br>- Monitoring System<br>- Wireless<br>- EDMS<br>- IS Project<br>- Knowledge Collaboration System<br>- Desktop Management<br>- Web Portal<br>- ITIL | - E-MR<br>- Queue System<br>- HIS Enhancement<br>- Asset Management<br>- IPD Doctor<br>- Nurse Activity<br>- IR<br>- CRM<br>- CCTV<br>- Internet Web | - Hardware & Devices<br>- HIS<br>- PACS<br>- LIS<br>- System Interface<br>- System Software Utilities |

The IT roadmap with initial details and an estimated budget was reviewed by the CEO. After the roadmap had been approved in principle, the IT manager gathered further information from the IT providers for each system. Except for the IT projects where the IT division was a supporter, the project owner who was a manager of the business function, would coordinate with the IT Manager in the process of information gathering from IT providers. After the detailed scope of the projects had been specified, quotations were requested from IT providers who could provide suitable products and services. Then the best quotation was selected and price negotiation was undertaken by the CEO and the procurement committee. Subsequently, a contract was signed and the process went to the implementation phase.

***IT Investment Process Summary***

IT investment process of HOSPITAL1 started from the activities of IT existing status review. IT manager, together with external consultants of IT assessment project gather requirements from executives and functional staffs in order to design IT roadmap for the hospital. The design based on the best technology and solution suggested by the consultants. IT planning team prioritized the lists of IT projects into three phases. The projects that can support the achievement of JCI accreditation and be the prerequisite for other projects, were classified as high priority projects. Besides the requirement and JCI standard supporting, the rationales, IT planning team used to convince CEO to approve the projects, were the technology that can compete with the competitors and the business process improvement that can lead to customer satisfaction. The budgets of the projects were proposed as the supplemental information, except in the case of the IT consolidation project that budget and cost comparison were the main criteria that made CEO approved that project. The process continued to IT vendor selection. HOSPITAL1 selected IT providers who can provide products and services that most satisfied the requirements. After that, IT projects were implemented based on the methodology of IT providers, and there was no evidence of post-implementation evaluation in any projects.

### 4.1.2 ENERGY1

The observation of ENERGY1 covered the ICT Master Plan Revision Project which ran from August 2009 until January 2010. The data collected was mainly related to the process of obtaining the ICT requirements, reviewing ICT projects in the pipeline, and modifying the plan. Being one of staffs on this project provided the opportunity for the researcher to investigate the IT analysis and planning processes of this organization.

***Background***

ENERGY1 is a government enterprise under the Ministry of the Interior, and was established in 1960. The authority's responsibility is primarily concerned with the generation, distribution, sale and provision of electric energy services to the business and industrial sectors, as well as to the general public in provincial areas, but not in Bangkok, Nonthaburi and Samut Prakran provinces. ENERGY1 has expanded electricity supply to all areas in 73 provinces, which cover approximately 510,000 $km^2$, and which accounts for 99% of the country's total area. In order to increase the quality of life for people and to support other developments in rural areas, it has developed and applied modern technology to electricity supply and the distribution dispatching system to improve the efficiency, reliability and quality of its services. The major objectives of the company are (1) to continue to improve its provision and distribution services for electric energy to customers: to achieve the highest possible level of sufficiency, efficiency and reliability in power distribution commensurate with safety practices; to meet the timely needs of customers; and to keep pace with changing circumstances, (2) to optimize its business and operations in order to be more profitable and thereby achieve sufficient revenues to facilitate further development, and (3) to develop its organizational structure, manpower and resource management in order to achieve the highest level of efficiency and effectiveness, with the vision of being "the leader organization in South East Asia with international standard services for energy and related services"

***ICT Unit***

ENERGY1 is a large organization. According the firm's annual report in 2009, it employed about 28,000 staff, and total revenue was around 290,000 million Baht. To provide IT services across the organization, there is an ICT Business Unit under a group of Venture Business Units which acts as the central IT unit of the organization. The ICT Unit consists of an ICT Strategy and Planning Department, an IT Operations Department, and a Communication Network Department.

The ICT Strategy and Planning Department takes care of IT planning and investment for the organization wide. The IT Operations Department responsible for IT operation and application systems support. And the Communication Network Department plans, designs and maintains the network infrastructure of ENERGY1.

Moreover, ENERGY1 has sub-offices located all over the country, and to provide IT support for them, there are Provincial IT Operation Units in 12 areas under the Retail Business. Figure 14 which display the organization chart for ENERGY1, illustrates only the line of command for the ICT Unit. The units responsible for ICT functions are displayed as gray boxes.

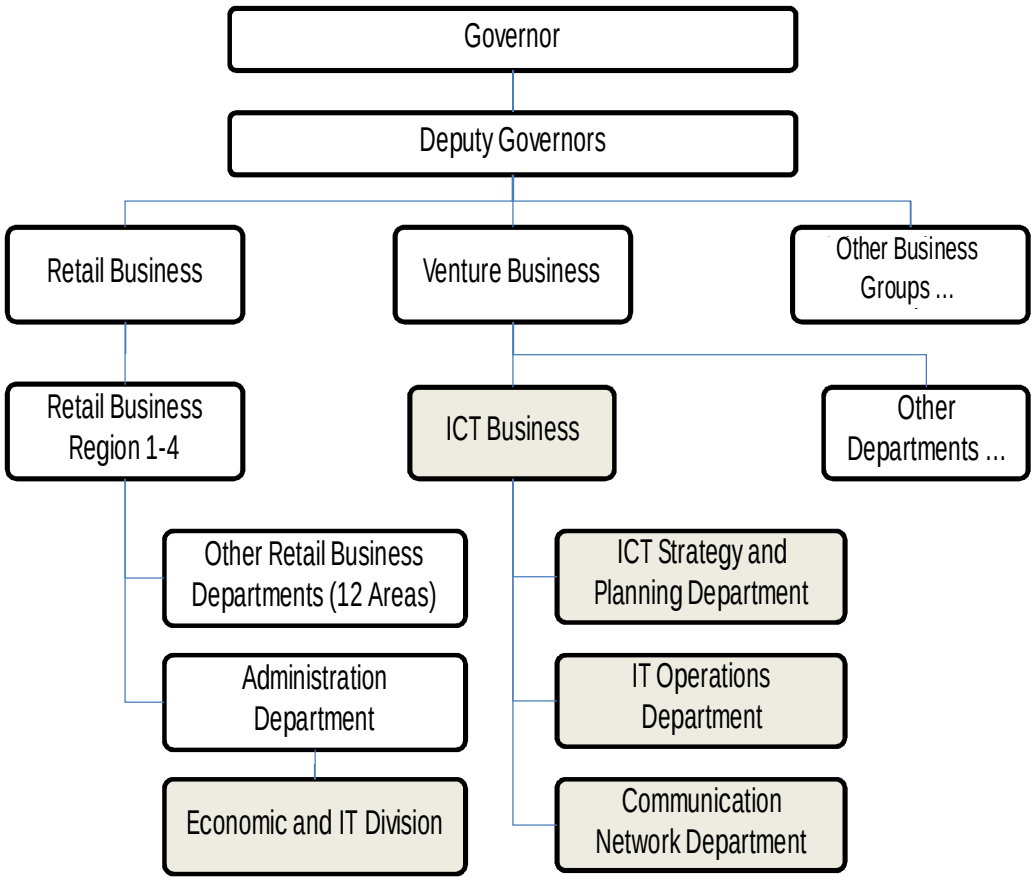



Figure 14 ENERGY1's organization chart (shortened version shows only the ICT Unit)

***ICT Master Plan Revision Project***

ENERGY1 had an ICT master plan for 2008-2012 which was used to guide ICT project investment and implementation. After the plan had been used for one year, the organization was required to revise the plan due to external changes and internal demands. Therefore, the ICT Master Plan Revision Project was set up by the ICT Strategy and Planning Department. They employed a team of consultants to conduct the project whose expected output was a new ICT master plan for the years 2011-2014, and ICT strategic direction for the years 2015-2020. The scope of the plan covered information systems, network communications, and IT organization management.

There were several principle ideas for planning including (1) enterprise-wide system integration, (2) business process improvement, (3) preparing for external changes, (4) IT governance, and (5) support for the organization's strategies. The process of ICT master plan formulation started with an anaysis of the internal and external environment of the organisation. The internal environment included the strategic requirements in the organization's strategic plan, the deputy-governor interview, the operational requirements from the interviews of other business groups, and the firm's current status in regard to the existing IT system, network communications, and IT organization management. The external environment comprised government policy, IT trends, and the requirements of stakeholders.

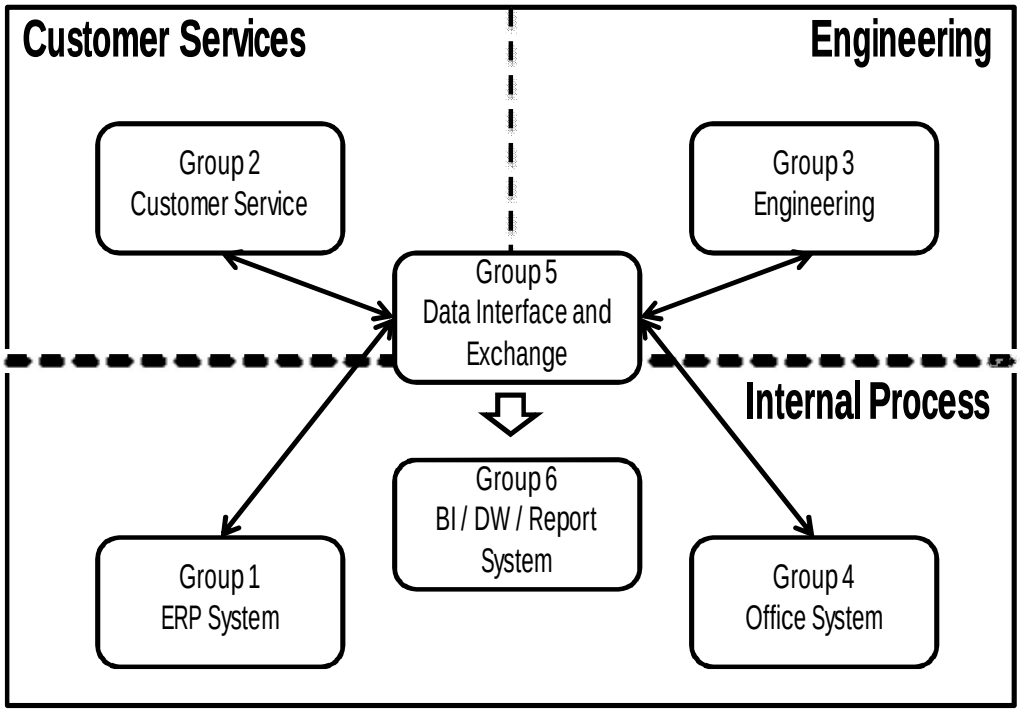



Figure 15 System overview of ENERGY1 (Before plan revision)

The consultant team reviewed the original plan and established the current status of the existing system. Then they classified the IT system of ENERGY1 into six groups based on the role of the systems which were (1) enterprise resource planning, (2) customer services, (3) engineering / operational systems, (4) internal administration / office systems, (5) external systems / data interface and exchange, and (6) business intelligence / data warehouse / reporting systems. The list of IT systems within those groups was a mixture of legacy systems, just deployed systems, developing systems, and systems preparing for implementation. The role of the ICT Master Plan Revision Team was to modify the list of potential IT projects in the old plan to bring them into accord with the current situation and policy. Due to the evolution of technology, some projects were re-scoped with new technolgy features, some projects were combined into one project to cut off redundant projects, and some projects were discarded due to the change in requirements. The projects in the original plan which had been implemented, were excluded from the new plan and were used as a initial criteria for the new design.

The ICT unit, together with the consultants, gathered requirements from the owners and users of the above systems. After supplementing this with external information, the ICT Master Plan Revision Team designed a new plan and categorized it into seven sub-plans as shown in Figure 16.

Plan 1 (network and communication) was focused on infrastructure implementation for communiation among the units located all over the country, and involved the installation of a core network, an aggregation network, and an access network. The projects in this plan would be implemented based on the theme of a smart grid which was the core objective of the organisation. Some examples of projects in this plan were a fiber optic implementation, an IP core network implementation, a SDH network improvement, an integrated network management system implementation, and network development for supporting a data center.

Plan 2 (IT resources) was developed to provide hardware devices for enhancing the organizational-wide IT capacity and availabilty of the system. The projects in this plan were ICT resource fulfillment (PC / hardware procurement) and a server consolidation project.

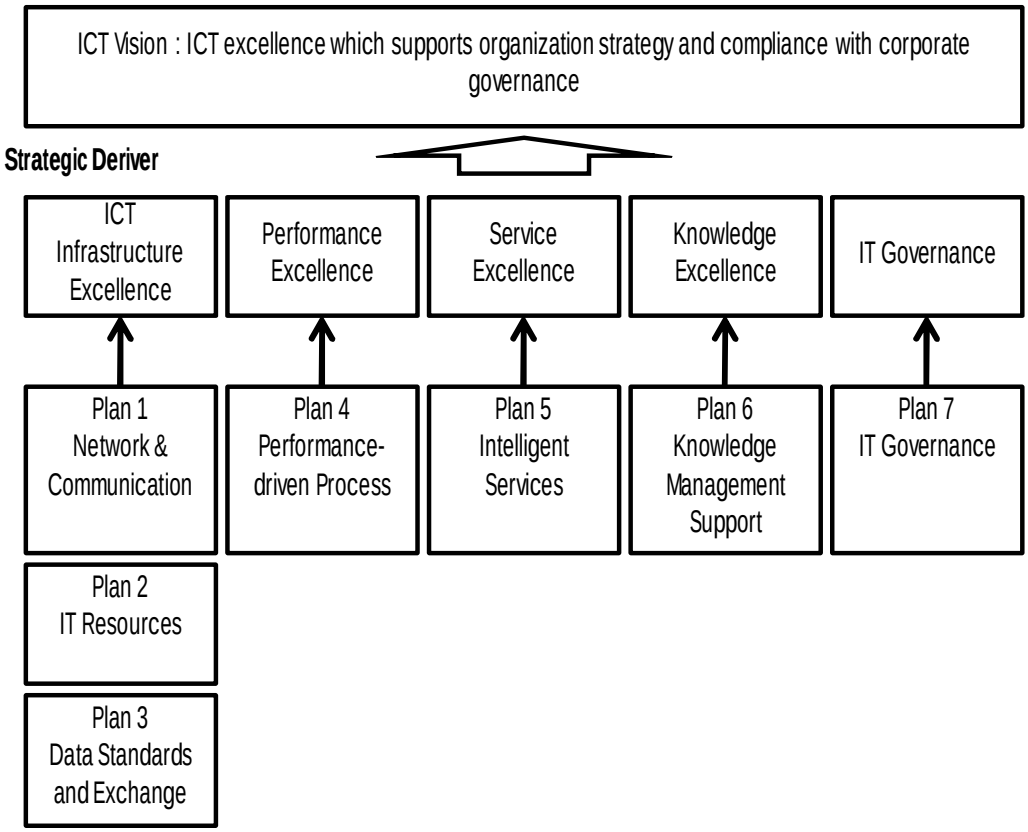



Figure 16 Strategic plan in the ICT master plan for ENERGY1

Plan 3 (data standards and exchange) was concerned with the standardization of the data dictionary used organization-wide and with system integration. The projects in this plan were enterprise application integration, inter-organization data exchange services, and the creation of a standard data dictionary.

Plan 4 (performance-driven processes) contained the list of projects which were expected to enhace the performance of operation functions such as the supply chain management system, smart contract management, GIS, EDMS, the business intelligence system, business process reengineering and improvement, and ERP system enhancement.

Plan 5 (intelligence services) covered the requirements of internal and external customer services including intelligence customer relationship management, call center, and smart offce projects.

Plan 6 (knowledge management support) aimed to support the development of human resource knowledge and skills through the knowledge management project, and the IT-HR development project.

Plan 7 (IT governance) contained a list of projects related to IT govenance such as a data center project, a disaster recovery center, and IT standard compliance.

All plans included phasing, scope setting, and budget coordination between the ICT Master Plan Revision Team and the owner of the system. The plan was approved by the Steering Committee of the ICT Master Plan Revision Project which had the deputy-governor as chairman. It was then presented to the Board of Executives for budget approval. After the plan and budget were approved, the projects were to be executed by the owners of the individual projects.

***IT Investment Process Summary***

The situation of ENERGY1's IT investment process can be observed only in the ICT Master Plan Revision Project which is the activity of IT selection phase. The steps of planning and analysis were mainly performed by external consultants. IT staffs from ENERGY1 were assigned to coordinate and provide the information for the process. The meetings with functional teams were performed to gather the information of IT existing status and operational requirements. IT master plan was design based on the main criteria to serve the strategy plan of ENERGY1, done by policy and planning team of the organization, which reflected the internal and external environment in the analysis of the plan. Moreover, consultants were asked by the executives to provide the best solution based on the latest trend of IT in the master plan. From the meeting of the planning team, all projects agreed to include in the master plan tend to be approved by the executives. However, the project's benefit scoring and budget were provided in the plan as the rationale why these projects were included in the master plan.

### 4.1.3 ENERGY2

The observation of ENERGY2 took place from April 2008 to May 2009 which coincided with the implementation of the Enterprise Resource Planning System (ERP) for the entire organization. During that period, the ERP implementation was the highest priority IT project for the organization. Consequently, a considerable budget and significant resources were dedicated to this project. Being one of the Steering Committee's consultants, the observation was mainly focused on project management which demonstrated processes in the control phase, the evaluation phase, and some parts of the selection phase in the IT investment process.

#### *Background*

ENERGY2, a state enterprise under the Thai Ministry of Energy, was established in 1969. It has built, and now owns and operates several types of different sized power plants across the country with a combined installed capacity of 13,617.10 MW, which accounts for about 47.8 percent of the country's 28,479 MW generating capacity. ENERGY2 also purchases electric power from private power companies and neighboring countries. The vision of the firm is to be a world-class organization in electricity and related businesses. The organization had refined its strategic directions for organizational development to better adapt to actual socio-economic changes and to support its future operations including (1) being a high performance organization, (2) expanding its core business and related businesses into international markets, (3) being a leader in energy conservation and environmental protection, (4) being considered a trustworthy organization through gaining social trust and public acceptance, and (5) having good governance with transparent and accountable operations, and sound management standards that focus on continuous improvement and preparation of the new generations for change.

The organizational management is headed by a board of directors which makes decisions concerning policies, determines corporate strategies, oversees the organization's overall operations, and appoints executive officers including the

Governor, Deputy-Governors, Assistant Governors, and Division Directors. The IT Division is located in the Policy and Planning section. Figure 17 shows ENERGY2's organization chart. Since the observation of this case is only in the ERP implementation project, the researcher focused on the participant in the situation who is the ERP project team rather than entire IT division of the organization. The detail of ERP the ERP project team is presented in the next section.

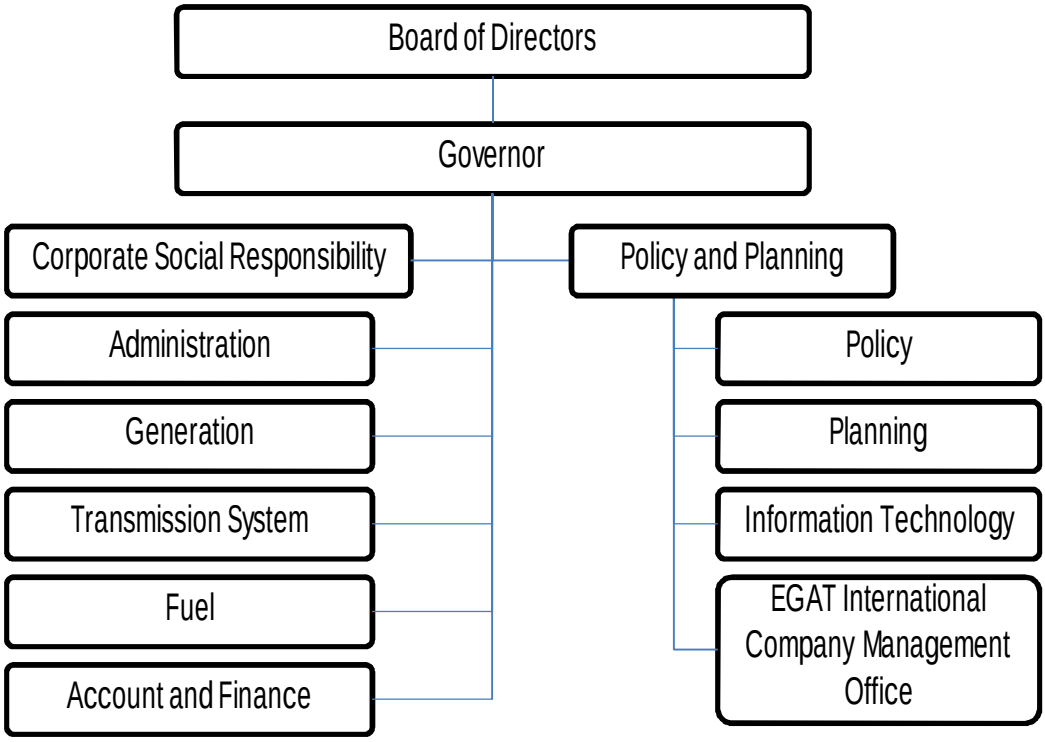



Figure 17 ENERGY2's organization chart (shortened version shows only Policy and Planning Unit)

***Consultant Project for project management of ERP implementation***

ENERGY2 started their ERP implementation project in 2007. The timeframe for the project was 36 months, and the system had to be up and running (go-live) within 24 months. During this period the project had experienced delays and conflicts concerning contract management. Consultants with expertise in the project management of ERP implementations were hired as advisors to the project management office in order to reconcile the disagreements, to drive the project forward to reach the

milestones, and to provide supporting information for decision making by the Steering Committee. The chairman of the Steering Committee was the Deputy-Governor of Policy and Planning, and the Assistant Governor of IT, while the CIO was the vice-chairman of the committee. The working party for the project comprised staff from ENERGY2 and contract implementers. The project was managed by the Project Management Office, and reported directly to the Steering Committee which was the arbitrator of the project. The structure of the project team is shown in Figure 18.

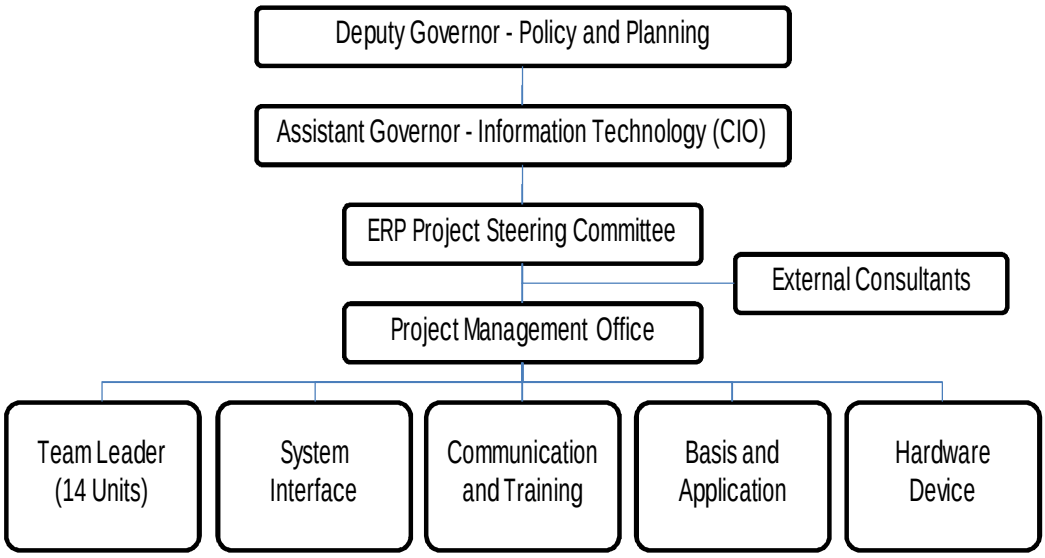



Figure 18 The structure of the ERP project team (ENERGY2)

During the period of observation, the ERP project experienced problems in unit testing, as well as being behind schedule with integration testing of the system. Moreover, the vague requirements and processes in the business blueprint led to repeated changes in the business logic and program during the testing, which then delayed the project. To reduce the generation of system changes, the implementer became inflexible in regard to change requests. This caused disaffection among team leaders and users at ENERGY2, as indicated in a field note from a team leader meeting which stated the *"[team leader said that] if he did not get what he wanted [the modification of a programming function] he would not sign off on the functional specification".* Many issues were pending and there was no decision making leading to viable solutions.

A compromise was reached when the external consultants suggested that the team aim for the original objectives of the ERP implementation. They said that customization of the program might not be the best solution. It would be better if users could change their traditional process to improve the overall process. This initial solution was adopted to control the emergence of unnecessary change requests. The project manager set time limits for change request submissions. In future, the change request form would indicate the time and cost of each issue, but the cost section was to be excluded from the document sent to key users to avoid a conflict of interest. All of the change requests would be filtered by the PMO while the Steering Committee, headed by the Deputy-Governor would make the final decision. Finally, the problem of change request pending issues that obstructed the project for a long time was solved and all change requests were decided in only three meetings with the Deputy-Governor.

***IT Investment Process Summary***

The situation of ENERGY2's IT investment process is the event in the ERP project implementation which there is no activity of analysis and planning happened in the time frame of the observation. The observation is mainly on the implementation and control process. As mentioned in the case detail, ENERGY2 followed the implementation and control methodology of the implementer. However, there were problems caused by conflict and project management issues. The main reason was the project manager and team leader did not make clear decision and keep the issues in the pending status. Many change requests which cost the project were created without concerning of the project time frame. Then the process of assessment and selection was performed to approve only the change requests which were essential to the core business process and affected on the go-live milestone. Since this project spent the amount of cost and resources, the project manager was asked by the executives to provide the information about the benefit of the project. External consultants had offered the solution about post-implementation evaluation service by IT provider, until the end of the observation this project was still pending.

### 4.1.4 UNIVERSITY1

The UNIVERSITY1 case was based solely on historical data. The source of the data was documents and reports covering the period 2004-2008 which was the period of intensive IT investment by the organization. The following section provides details of this case.

#### *Background*

UNIVERSITY1 is a large educational institution which has a long history that began in 1917. UNIVERSITY1 has a total of 41 faculties, departments, colleges, academic, research, and service institutes, and academic offices. There are approximately 20,000 undergraduate students, 10,000 graduate students, and 8,000 government officials and university personnel. During the period 2004-2008, the university was a non-profit organization which had a vision of becoming the nation's source of knowledge and reference, and a mission to produce graduates who could co-operate and compete on an equal basis in national and world arenas. This mission would be supported by continued development of education. In terms of IT management and authorization, the university has a mixture of both centralized and decentralized management styles with the majority of faculties and service institutes having their own IT units to take care of their specific IT requirements. The university has the Office of IT as a central unit which provides IT services, support, and IT infrastructure organization-wide.

#### *The Office of IT*

UNIVERSITY1's Office of IT was established in 1996 to be responsible for setting IT policy, providing IT services and support, and coordinating with internal and external units on IT issues. In the early period of service, the Office of IT concentrated on network infrastructure implementation and maintenance. Between 2004 and 2008, which is the period of the observation in this study, the university again had an intensive IT investment period under the theme of "unified ERP and single source of data". At that time, UNIVERSITY1 had some legacy systems including a human resource management

system, a financial management system, and an e-document system which were the responsibility of the Office of IT. Therefore, apart from routine operations, the additional tasks of the Office of IT were to upgrade and replace the legacy systems, to develop new applications to enhance information accessibility, and system integration. Details of these IT projects will be provided in the next section.

As mentioned previously, the Office of IT's functions were to provide IT services, and to support its customers who were faculties, service institutes, other office units, lecturers, staff, and students. Its mission, which became part of the IT policy at that time, was (1) to provide infrastructure which was capable and available to support the requirements of the systems and the users, (2) to support and implement information systems for users as required, (3) to deliver services such as IT facilities, training, and consulting services, and (4) to build up relationships with IT business alliances. The Office of IT's organization chart is shown in Figure 19.

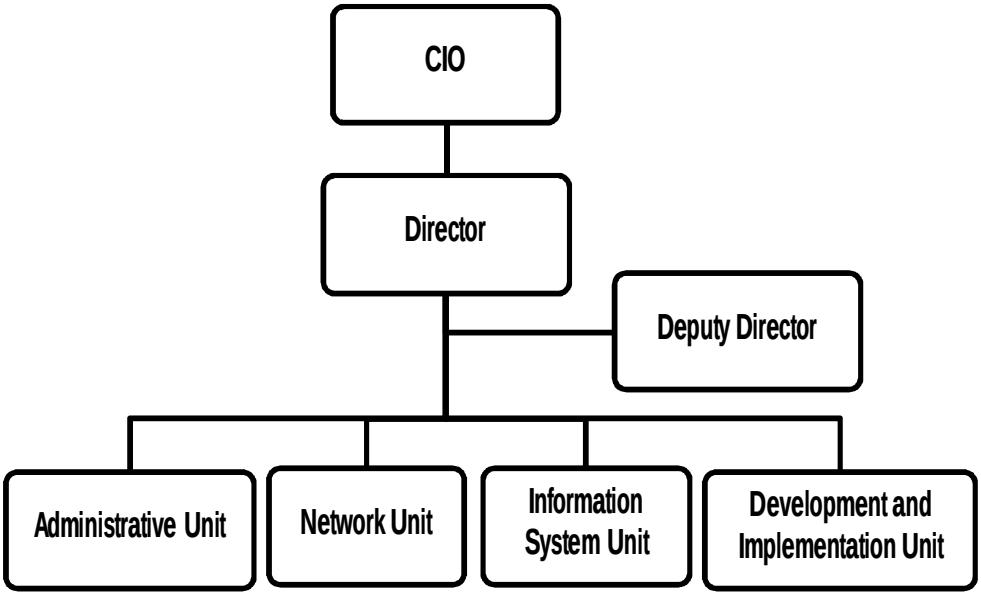



Figure 19 Office of IT's organization chart (UNIVERSITY1)

The top level of the Office of IT's organizational chart was occupied by the Chief Information Officer (CIO) who was a member of the Executive Board of UNIVERSITY1. The Office of IT was headed by a director. There were four units, the

Administrative Unit, the Network Unit, the Information System Unit, and the Development and Implementation Unit, reporting to the Director. The Administrative Unit took care of the administrative work for the office such as paper work and coordination. The core functions of the Network Unit were to design, implement and manage the telecommunications systems (internet and intranet) for business applications, to configure and maintain infrastructure components including routers, switches and firewalls, to support enterprise networks and related data systems such as the voice and wireless communication services, to monitor bandwidth utilization for core infrastructure components, and to recommend hardware and software solutions to meet capacity requirements. The Information System Unit was assigned to manage and support the IT functions on a day-to-day operational basis, to provide hardware and software or application systems for faculties and other departments, and to manage and maintain servers for the university's systems or other departments' applications. The Development and Implementation Unit was responsible for the development and implementation of strategic IT projects in the IT plan.

***IT Planning***

Once the strategic plan of UNIVERSITY1 had been developed, the CIO already knew which IT projects would be in the plan. He communicated his ideas to the IT Director, the Deputy-Director and IT Planning Team which reported to the Development and Implementation Unit. The strategic themes of the CIO were system integration and single source of data. The names of the IT projects were then listed. The first set contained the unified ERP project (from the theme system integration and a single database), the business intelligence project (from the theme a single source of data), and web portal (from the theme a single source of data since accessing different data sources was transparent to portal users). The second set of projects came from the list of existing IT services that required enhanced including the infrastructure upgrade project, the electronic document management system project (EDMS), and the other service systems providing services for the students, faculties and staff of UNIVERSITY1.

The first draft of the IT strategic projects plan was drawn up to describe the type and position of the system as displayed in Figure 20.

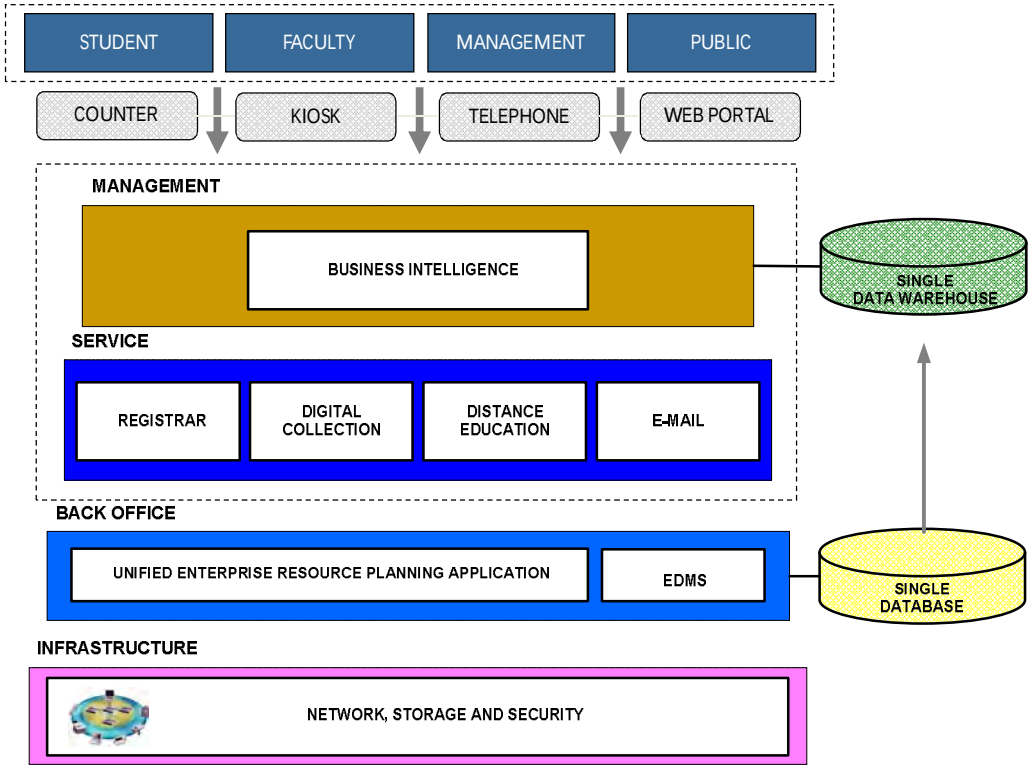



Figure 20 The first draft of the IT strategic projects plan

Thereafter, the CIO instructed the planning staff to compare the IT strategic projects with the strategy map of the university in order to review the alignment of IT and business strategy, and to use this mapping for communication with the Board of Executives and relevant business units. In the process of mapping, some IT projects were added to the plan in response to users' requirements. In Figure 21, the rectangular boxes are the strategic objectives from each perspective in the balanced scorecard of the university, while the capsule-shaped boxes are the IT projects which are IT initiatives designed to support the success of those objectives. Investment was planned for all of the IT projects on this map during the time frame 2004-2008.

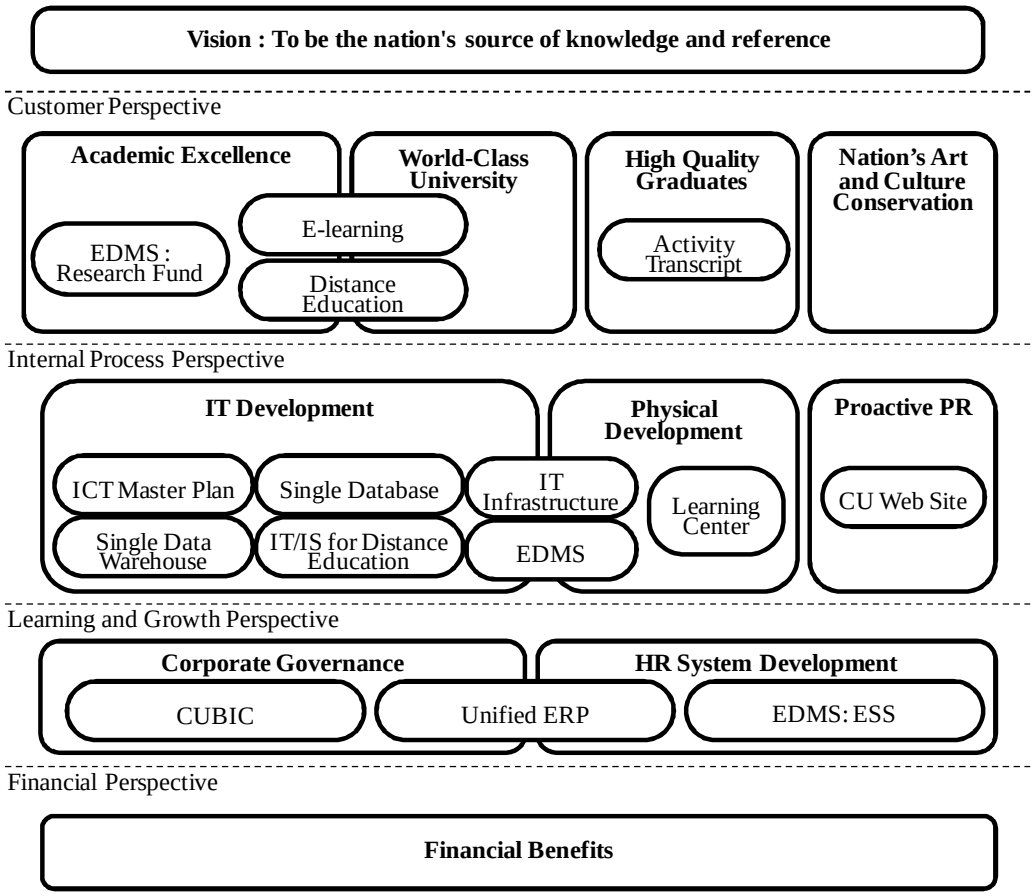



Figure 21 IT Strategy map of UNIVERSITY1

### *IT Selection*

Once the list of IT projects was depicted in the IT strategy map, without prioritization since all projects were classified as strategic projects, IT selection was performed. In this case, the IT selection was not choosing IT projects for investment from the list because they were already approved for investment, but rather the selection of IT providers for the projects. The IT projects were assigned to staff who then generated the TOR for hiring or purchasing. Before that the staff would gather the initial requirements from users, and obtain information on the products and services from several IT providers in the market. The scope, details, time frame, and budget of the projects were indicated in this process and had to be approved by the CIO.

The types of IT projects at UNIVERSITY1 can be classified broadly into two groups which were (1) hardware and infrastructure projects, and (2) system development projects. The former refers to the projects involving hardware and device purchases such as network devices, servers, storage, UPS, and PCs. The Network Unit was responsible for this type of project. The IT staff worked with IT providers in the process of information gathering until the system installation and configuration processes were finished. Since they were technical projects, it was unnecessary to coordinate with business users. The benefits written in the project's proposal to convince the CIO to grant approval were mainly intangible outputs such as incremental increases in bandwidth, storage, mailboxes, processing speed, and network coverage. The criteria used to select the IT provider for hardware and infrastructure projects were specifications, features, price, services, and special offers from the IT provider.

System development projects were assigned to the Development and Implementation Team. An additional process for this type of project was coordination with the users who were the owners of the systems, and collection of the additional selection criteria which were the requirements of the users. While the hardware and infrastructure projects used selection criteria and justified benefits based on tangible aspects, the system development projects relied on achieving business objectives such as system integration, convenience for users, process reduction, data accuracy, etc.

After formulating TOR, the projects went through the public organizations' procurement regulations which were invitation to tender, quotation consideration, winner notification, and contract signing. The next stage was project implementation. The traditional procurement rules of a public organization had a weakness in relation to IT acquisition. The tender who offered the lowest price would win the auction. This could permit a low-quality IT provider to win the auction, and then the university would not acquire IT products and services with an acceptable level of quality. The Office of IT solved this problem by using the proposed system specifications as the main criteria. The auction committee rated the proposal of each bidder, and the one which had features that most closely matched the system

requirements was given the highest score. Proposals with a score higher than 80% were passed on to the next step, price competition. The IT provider who had highest score and submitted the best offer, won the auction. The contract was signed and the implementation activities were performed as planned in the proposal. Then, the system was delivered at the end of project after conforming to the acceptance approval process. There was an examination of the output of the project, but there was no formal evaluation process in the post-implementation period.

***IT Investment Process Summary***

The IT investment process of UNIVERSITY1 started from the CIO's policy. In the process of the IT and business strategy alignment review, several IT projects were added in the IT strategic plan by gathering requirements from functional units which were assigned to be the owners of the strategic objectives in the UNIVERSITY1's strategy map. All of the IT projects in IT strategic plan were considered as high priority projects and were approved to be implemented with the criteria of IT supporting the business strategy. The projects that the process owners were ready for the project implementation, were the first candidates to be implemented. Budget and description of projects' benefits were provided in IT proposal as the information to communicate with executives and functional units and to convince them to assign staffs and resources into the projects. IT providers selection process was conformed with the procurement regulations of the organization. The selection criteria were the scoring of proposed system specification and project costs. The implementation and control process was performed by followed the IT providers' methodology. All the processes from planning to implementation were closely monitored by CIO. There was no the evidence of project post-implementation evaluation found in this case.

## 4.2 Case Comparison

Analysis of individual cases enables the researcher to understand situation that occurs in each case, while the across-case analysis reveals the pattern

formed by the confluence of meanings within those cases. This section presents a comparison of cases based on the dimensions from the conceptual framework of the IT investment process.

According to the conceptual framework for the IT investment process, the activities of IT investment include analysis and planning, assessment and selection, implementation and control, and post-implementation evaluation. The empirical data reveals the situation at each stage. Using field notes from the observation and the documents of cases, the research captured the pattern of the IT investment process for all cases. It begins with the analysis and planning process.

The empirical data shows the first pattern which is that the requirement for IT investment was initiated by three groups of people in the organization. These were (1) the executives, (2) the business functional units, and (3) the IT functional unit. A summary of the empirical evidence is provided in Table 11 and Table 12.

(Remarks: Because the observation scope for ENERGY2 is in the ERP implementation project, the scenario of IT selection phase of this case is in the situation when new requirements occur, which lead to more investment or time and resource spending.)

Table 11 People in the IT planning stage

| | **HOSPITAL1** | **ENERGY1** | **ENERGY2** | **UNIVERSITY1** |
|---|---|---|---|---|
| **Persons who Initiate IT Projects** | - CEO<br>- Doctors<br>- Functional Manager<br>- Consultants<br>- IT Division | - CIO<br>- Consultants<br>- Functional Unit<br>- ICT Business Line | - Deputy Governor<br>- Key users<br>- IT Unit | - CIO<br>- Network Unit<br>- Functional Unit |

| | | | | |
|---|---|---|---|---|
| **Persons who Formulate the IT Plan** | - IT Manager | - ICT Strategy and Planning Department<br>- External Consultants | - Project Management Office (PMO) | - Deputy-Director,<br>- Development and Implementation Unit |

Table 12 Persons initiating IT requirements comparison among cases

| **Initiated IT Requirement Persons** | **HOSPITAL1** | **ENERGY1** | **ENERGY2** | **UNIVERSITY1** |
|---|---|---|---|---|
| **Executives** | Initiate IT projects which support core business such as e-medical record project | Initiate via vision statement | Initiate the requirement for the EIS Project | Initiate strategic IT projects such as Unified ERP, CUBIC |
| **Business Functional Units** | Initiate IT projects which support functional operations such as the Asset Management Project, CCTV Project | Initiate IT projects which support their functional operations, or of which they are the owner | Initiate the requirement for change requests | Initiate IT projects which support functional operations such as the Activities Transcript project, EDMS: Research Fund Project |

| Initiated IT Requirement Persons | HOSPITAL1 | ENERGY1 | ENERGY2 | UNIVERSITY1 |
|---|---|---|---|---|
| **IT Unit** | Initiate IT projects which are concerned with IT infrastructure such as the IT Consolidation Project, Wireless Network project | Initiate IT infrastructure projects and other IT projects by reflecting on the requirements of executives and business functional units | Initiate the requirement for disaster recovery site of ERP system | Initiate IT infrastructure projects |

At HOSPITAL1, the people who initiated IT projects were mainly from the IT Unit or from the IT consultants in the IT Assessment Project (The IT Assessment Project was undertaken by the IT Unit as the owner of the project, so the output of the project was classified as output from the IT Unit.) They combined the rough ideas of the executives with the business unit's requirements, and then proposed the names of potential IT projects for the IT roadmap. At ENERGY1, the staffs who initiated IT projects were from the IT Unit, but there were business units who were the owners of systems such as the systems in the customer service group, and the engineering group, who also played an important part in initiating IT requirements. The executives of ENERGY1 just stated their vision and provided a rough idea of IT requirements as principles for further initiatives by the business and IT units. The major initiator of IT requirements at ENERGY2 cannot be determined because the evidence shows that a group of people proposed the requirements in different scenarios as shown in Table 12. The IT projects at UNIVERSITY1 were mainly initiated by the CIO and the IT Unit responsible for completing the roadmap initiated by the CIO.

The initiatives of each group of people stem from different sources which the researcher grouped by the factors presented in the framework. Table 17 shows the factors influencing IT requirements for the group of people in each case. In the case of

HOSPITAL1, executives' IT requirements stem from the IT status of competitors or firms in the same industry, customer demand, and IT trends and standard compliance. In contrast, business and IT units thought that customer demand and competition issues would already be reflected in the strategic plan, so they were concerned only with how to support the strategic plan, the standards they had to conform to, and how to operate effectively. At ENEREGY1, the basic ideas for IT strategic investment projects came from executives who were concerned with all the factors influencing IT investment in the framework except supplier terms and conditions. The absence of supplier terms and conditions will be discussed later. Similar to HOSPITAL1, the strategic plan for ENERGY1 reflected concerns for all aspects of the business. The business and IT unit obtained their ideas from the strategic requirements and then combined them with IT innovation and regulation constraints, before converting them into an action plan with a list of potential IT projects. Although the situation at ENERGY2 may not fit the interpretation at this stage, the data does show that the executives developed the need for change from external factors, while business units derived their need for change from operational requirements which aligned with the strategic direction of the organization. The IT unit had a supporting role and therefore supported the requirements of the executives and the business unit, and enhanced the initiative by using its knowledge of the technology available in the market. Like the prior case, the CIO of UNIVERSITY1 formulated his IT vision by using the strategic plan of the university and the IT solutions available in the market. Then the IT unit combined the strategic requirements and the operational requirements from business units into the IT investment plan. There was no issue of supplier conditions to be considered because the case firms did not coordinate or have transactions with their suppliers in terms of a business-to-business model, so there was no requirement for a system interface with their suppliers.

Below are listed the issues that concerned staff when initiating IT requirements.

Table 13 Issues of concerning for the person initiating IT requirements (HOSPITAL1)

| Factors | HOSPITAL1 | | |
|---|---|---|---|
| | **Executives** | **Business Unit** | **IT Unit** |
| **Strategic Requirement** | - | - Strategic Plan<br>- Executives' Vision | - Strategic Plan<br>- Executives' Vision |
| **Operational Requirement** | - | - Routine operation<br>- A requirement for problem solving | - Requirements of users<br>- Requirement to provide IT service support for users |
| **Social and Regulatory Changes** | - JCI standard | - JCI standard<br>- ISO, HA | - JCI standard |
| **Customer Demand** | - Service time reduction | - | - |
| **Industry Competition** | - The use of an EMR system,<br>- the improvement of the call center system | - | - |
| **Supplier Terms and Conditions** | - | - | - |
| **IT Availability and Acquirability** | - Paperless system | - | - System virtualization |

Table 14 Issues of concerning for the person initiating IT requirements (ENERGY1)

| Factors | ENERGY1 | | |
|---|---|---|---|
| | **Executives** | **Business Unit** | **IT Unit** |
| **Strategic Requirement** | - Strategic Plan | - Strategic Plan<br>- Executives' Vision | - Strategic Plan<br>- Executives' Vision |
| **Operational Requirement** | - | - Routine operation<br>- A requirement for problem solving<br>- A requirement for enable a new process | - Requirements of users<br>- Requirement to provide IT service support for users |
| **Social and Regulatory Changes** | - National ICT Master Plan<br>- E-Government<br>- Ministry regulation | - | - COBIT<br>- ITIL<br>- ISO |
| **Customer Demand** | - Customer service excellence<br>- One stop service | - | - |
| **Industry Competition** | - ERP system of the firms in the same industry | - | - |
| **Supplier Terms and Conditions** | - | - | - |
| **IT Availability and Acquirability** | - IP Convergence<br>- Application for best practice<br>- Smart GRID | - Knowledge management<br>- IT governance | - Standard data exchange<br>- High performance hardware and network devices |

Table 15 Issues of concerning for the person initiating IT requirements (ENERGY2)

| Factors | ENERGY2 | | |
|---|---|---|---|
| | Executives | Business Unit | IT Unit |
| **Strategic Requirement** | - | - Executives' Vision | - Executives' Vision |
| **Operational Requirement** | - | - Routine operation | - Requirements of users<br>- Requirement to provide IT service support for users |
| **Social and Regulatory Changes** | - | - Financial and accounting regulation | - |
| **Customer Demand** | - | - | - |
| **Industry Competition** | - EIS and ERP system of the organizations in the same industry | - | - |
| **Supplier Terms and Conditions** | - | - | - |
| **IT Availability and Acquirability** | - BI and EIS | - | - High performance hardware and network devices<br>- Disaster recovery site |

Table 16 Issues of concerning for the person initiating IT requirements (UNIVERSITY1)

| Factors | UNIVERSITY1 | | |
|---|---|---|---|
| | Executives | Business Unit | IT Unit |
| **Strategic Requirement** | - Executives' Vision<br>- Strategic Plan | - Strategic Plan | - Executives' Vision |
| **Operational Requirement** | - | - A requirement for enable a new process | - Requirements of users<br>- Requirement to provide IT service support for users |
| **Social and Regulatory Changes** | - | - | - |
| **Customer Demand** | - Internet and mail service | - | - |
| **Industry Competition** | - | - | - |
| **Supplier Terms and Conditions** | - | - | - |
| **IT Availability and Acquirability** | - BI<br>- Web portal | - | - |

Table 17 Factors influencing IT requirements for each group from the cases

| Factors | HOSPITAL1 | | | ENERGY1 | | | ENERGY2 | | | UNIVERSITY1 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EX | BU | IT | EX | BU | IT | EX | BU | IT | EX | BU | IT |
| **Strategic Requirement** | - | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Operational Requirement** | - | ✓ | ✓ | - | ✓ | ✓ | - | ✓ | ✓ | - | ✓ | ✓ |

| Factors | HOSPITAL1 | | | ENERGY1 | | | ENERGY2 | | | UNIVERSITY1 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Social and Regulatory Changes** | ✓ | ✓ | ✓ | ✓ | - | ✓ | - | ✓ | - | - | - | - |
| **Customer Demand** | ✓ | - | - | ✓ | - | - | - | - | - | ✓ | - | - |
| **Industry Competition** | ✓ | - | - | ✓ | - | - | ✓ | - | - | - | - | - |
| **Supplier Terms and Conditions** | - | - | - | - | - | - | - | - | - | - | - | - |
| **IT Availability and Acquirability** | ✓ | - | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ | ✓ | - | - |
| * EX : Executives, BU: Business Functional Units, IT: IT Unit | | | | | | | | | | | | |

After a requirement had arisen, the IT units of all cases (except the case of ENERGY2 which could not be observed) undertook an IT status survey in order to define the way to the desired stage of IT, and then the IT roadmap was designed. HOSPITAL1 and ENERGY1 undertook project prioritization and phasing in this step. In ENERGY1 redundant projects were also eliminated during this step

There was no evidence of project prioritization and phasing at UNIVERSITY1 and ENERGY2. However, in the case of ENERGY2, there was a prioritization in change management consideration, and in order to solve the problem and meet the milestone of the project, the ERP project was treated as the highest priority IT project, as stated earlier, due to the resources needed on this project and the impact of the project on the organization. Table 18 shows details of the project prioritization in each case.

Table 18 Project prioritization in each case

| | HOSPITAL1 | ENERGY1 | ENERGY2 | UNIVERSITY1 |
|---|---|---|---|---|
| **Prioritizing Methods** | Phasing the project into phase I,II,III | Scoring | Marked as High, Medium, Low | no evidence of project prioritization and phasing |
| **Prioritizing Criteria** | - Serve the requirements of the JCI standard<br>- Necessity for business process<br>- Prerequisite for other projects | - Business problem solving (weight=0.4)<br>- Enhancing business performance (weight=0.3)<br>- Being infrastructure for the future system (weight=0.2)<br>- Enhancing customer service capability or serving the requirements of TRIS (weight=0.1) | - Effect on the go-live milestone<br>- Dependency on other programs | - |

During the process, the IT unit in all cases would contact the IT provider for information about IT solutions in the market. After a list of potential IT projects was created, and projects' owners were assigned, the IT unit who took responsibility for developing the IT plan, gathered requirement specifications from the projects' owner in order to formulate a detailed plan for each project. In this step, if there was any project without an official owner, the detailed plan for that project would not be generated, and

the status of the project would be remain pending or it would be removed from the IT Master Plan. For example in the CRM project at HOSPITAL1, the plan for the project started with a call center improvement project, but since the supervisor of the call center unit had resigned, there was no current owner for the project. Consequently, although the CRM and the call center project were still on the IT roadmap, the status of these projects remained pending.

In reality, the steps in the IT plan progression presentation for executives happened consecutively throughout the period of the meetings. Finally, the IT projects' plan with its scope and budget would be approved by the final decision maker. In this stage, iterative plan modification would take place until the project was approved. Table 19 shows the criteria used in the IT proposal to convince the investment decision makers.

Table 19 Criteria for convincing decision makers in each case

| | **HOSPITAL1** | **ENERGY1** | **ENERGY2** | **UNIVERSITY1** |
|---|---|---|---|---|
| Final decision maker | CEO | Steering Committee of the ICT Master Plan Revision Project | Steering Committee of the ERP project | CIO |
| Criteria used to gain approval | - Supporting JCI standard<br>- Business requirement<br>- Process enabling<br>- estimated cost comparison (only IT Consolidation Project) | - Benefit of project<br>- strategic support<br>- budget is considered as support information | - business need compared with cost | - strategic support |

Since HOSPITAL1 was aiming for JCI accreditation in 2011, the highest priority projects that the CEO of HOSPITAL1 would approve were the projects supporting the achievement of JCI accreditation such as the EMR, CCTV and queue systems. Other system development projects used benefits from process enabling and business requirement support as convincing criteria. IT infrastructure projects such as the IT consolidation and wireless projects, used benefits from concrete outputs such as network coverage area, system performance, and estimations of cost reductions. The plan for ENERGY1 had stated the project's benefit and relationship with the organization's strategy. For ENERGY2 in regard to change request approvals, the Deputy-Governor of Policy and Planning and the Deputy-Governor of Accounting would decide by looking at critical business needs and then weighting them against with costs of executing the change request. Change requests which were critical to the business process and those which were moderately critical to the business process and had execution costs would be approved. In the case of UNIVERSITY1, the CIO had already approved the IT project since the IT roadmap had been approved. The main objective of the detailed plan approval was to inspect the soundness of the scope and the budget for the IT plan.

It is evident that there was a business-IT alignment from the first planning steps until the project was approved for investment. The IT planner in all cases formulated a plan based on business requirements, and the executives also approved the project based on the criteria that the project would serve the business needs of their organizations.

Once the plan was approved, the project owner would coordinate with the IT unit to generate TOR in the cases of public organizations and state enterprises. They would then approach the auction process in accordance with the procurement regulations for public organizations, while the private firm, HOSPITAL1, sent the request for a quotation to potential IT providers. Then they selected a product and service from an IT provider who had proposed the system and service which most closely matched the scope and requirements of the organization. HOSPITAL1 use price negotiation to

control the project acquisition cost. The process used by UNIVERSITY1 has already been described in the case detail section. TOR generating and bidding were not observed at ENERGY1 and ENERGY2.

Table 20 IT provider selection method for each case

| | HOSPITAL1 | ENERGY1 | ENERGY2 | UNIVERSITY1 |
|---|---|---|---|---|
| IT provider selection method | Specific list | Could not be observed | Could not be observed | Auction |
| Criteria for selection | - System and service as required<br>- Acquisition cost<br>- Satisfaction for the IT provider | - | - | - Specification score<br>- Acquisition cost |

After the contract had been signed, project implementation was started. In this step, the case organization undertook their project implementation based on the methodology of the IT providers. No project implementations were observed for ENERGY1. Table 21 summarizes the implementation and control for each case.

Table 21 Implementation and control for each case

| | HOSPITAL1 | ENERGY1 | ENERGY2 | UNIVERSITY1 |
|---|---|---|---|---|
| Implementation control method | - Project management using the methods of the IT providers<br>- Reporting status by period specified in the plan<br>- Ad hoc meetings as required | Could not be observed | - Project management<br>- Team leader meeting<br>- PMO meeting<br>- STC meeting | - Project management using the methods of the IT providers<br>- Weekly meeting |

| | HOSPITAL1 | ENERGY1 | ENERGY2 | UNIVERSITY1 |
|---|---|---|---|---|
| Implementation problems | - There was no confirmation of business process from users<br>- There was no decision making at middle management level<br>- There was a group of users who could not be controlled such as doctors; some of them didn't use the system or accept the system | - | - The creation of issues from users with pending issues was still not decided<br>- Users who were associated with the process gave priority to their routine jobs rather than the project's activities<br>- There was conflict between implementers and organization staff due to distrust of the working experience of the implementers | - Could not detect implementation problems from the historical documents |

When the system had been implemented, the IT provider delivered the system, and then the system was signed off by the acceptance committee of the organization according to their regulations. No formal post-implementation evaluation happened during the period of observation. All processes reflection was illustrated as a process diagram in

Figure 22.

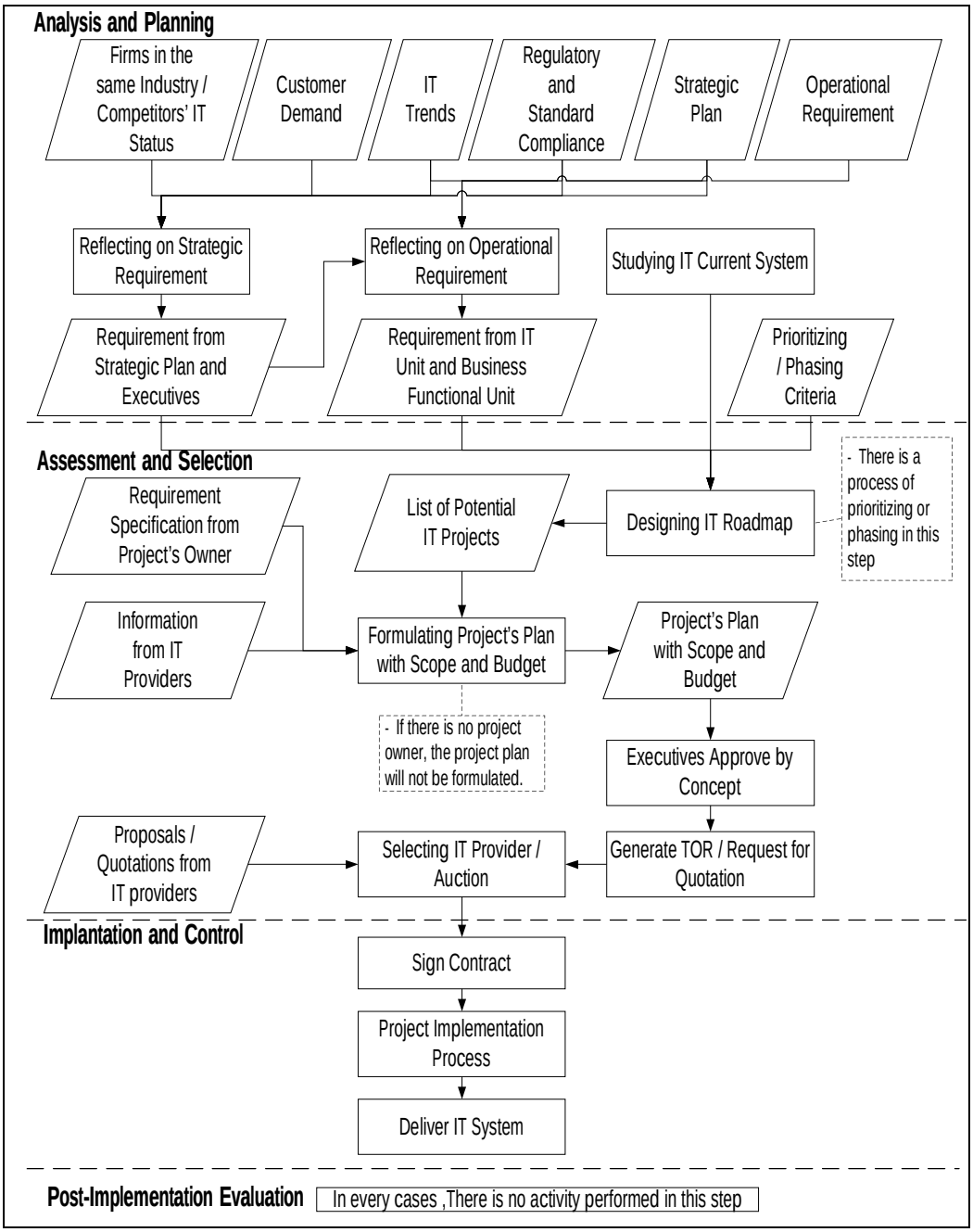



Figure 22 IT investment process diagram: cases reflection

## 4.3 Additional Results

This section presents the results of data interpretation in addition to the components in the conceptual framework from the literature. The issues raised in this section are the situations from the cases, which can alter the process, time spending and results of IT investment.

### 4.3.1 Initiating Person, Project Type, and Project Owner

The results of the data analysis show that the people who identified the need for a change in the IT of the organization were (1) the executives, (2) the business unit, and (3) the IT unit. In the first situation, the executives were responsible for all decision-making, for setting policies and guidelines for the investment, and for aligning the IS-strategy with the business strategy. Even if a Steering Committee was active, senior management should still have overall responsibility for the investment despite the fact that collaboration between the top management, the IT department, and the operative management is essential (Lucas, 1986). One common situation was that the business unit identified the requirement for the IT system which could be either a specific requirement for the system, or just an idea for process enabling by IT. After the initiative was taken, the business unit would coordinate with the IT unit in order to set up a plan (Lucas, 1986; Reponen, 1994). The last situation was when the IT department takes the initiative for the investment. Thereafter the IT department developed policies and guidelines, and at the same time, they also aligned the IS-strategy with the overall strategy (Stephens, et al., 1992). When aligning strategies or business processes, cooperation between the executives and the business unit occurred (Feeny, Edwards, and Simpson, 1992).

From the empirical data, IT projects can be classified into two groups. Group 1 contains technical IT projects, for example, when a project dealt with technical issues such as IT infrastructure development, and hardware and device procurement. It was easy to generate the requirement specification for this group of IT projects, since it

was just like defining the specifications for machinery procurement. This would require expertise and knowledge in the field of technology which was a property of IT staff. Group 2 contained application system development projects which involved business processes or operational functions of the organization, and thus required collaboration with the business unit who owned the process, for example, the EMR project at HOSPITAL1, the group of projects in plan 4 at ENERGY1, the ERP project at ENERGY2, and the activities transcript project at UNIVERSITY1.

The requirement for IT investment could initiate both types of projects. Once the IT project was initiated, it would be assigned to the owner for execution until the end of the process. Interpretation of the data reveals that variations between the initiating person, the project type, and the project owner would lead to different situations for IT investment processes as shown in Figure 23.

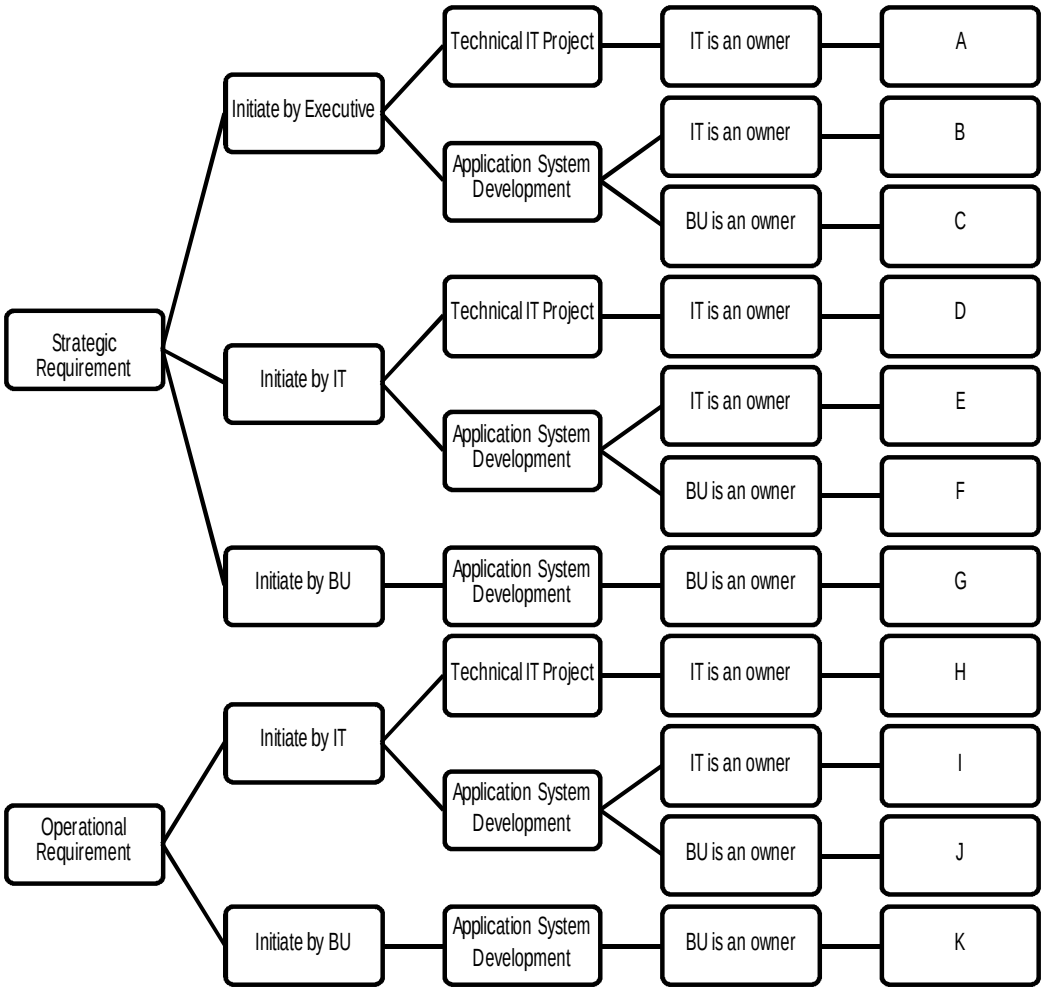



Figure 23 Initiative person, project type, and project owner matching diagram

To support strategic requirements, executives that technical IT projects are owned by the IT unit, application system development projects can be owned by either the IT unit or business units. Application system development projects initiated by business units are hardly ever owned by IT units. In the same way, operational requirements can be supported by initiatives from business units and the IT unit. In this case executives will let the functional units take care of it themselves. Examples of projects in each situation are provided in Table 22.

Table 22 Examples of IT projects

| | HOSPITAL1 | ENERGY1 | ENERGY2 | UNIVERSITY1 |
|---|---|---|---|---|
| Project A | - | - Fiber optic<br>- IP core network | - | - Infrastructure improvement |
| Project B | - EMR | - ERP | - ERP | - |
| Project C | - Nurse activity | - BI | - | - Unified ERP |
| Project D | - IT consolidation | - Server consolidation | - | - |
| Project E | - Asset Management | - | - | - |
| Project F | - | - | - | - |
| Project G | - Queue system | - Smart contract management | - | - Activity transcript |
| Project H | - Hardware procurement | - ICT resource fulfillment | - | - Hardware procurement |
| Project I | - | - | - | - |
| Project J | - | - | - | - |
| Project K | - | - | - | - |

Matching between the initiating person, the project type, and project owner will lead to different situations for IT investment processes from A to K. When considering the properties of projects in the selection and implementation phases, the smoothness of the project approval by executives indicates that those IT projects are favored by executives. This means that the executives will tend to approve these projects more easily. The smoothness of the project execution is reflected in the ability to coordinate among people in the process, which means that projects having to coordinate with many departments will tend to face more difficulties during the project execution process than projects that have no need to coordinate with a lot of people.

In project C, the executives provide ideas at a high level, and then the owner of the project has the responsibility for converting their requirements into an action plan. This may cause difficulties in the decision-making about system specifications. In the unified ERP project at UNIVERSITY1, key users tended not to make any decisions, preferring instead to wait for decisions by the project steering committee. Application system development projects which are initiated by IT units and are assigned to business units (F, J), also need to be interpreted. Moreover, business users may think that they do not need to change when their IT projects are initiated, so they will not prioritize these projects. Also, for the application system development projects to which executives have assigned IT units as owners (J), problems in the implementation and system delivery process may occur, since these projects need support from business users. If the users do not feel a sense of responsibility, they will not prioritize these projects, or even resist changes to their routine activities such as happened in the ERP project at ENERGY2. Similarly, in the application system development projects which are initiated and owned by IT (E, I), the users will not give the required level of importance to the projects since they do not come from the executives, and they are not the responsibility of the users.

In relation to the smoothness of project execution, the application system development projects which are initiated and owned by IT units, tend to encounter coordination problems from business units who are the owners of the business process. If IT units cannot convince the owners of the process to agree with the reasons behind the projects or with the benefits of the projects because that will require them to change their business process, the process owners will oppose the implementation of the project and may refuse to collaborate with the implementation team. For example, the ERP project at ENERGY2 was an initiative of executives, but the process owners did not realize how important the business improvements were in this project. The process owners did not give sufficient importance to improving the business processes that were in the business blueprint. Moreover, without a sense of ownership, they did not make decisions on any issues that were relevant to changing the business processes. These

issues obstructed the project, until the executive level paid serious attention to this project and made decisions on the remaining pending issues which allowed the project to overcome the crisis. Another example from HOSPITAL1, the asset management project, showed that although the IT unit could convince the process owners to agree on the benefits of implementing this project, without follow up from the IT unit, the process owners were slow to react. It took more than a month after the demonstration of the asset management applications arranged by the IT unit for the process owner to review the features and sent feedback to the IT unit. The asset management project is still pending.

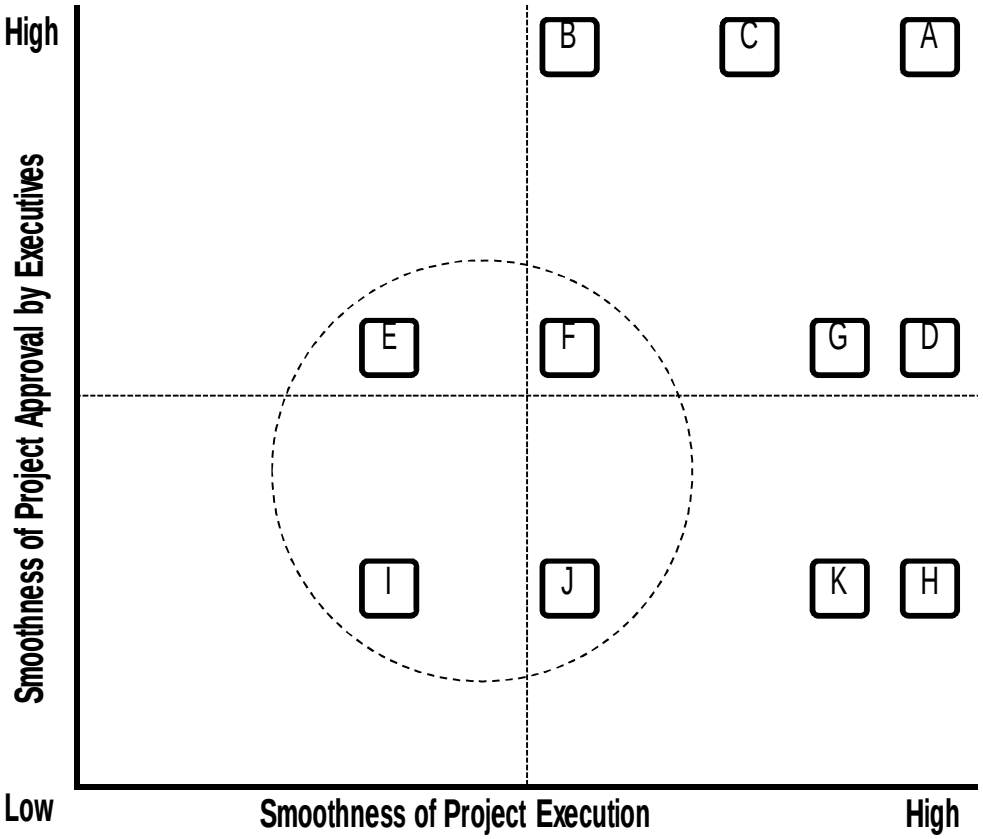



Figure 24 IT project execution smoothness

Figure 24 is a plot of different situations in IT projects during the IT investment process. The figure shows that there are three levels of executive consideration. The projects initiated by executives will be approved easily (A, B, C).

They will take a longer time however, to consider projects initiated by others but which support strategic requirements (D, E, F, G) than projects which support only operational requirements (H, I, J, K) respectively. In relation to the effort in coordinating during the process, IT technical projects (A, D, H) have a high smoothness, since, regardless of who initiated the project, it is still easy to interpret the requirements to produce system specifications. Moreover, the project is assigned to an IT unit which has expertise in the area. Application system development projects initiated and owned by business units also have high smoothness (G, K), because they know what they want from the beginning and execute what they have planned. They just put additional effort into coordination with the IT unit in order to have their project incorporated into the master plan, and also to help them contact IT providers.

The projects in the circles in Figure 24 (E, F, I, J) are in the undesirable situation of having low conditions of smoothness for both project approval by executives, and project execution. It can be noticed that the smoothness of project approval by executives is dependent on how the projects objectives resonate with the policies of the executives. IT and business units have to convince the executives that their initiatives are worthy of investment. If they can show the executives that the IT projects can support strategic requirements or provide some benefit to the organization, the executives will be more likely to approve their projects. Therefore, it can be presumed that the executives tend to concur with the IT projects that align with business strategy.

To mitigate this type of problem, the IT unit should let the process owners initiate and own their IT projects. However, if process owners really do not see any problems with the existing processes, initiatives and improvements will not happen. Alternatively IT units could try to compromise with them.

In decision making involving many parties, there are process owners and an IT unit, who can be assumed to know how to frame the situation of interest. If the frames of the process owners and the IT unit are different, for example where the IT unit

thinks that process reduction by using a new application is the way to increase customer's satisfaction, while the process owners disagree, there is potential for conflict. In order to avoid conflict or censure the IT unit must try to make decisions on IT investments that are not anomalous from the viewpoints of the process owners' frame of reference, or alternatively, the IT unit must try to bring the IT unit's frame and process owners' frame into alignment.

People align their frames through discussion. This permits them to compromise on differences and to come to some mutually shared idea about the nature of the situation and about what their options might be (Beach and Connolly, 2005). If they cannot align, they can at least understand where they differ and can bring the issues to the executives for a decision.

### 4.3.2 Lead Time for The IT Selection Phase

The lead time for decision making is the latency between the recognition of the problem and the execution of a decision. In the literature of decision making, the steps involved are the diagnosis of the problem event, selection of an action that will solve the problem, and implementation of the selected action until the problem is solved (Beach and Connolly, 2005). Therefore, the time which decision makers use in diagnosis before action selection can be regarded as the lead time of the decision-making process.

According to the empirical data, there are a number of decision-making steps in the process of IT investment. After recognition that IT investment is necessary, decision makers have to select the project that can satisfy their requirements and then make decisions on specifying the scope of IT proposals, while executives have to make decisions on approving or rejecting those proposals. All of these processes are in the selection phase.

When the requirements were initiated by executives, some executives specified the name of IT projects such as the unified ERP project for integrating the

systems at UNIVERSITY1, while some only provided a broad directive such as the direction for the smart grid at ENERGY1, and the requirement to pass the JCI accreditation for HOSPITAL1. After that, they assigned those initiatives to the IT unit and the process owner (business unit). The management level would cascade the initiatives by interpreting the executives' ideas to produce a list of potential IT projects. Before the IT project proposals were sent for approval, the project owners would gather information to specify the scope and budget of the projects.

From the observations, all case firms (except ENERGY2 that did not perform this process during the observation timeframe ) used more time in gathering information about application features and the total system development solutions than in gathering information about hardware, network devices and technological solutions, perhaps because of the complex nature of the application system development project.

For the technical projects A, D, and H, the IT unit which was the project owner would specify the scope and budget after gathering enough information. In the case of an IT unit which was assigned to take care of an application system development project (B, E, I), it had to obtain the process conditions and requirements from the process owner before specifying the scope, and then the scope of IT projects had to be re-confirmed by the process owner.

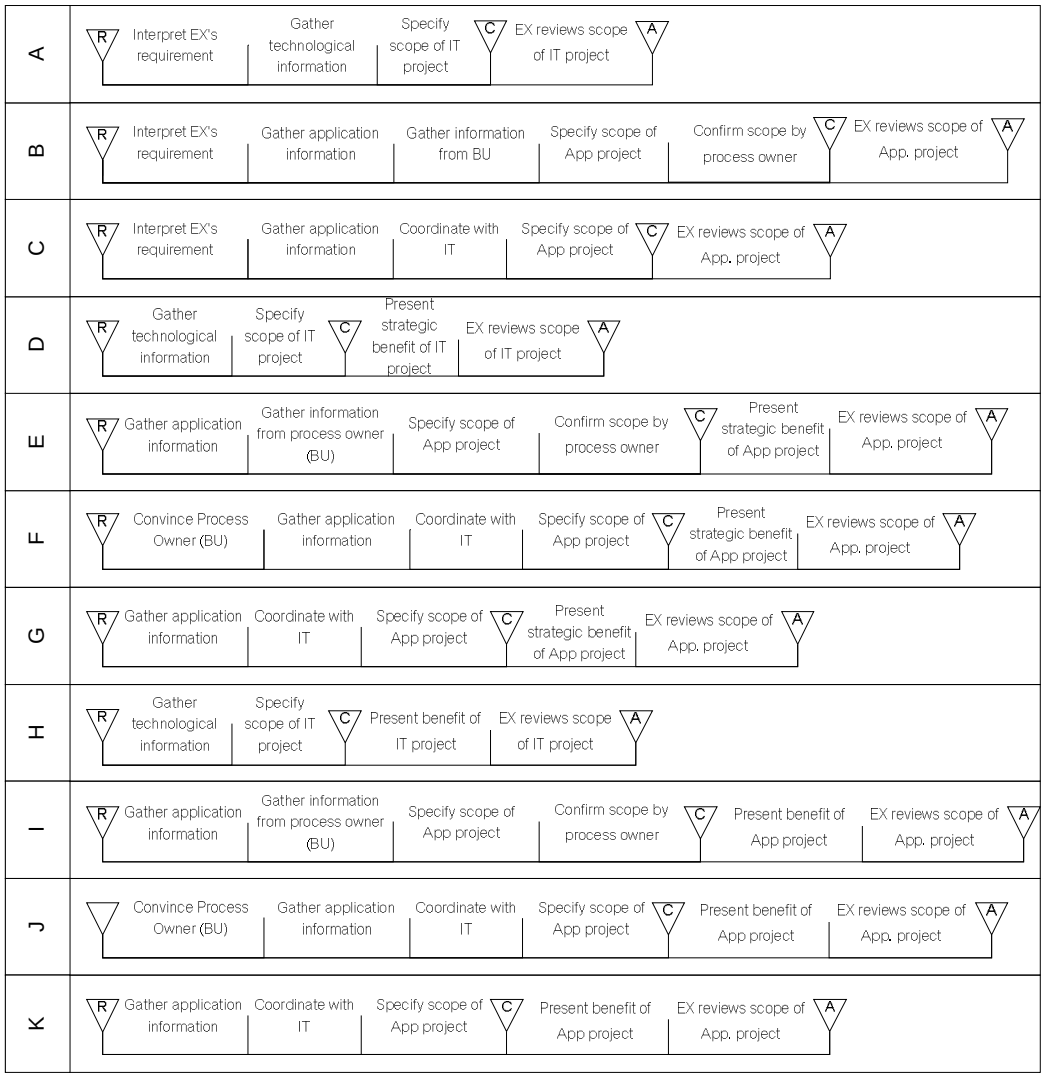
If a business unit was assign as the project owner, along with the process of information gathering, the business unit would coordinate with the IT unit in order to help them arrange meetings with the IT provider, and IT unit would also provide the technical aspects for the project proposal. In the case where that project was initiated by the IT unit, it cannot just assign the process owner in the same way that executives can. Instead, it has to convince the business unit to agree to the initiative, and then the business unit could accept the role of being the project owner.

Once the proposal has been created, executives would review the scope of the project to determine if it aligned with their policies, and then make a decision to approve or reject the project. If the project was initiated by an IT or business unit for

either strategic requirements or operational requirements, it would not face the process of executive requirement interpretation, but when the proposal was sent for approval, the project owner would have to convince the executives to agree with the project by presenting the benefits of investing in this project.

The projects which took a long lead time for the decision-making process were projects B, E, F, I, and J, due to the number of steps involved. The lead time for the IT selection phase can be reduced by cutting unessential steps. For example, by assigning the process owner as the project owner rather than the IT unit, the step of gathering information from the process owner's unit and scope confirmation by the business unit could be skipped.

The process capturing, by using common activities from empirical data, is presented in Figure 25. In each case, there are different steps of work due to the characteristics of an organization. In order to interpret the data into one diagram, the researcher captured the common activities in each type of project, and then adjusted the length of time spending in each activity into the standard proportion. It starts with the requirement to use IT, follows by the creation of the proposal by the owner of the project, and ends when the approval of the proposal by the executives. By using the situation diagram in Figure 23, the different situations in the IT selection phase can be seen to involve different activities before decisions are made which leads to different time usages as depicted in Figure 25.




R = Requirement Occurs; C = Proposal was Created; A = Proposal was Approved by Executives

Figure 25 Lead time in each project's situation

One of the ways to improve the process efficiency is to reduce the time for diagnosis. When a decision situation is encountered, the decision makers should use its salient features to probe their memory. If they can recognize its characteristics, the decision makers can draw upon their knowledge about previously encountered, similar situations to guide their behavior in this situation. In decision-making theory, old behaviors that are used in new but similar situations are called policies. In social

psychology they are called scripts (Klein, 1993). The fact that behavior seldom is exactly the same from one time to another, suggests that people use perceptual cues to make decisions (inferences) about the state of their surrounding environment (Brunswik, 1947).

In this case, the project owners would like to have information for the project and to assist them in making a decision about whether they should invest in it or not. The first step is to turn the inference process around and find out what criteria of the project are applicable for investing. The second step is to use this knowledge to devise a policy for selecting the potential project. The third step is getting the people in the process to use this policy as a base for the IT investment decision-making process. With this guide or policy for decision making, the decision makers can reduce the time needed for inference and for information gathering.

### 4.3.3 IT Investment Decision Making Based on Historical Matters

Previous research (W. M. Cohen and Levinthal, 1990; Levinthal and March, 1993) has found that the strategic actions of an organization are path dependent. They observed that past experience tends to limit an organization's actions to those which are similar to its past practices.

Path dependence influences an organization's tendency to make decisions based on its former system through two primary mechanisms: self-specialization and constrained cognition (Huff, Huff, and Thomas, 1992). First, self-specialization causes an organization to follow its past experiences to solve problems. Organizations prefer following past experiences that has been successfully applied instead of searching for new alternatives. Second, managers with constrained cognition usually cannot recognize the urgency of changes in strategy (Levinthal and March, 1993). Consequently they search for alternatives based on past experience, which lowers their organizations' likelihood of entering new fields (Simon, 1955; Singh, 1986)

Empirical studies have confirmed these insights in the case of ENERGY2 which exhibited an example of self-specialization. In adhering to the original working process, the business blueprint for the ERP system was designed to accommodate the original business processes. This caused an exhaustive customization of the system which required intensive use of resources. Another example is constrained cognition in HOSPITAL1. Although the idea of system integration had been considered by the CEO, at first she was unconvinced about the benefits of the IT consolidation projects as shown in a field note:

> *"Because she was not an IT expert she might not understand the technical benefits, so she expressed her hesitation and she did not give any comment on this project when the project was introduced by IT consultants at the first meeting. After the consultants had left the meeting room, she asked her IT manager whether they could choose the option of not investing in IT consolidation but instead keep maintaining the old system."*

However after the IT team had compared the cost of maintenance with the cost of a new project acquisition, the results showed that the investment cost of the new project in the first year was higher than the maintenance option, but when the total cost of the project was calculated over three years, the cost of the IT consolidation project was less than two-thirds of the maintenance cost option. Then the CEO began to be convinced and to be interested in the IT consolidation project.

From the HOSPITAL1 example, if the decision makers can see the project's value compared with the option influenced by path dependence, it will make the decision maker aware of the principle of maximizing value based on prescriptive theory. As a result, path dependence might not then strongly influence new technology investment decisions.

# Chapter V Discussion and Conclusion

## 5.1 Discussion

This chapter explores the results of the study and the broader meaning that these results have for the IT investment process. The chapter starts with a discussion of the findings. The IT investment process framework was modified by the key research findings.

### 5.1.1 Analysis and Planning

In the scope of the analysis and planning, the research in IT investment focus on this activity as an initial process to align IT with business requirements. However, a few of them mention to the process of selecting a vital business requirement that can really enhance by IT (Boar, 1994; Sabherwal and Kirs, 2007; Ward and Griffiths, 2002). In another area, the empirical data shows that practitioners give the high priority and resource spending on this process. Two out of three cases which the researcher can observe in their analysis and process, HOSPITAL1 and ENERGY1, hired external business and IT consultants to formulate the IT plan for them. This can be implied that both researchers and practitioners give the important to the analysis and planning process, and want to improve the efficiency of the process. Further study in this area still contributes to both researchers and practitioners.

### 5.1.2 Assessment and Selection

The IT investment study about assessment and selection method is quite ample (Bacon, 1992; Bardhan, Bagchi, and Sougstad, 2004; Dehning and Richardson, 2002; Farbey, Land, and Targett, 1992; Li and Johnson, 2002; Schniederjans and Wilson, 1991). Although those studies have proposed either finance or non-finance criteria in their assessment and selection method, the practitioners in the cases prefer

using non-financial criteria, especially the property of strategic supporting, to financial measure. Because of the difficulty in collecting and calculating financial data, and the anxiety to the data accuracy, IT planners of the cases choose to rely on non-financial criteria. This makes them overlook to the hidden cost of an IT project.

Beyond the issues of financial and non- financial criteria, in the cases that a proposal had been approved by the reason of a strategic alignment with the business such as the ERP project at ENERGY2, and the CRM project at HOSPITAL1, it still faced some problems. From those cases, it can be seen that the decision to adopt an IT system is mandated by some central authority or executives, and changes the involvement of the users and managers within the business units. Therefore, user commitment to the decision outcome to adopt an IT system may be reduced. This is the sample of an IT project's risk of failure.

Although each of the case firms had a risk management policy, they rarely demonstrated evidence of a project risk review during the proposal formulation stage. This may be because the case firms relied on the solid methodology of the IT providers or implementers. However, the lack of a risk and readiness review may cause the project owner to underestimate the time and resources necessary for the project.

In order to justify the IT project in the selection process, the practitioners should combine financial, non- financial and also risk criteria as suggested in a functional model of Irani, Ezingeard and Grieve (1998) mentioned in section 2.4 of Chapter 2.

### 5.1.3 Implementation and Control

The issues of implementation and control are in the literature relating to IT management (Benbasat, Goldstein, and Mead, 1987; David, Schuff, and Louis, 2002; Jie, Mingjie, and Jinjun, 2006) rather than IT investment decision-making research. The case organizations also relied on IT providers' project management methodology, and left this issue out of the concerning scope in the step of IT investment. The example

problem from this issue is in ENERGY2 case. The project team of ENERGY2 left all of the project management issues to the implementers. Until they faced the problem of conflicts and project delay caused by project management issues, they had to allocate the extra budget which was not include in the project's budget, to hire the external consultants to supervise and control the project implementation. Therefore, the implementation and control issues should be concerned since the step of the IT plan formulation, that the draft implementation plan and budget will be included in the investment cost of the project.

### 5.1.4 Post-Implementation Evaluation

An IT investment process is a continuing process that must be reviewed on an ongoing basis. At the point of system delivery, the system solution should effectively and efficiently satisfy user requirements. In order to investigate the results of project implementation a post-implementation evaluation must be performed. However, both research and empirical data have a little mention in this issue. Without the post-implementation evaluation, the stakeholders might not know what the actual results of the project implementation were. This issue should be brought to the concern of both IT investment research and practical area.

### 5.1.5 A Framework for IT Investment Process

The framework for the IT investment process proposed in chapter 2 was used as a template to analyze and interpret the qualitative data. The results of the data analysis and the prior discussion of this topic could enhance the framework of the process flow as shown in Figure 26.

The IT investment process is still based on four stages: analysis and planning, assessment and selection, implementation and control, and post-implementation evaluation. Each step consists of a process represented by a rectangle. The process starts with a review of the existing information system architecture of the

organization. All of the case firms performed this step in order to find the areas to be improved in the existing systems, and to develop the requirements for the new systems.

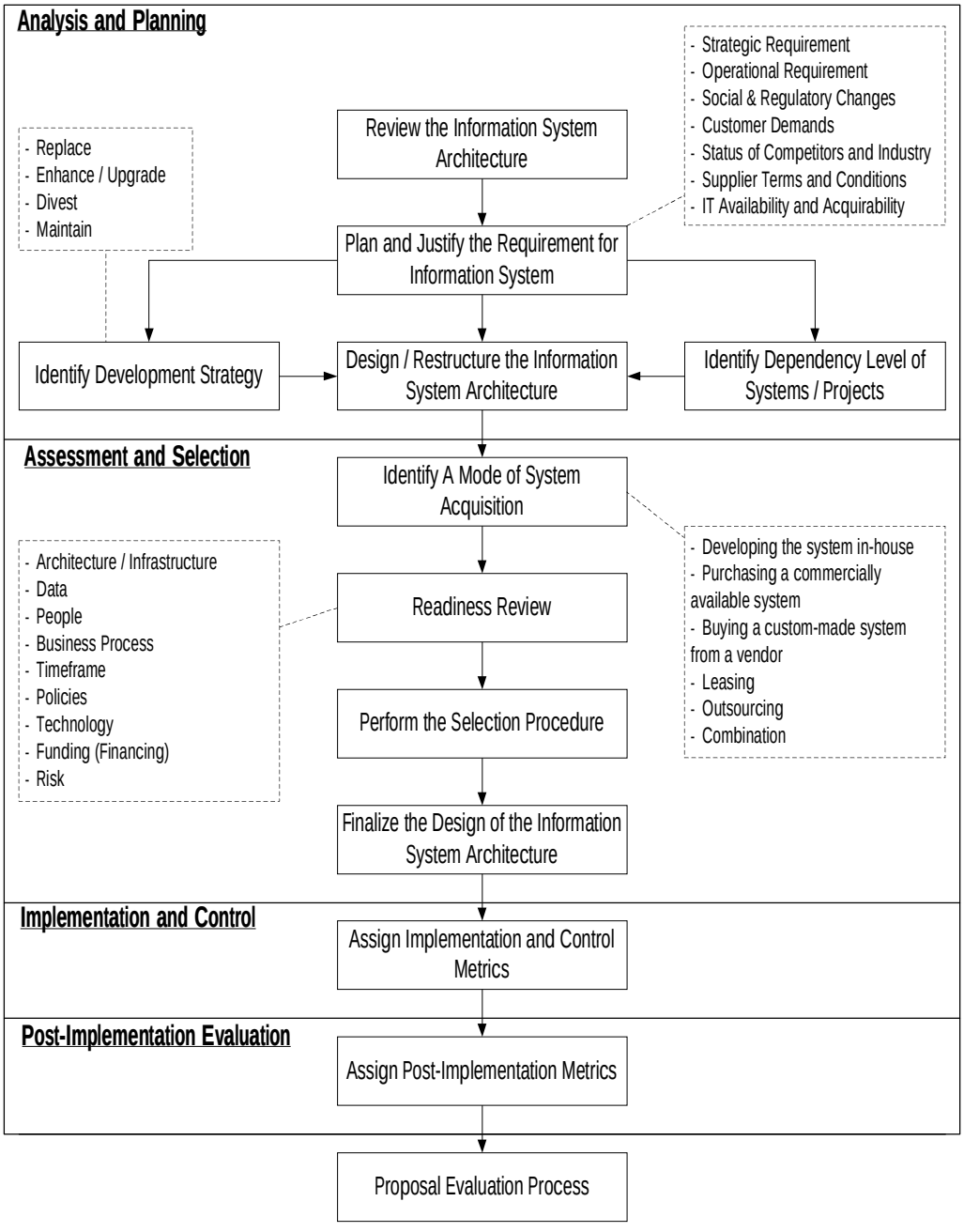



Figure 26 A framework for the IT investment process

One of the most essential assessments in the decision-making process is identifying the business objective which often stems from strategic requirements, operational requirements, social and regulatory changes, customer demands, the status of competitors and the industry, supplier terms and conditions, and IT availability and acquirability. A list of IT projects is developed as enablers of the business processes. The property of business-IT alignment should be provided by this step. Note that a specific business process requirement may need to be prioritized to fully obtain the benefits of IT implementation. Moreover, each business process should be carefully analyzed to ensure that IT will have certain functionality to meet the requirements of the business process and the users (Xia and Lee, 2004).

Another challenge in acquiring information systems is to define the system requirements. System requirements describe the objectives of the system. They define the problem to be solved, the business and system goals, the system processes to be accomplished, user expectations, and the deliverables of the system. Furthermore, the requirements should incorporate information about the dependencies of the system, system inputs, the information being processed in the system, and the information expected out of the system. This information should be clearly defined so that later gaps in requirements and expectations are avoided. With the system specification, the project owner has to define a development strategy which can be the replacement of the old system, a system upgrade, system maintenance, or divestment of the system (Xia and Lee, 2004). The output of this step is a decision to go with a specific application, a timetable, a budget, system expectations, and dependency on other systems.

In regard to the system analysis approach, the organization should design the future system architecture as an IT roadmap. This system architecture is the conceptualization of how the organization's information objectives are met by the capabilities of the specific applications (Gallegos, et al., 2004). This structural design describes the flow of the information, data hierarchy, application functionality, technical feasibility, and organization architecture in the organization. The output from this stage should be a strategic planning level document on how to develop specific applications

that meet the constraints defined by the system architecture. As a result, the application portfolio may have to be changed to correspond to this structure.

When the IT roadmap has been formulated, the project owner has to identify a mode of system acquisition for the proposal. There are several options in procuring software solutions. Some available alternatives are: (1) Developing the system in-house, (2) Purchasing a commercially available solution, (3) Buying a custom-made system from a vendor, (4) Leasing software from an application service provider (ASP) or leasing through utility computing (contracted development), (5) Outsourcing a system from other companies, or (6) Using a combination of these listed options (Gupta, Gould, and Pola, 2004).

A readiness review is concerned with a reflection on the current status of the organization and whether it has favorable properties for implementing the project. Examples of readiness reviews include those for architecture / infrastructure, data readiness, human resources, business processes, timeframe estimation, policy, supporting technology, funding, and risk. The performance of a readiness review will assist in identifying potential blockages to effective system implementation. Another primary objective of a readiness review is to determine the risks that may have an impact on the degree of the success of the investment in the project.

If the results for a critical project are not good, it will alert the decision maker to the necessity of undertaking a mitigation strategy for preventive and corrective action such as re-scoping the project, phasing, seeking external resources, and training or hiring people, in order to avoid failure of the project implementation.

The next step is the execution of a selection procedure which is the process of identifying the best match between the available options and the identified requirements. In this process, the firm requests a proposal from prospective IT providers, evaluates the proposals, and selects the best available alternative. There are various ways to solicit responses from providers. Some of the common methods comprise the Request for Information (RFI) and the Request for Proposal (RFP). An RFI

is used to seek information from vendors with a specific intention. An RFI should act as a tool for determining the alternatives or associated alternatives for meeting the organization's needs. An RFP specifies the minimal acceptable requirements, including functional, technical, and contractual aspects. This document offers flexibility to respondents to further define the requested requirements. RFPs can be a lead to a purchase or continued negotiation as in case of HOSPITAL1.

Before the project owner sends the project proposal to the executives for approval, he or she must provide the information to support the decision-making in order to communicate and convince the stakeholders, and to reduce the diagnosis time for the executives. Martin et al., (2005) defined the criteria for selecting a software application package as follows:

Table 23 Criteria for selecting a software application package (Martin, et al., 2005)

| | |
|---|---|
| · Usability and functionality | · Required training |
| · Cost-benefit analysis | · System security |
| · Upgrade policy and cost | · Maintenance and operational requirements |
| · Vendor reputation | · Easiness for users to learn |
| · System flexibility and scalability | · Performance measurement |
| · Manageability | · Interoperability and data handling |
| · Quality of documentation | · Ease of integration |
| · Hardware and networking resources | · Reliability measurement |
| · Upgradeability | · Compatibility with other applications |

While all of the non-financial criteria can be evaluated by scoring or ranking, a financial evaluation should be include in the proposal for selection, and should include acquisition cost, total cost of ownership, and estimated cash-flow or ROI (Bacon, 1992). In summary, the results of all evaluation processes from the beginning of the framework, with a weight on the business-IT alignment, show that if a project does not align with business requirements, it will be rejected. Where a project is aligned, it will

be approved for investment up to a certain level, but if the other criteria fail, the project will be sent back to be re-planned.

Table 24 Summary of decision-making issues

| Business-IT Alignment | Readiness Review | Non-financial Evaluation | Financial Evaluation | Example of Decision |
|---|---|---|---|---|
| Yes | Pass | Pass | Pass | Approve |
| Yes | Pass | Pass | Fail | Approve if it can leverage benefits from non-financial benefits |
| Yes | Pass | Fail | Fail | Sent back to the project owner to perform mitigation actions, and then it will be reconsidered. |
| Yes | Fail | Pass | Pass | Sent back to the project owner to perform mitigation actions, and then it will be reconsidered. |

| Business-IT Alignment | Readiness Review | Non-financial Evaluation | Financial Evaluation | Example of Decision |
|---|---|---|---|---|
| No | - | - | - | Reject |

All of these processes should be structured to ensure the process is completed in a timely fashion. If done properly, this process will turn out to be a purchasing decision for the selected application. Note that the entire process must be documented before moving on to the next step.

Upon completion of the contract negotiation, a project plan should be agreed to by both the firm and the IT provider so that the new application or system can be ready to be installed or developed. During this process, the application is also tested and user reactions are evaluated. After the application or prototype of the application has passed user requirements, it can be deployed. This process allows the organization management to deal with organizational issues such as conversion strategies, training, and resistance to change (Whitten, Bentley, and Dittman, 2000).

In order to prepare for those activities the project owner develops a plan for dealing with project management issues. An additional budget and a standard matrix for implementation and control should be setup for each type of project and include in the draft implementation plan. Predictions from those matrices can be used in the readiness review process, and once project implementation begins a comparison of the collected data with estimated data will help the project manager monitor the soundness of the plan and its processes. Examples of indicators are the correlation between actual and planned project performance, the time lag between identification of deviations and their rectification, the resources spent on project management, and the satisfaction of the business sponsor regarding project management and outcomes.

The setting of indicators for the post-implementation evaluation of the project will remind the project manager and staff to keep monitoring their work until the system is delivered. Moreover, they can perform the sensitivity analysis by using those

indicators to predict the result of an IT investment project. Examples of indicators are total time and cost spending on the project, and the contribution of individual IT-enabled investments to optimal value.

This framework can be the guideline for the person who responsible for an IT plan generation. It has the objective that the IT planner can perform the step suggested by the framework to provide the sufficient information for the decision makers and can use the output from each step to communicate or coordinate with the stakeholders such as users, process owners, IT providers, and external consultants.

## 5.2 Conclusion

Dependency on information technology (IT) has increased progressively for organizations as IT has become a strategically important competitive advantage. If planned, developed, and managed properly, IT can bring about greater efficiency in organizational operations. The IT investment process has become a critical process for adopting IT into the organization. Good investment decisions will lead to good outcomes.

The research attempted to locate empirical data on the IT investment process from organizations in order to use the patterns inherent in the data to enhance the IT investment process framework using a theoretical approach. The literature relevant to IT investment in the IS research field was studied to define standard theoretical IT investment process. In order to establish a method for making good decisions on IT investments, the literature of psychological decision making and investment theory were also studied. This led to the proposal of a conceptual framework for the IT investment process.

The approach of this study was based on the investigation of the IT investment processes in organization, and of the components related to these processes. The research was conducted by adopting a qualitative methodology for obtaining contextual data in order to gain insights into the research problem (Creswell,

2003). The research process in this study consisted of three phases: (1) exploratory, (2) empirical, and (3) conclusion.

In the exploratory phase, the extensive literature was reviewed to establish the framework and the scope based on previous research and theoretical approaches (Chapter 2). In the empirical phase, data was gathered from empirical evidence by applying a case study strategy. The case study was employed in the context of medium to large organizations located in Thailand. Cases were selected on the criteria of data richness. A discussion of the results of the data analysis was provided in the conclusion phase.

The results of the data analysis led to the following findings:

(1) IT investment in each organization was initiated by three groups in the organization, (1) the executives, (2) the business functional units, and (3) the IT functional unit.

(2) The initiatives of each group stem from different sources. Business functional units and the IT functional unit tended to rely on strategic requirements, while the executives extended their vision for the organization to external criteria such as customer demand, and industry competition.

(3) The case organizations prioritized projects based on non-financial criteria.

(4) There was no evidence of risk evaluation for each project in the case study. To avoid under-estimation of the project scope there should have been a process of risk review in the project study stage.

(5) There was also no evidence found of post-implementation evaluation in the case studies. Since this type of evaluation would permit the

project manager to complete the cycle of project management and monitoring, it should be included in the process in future.

(6) Differences in the source of the initiative, the project type, and the project owner, led to different results in the IT investment process.

(7) Executives agreed to projects which they initiated, and also approved projects in which there was business-IT alignment.

(8) The commitment of the process owner was reduced when there was a different project owner. A lack of commitment could lead to indifference or deliberate resistance and may even cause the project to be abandoned (Ewusi-Mensah and Przasnyski, 1991).

(9) To reduce the lead time for the IT investment decision-making process, guidelines or policies for decision making should be provided for decision makers. This can reduce the time required for inference and information gathering.

(10) Provision of clear information about the project's value will make the decision maker more aware of the principle of maximizing value based on prescriptive theory rather than experiencing the pitfalls of prospect theory.

(11) Ultimately, investing in an IT project may require both streamlining of one or more business processes and excellent coordination between all the related entities.

(12) In order to fill the gap between the theory and the practice of IT investment in Thailand, this study proposes a framework for the IT investment process by weaving together the applicable features of various decision-making techniques and investment methods from both theoretical and practical viewpoints.

In order to achieve the goals of an IT investment, an organization may adopt a typical framework proposed by prior research. But implementing these practices requires a reasonable amount of effort since an organization must evaluate and re-organize its processes, which is another investment. Investing in such a IT-related governance and management practices of IT investment can be perceived as costly and complex, while return in short- and long-term value is difficult to measure in tangible (financial) outcomes. Therefore, with the simplicity of the framework proposed in this study, can support practitioners to reach for their goals without much of effort using.

Figure 27 summarizes the results of the study which response to each research objective.

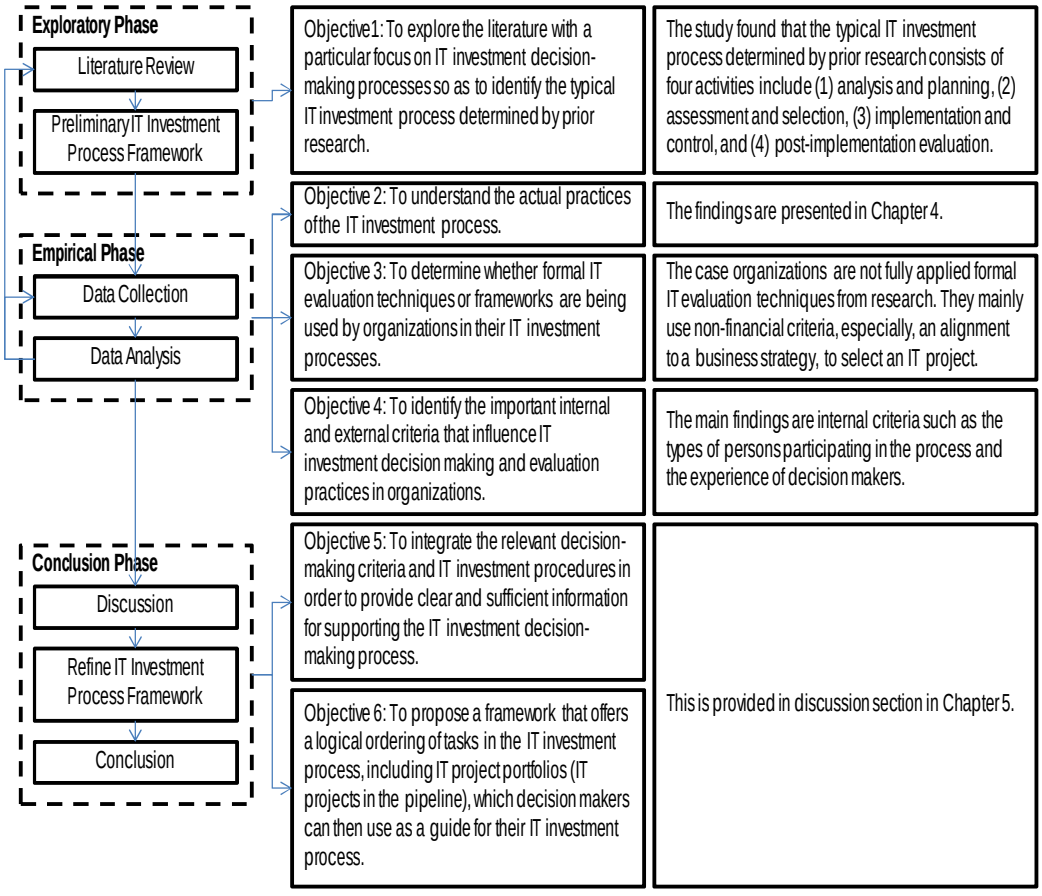



Figure 27 Research process, research objectives and results

## 5.3 Limitations

This study has two main limitations. First, the study was restricted to the context of Thai organizations which probably limits the generalizability of the study results. Second, the scope of the study was limited to generating a framework for use as a guide for decision makers. The study did not aim to test the hypothesis or prove the causal relationship between the model's effectiveness and IT productivity since this was outside the scope.

## 5.4 Further Study

Throughout this study, several fascinating ideas have arisen for further research. One possibility for further research could be a study into the specific contexts characterized by criteria such as a specific industry, public versus private sector, or economic properties, in order to investigate how the characteristics of the context influences the IT investment decision-making process in organizations. Furthermore, it also would be interesting to investigate the productivity and efficiency of the IT investment processes of organizations which apply the guidelines from this study. It would also be useful to determine whether the framework would affect the quality of the IT plan or the IT project list in a pipeline waiting for investment.

During the process of writing a summary, the researcher had an opportunity to propose the IT investment process developed in this study to two organizations. Both of them are large state enterprises based on total revenue and the number of staff. One was formulating an ICT master plan, while the other was conducting a feasibility study for ERP implementation within the next two years. Some parts of the process, especially the process of selection, were applied in these projects. The work and information steps, which provided support for the decision-making process, were undertaken based on the application of the IT investment process framework. The result of using this framework was that the decision makers all agreed on the methodology and the planning results. However, no comparison was undertaken

between organization using the framework and those that did not use it. This could be undertaken in a further study.

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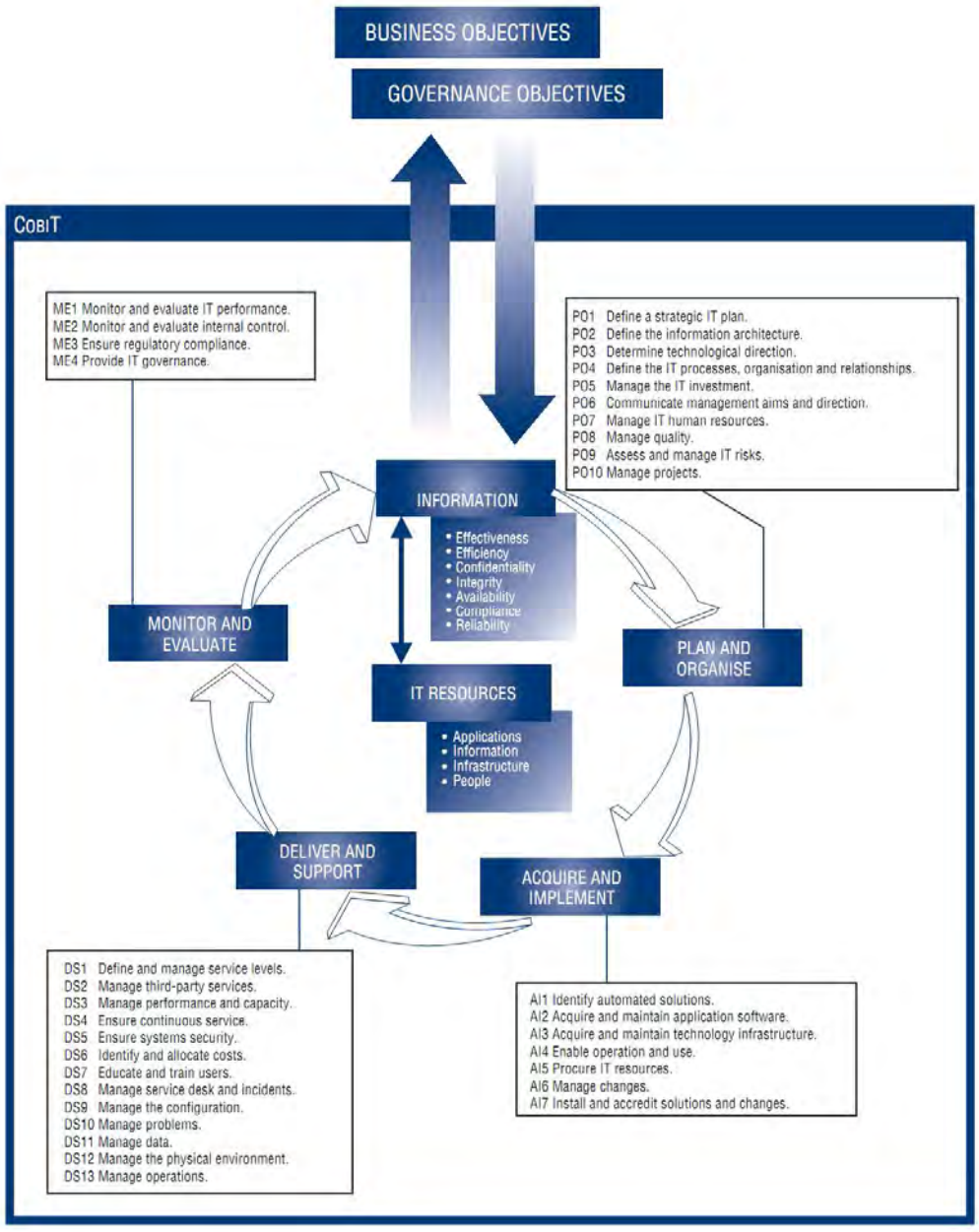
# Appendices

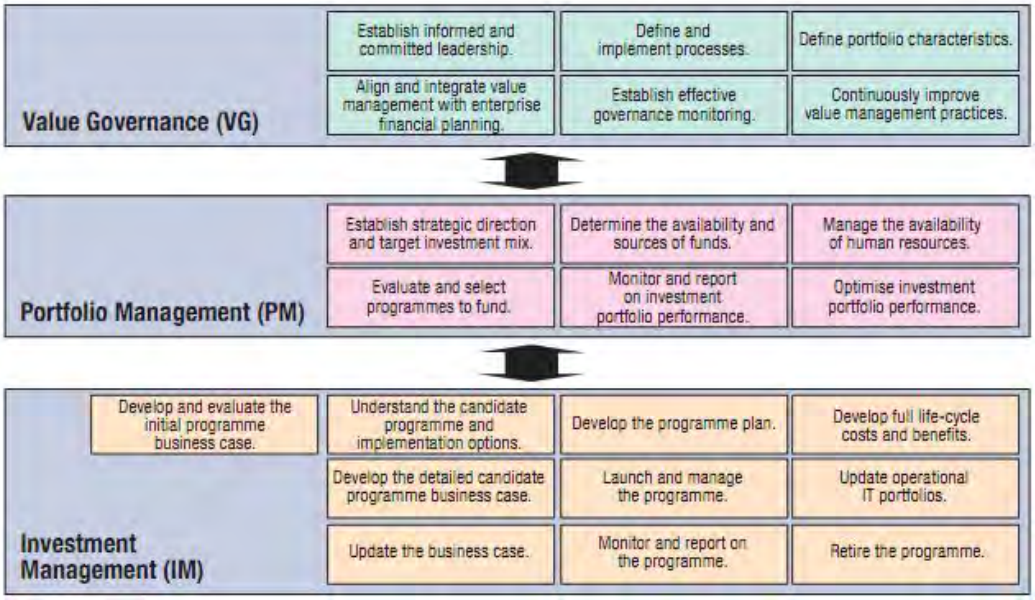
# Appendix A Figure of Overall COBIT Framework

(Source: ITGI, (2007). "COBIT 4.1", IT Governance Institute, available at www.itgi.org)



# Appendix B Figure of Val IT Domains and Processes

(Source: ITGI, (2008). “Enterprise Value: Governance of IT Iinvestments: The Val IT Framework 2.0”, IT Governance Institute, available at www.itgi.org)



# Appendix C Case Study Research Literature

Yin (2008) defines the scope of a case study as an empirical inquiry which investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and context are not clearly evident. A case study tries to answer questions like “how” or “why”, which the general circumstances of the phenomenon to be studied are contemporary phenomenon in a real-life context over which the investigator has little or no control.

Case studies can be single or multiple-case designs (Yin, 2008). A study will employ a single case when a case seems to represent a critical test of an existing theory, while multiple cases will be employed when replication logic is supposed to reveal support for a theory.

Yin (2008) identified at least six sources of evidence in case studies including documents, archival records, interviews, direct observation, participant-observation, and physical artifacts. Documents could be letters, memoranda, agendas, documents, reports, newspaper articles, or any document that is relevant to the investigation. Archival documents can be service records, organizational records, survey data, and other such records. Interviews, both structured and unstructured, are one of the most important sources of case study information. Direct observation occurs when a field visit is conducted during a case study. It could be a casual data collection activity, or a formal protocol to measure and record behaviors. This technique is useful for providing additional information about the topic being studied. Participant observation makes a researcher into an active participant in the events being studied. Physical artifacts can be tools, instruments, or some other physical evidence that may be collected during the study as part of a field visit. The perspective of the researcher can be broadened as a result of discoveries.

Yin (2008) presented analytic strategies for use in case studies including pattern matching, explanation-building, and time-series analysis.

Case study is a valuable method of research, with distinctive characteristics that allow it to be applied in many types of investigations. It can also be used in combination with other methods.

## Appendix D Characteristics of small and medium-sized enterprises in Thailand

| Type of enterprise | Small-Sized Enterprise | | Medium-Sized Enterprise | |
|---|---|---|---|---|
| | No. of employees | Fixed Assets (million Baht) | No. of employees | Fixed Assets (million Baht) |
| Production | < 50 | < 50 | 50-200 | 50-200 |
| Service | < 50 | < 50 | 50-200 | 50-200 |
| Wholesale | < 25 | < 50 | 25-50 | 50-100 |
| Retail | < 15 | < 30 | 15-30 | 30-60 |

(Source: Ministerial Regulation of Ministry of Industry, Thailand, 2002)

# Appendix E Sizing Factors

| | Primary Factors | | |
|---|---|---|---|
| | Project Team Size, Duration and Cost | | |
| **Other Factors to Consider** | < 5 people<br>< 3 months<br>< ฿10 Million | ~ 5-10 people<br>~ 3-12 months<br>~ ฿10-฿100 Million | > 10 people<br>> 12 months<br>> ฿100 Million |
| Low Impact<br>• Minor strategic value<br>• Impacts a single business unit<br>• Impacts fewer than 25 end-users<br>• Strong stakeholder/management support<br>• Problem and solution are defined and easy to achieve (e.g., consider project size, interrelationship to existing systems, and location of the implementation sites)<br>• No dependencies on other projects<br>• Minor impact on financial revenue, and expenses<br>• Project Team very familiar with project's objective and solution (e.g., consider whether project team has ever used the required, new technology)<br>• Project Team is very familiar with the customer and their business<br>• Project Manager is very familiar with project management practices (e.g. consider familiarity with containing scope creep, and meeting firm deadlines) | small | small | medium |

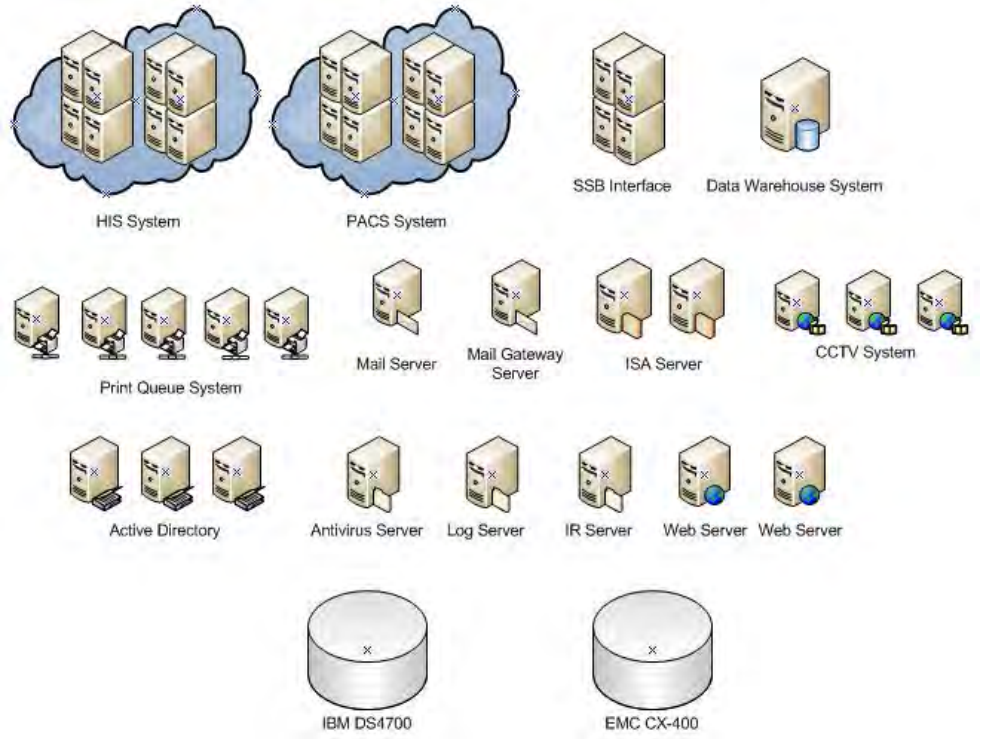
| | Primary Factors | | |
|---|---|---|---|
| | Project Team Size, Duration and Cost | | |
| **Other Factors to Consider** | < 5 people<br>< 3 months<br>< ฿10 Million | ~ 5-10 people<br>~ 3-12 months<br>~ ฿10-฿100 Million | > 10 people<br>> 12 months<br>> ฿100 Million |
| Moderate Impact<br>• Moderate strategic value<br>• Impacts two to four business units<br>• Impacts 25 to 250 end-users<br>• Moderate stakeholder/management support<br>• Problem and solution may be somewhat difficult to achieve (e.g., consider project size, interrelationship to existing systems, and location of the implementation sites)<br>• Minor links to other projects (low impact)<br>• Moderate impact on financial revenue, and expenses<br>• Project Team is somewhat familiar with project's objective and solution (e.g., consider whether project team has ever used the required, new technology)<br>• Project Team is somewhat familiar with the customer and their business<br>• Project Manager is somewhat familiar with project management practices (e.g. consider familiarity with containing scope creep, and meeting firm deadlines) | small | medium | large |

| | Primary Factors | | |
|---|---|---|---|
| | Project Team Size, Duration and Cost | | |
| **Other Factors to Consider** | < 5 people<br>< 3 months<br>< ฿10 Million | ~ 5-10 people<br>~ 3-12 months<br>~ ฿10-฿100 Million | > 10 people<br>> 12 months<br>> ฿100 Million |
| High Impact<br>• High strategic value<br>• Impacts five or more business units<br>• Impacts more than 250 end-users<br>• Limited stakeholder/management support<br>• Problem and solution will be difficult to define and achieve (e.g. consider project size, interrelationship to existing systems, and location of the implementation sites)<br>• Significant links to other projects<br>• Significant impact on financial revenue, and expenses<br>• Project Team has limited or no experience with the project's objective and solution (e.g. consider whether the project team has ever used the required, new technology)<br>• Project Team has limited or no experience with the customer and their business<br>• Project Manager has limited or no experience with project management practices (e.g. consider familiarity with containing scope creep, and meeting firm deadlines) | medium | large | large |

# Appendix F Example of Project Review

(Remark: coding and filling empirical data into the framework)

**Review Information System Architecture**




- There were a total of 50 servers within the scope of the study. There were 8 servers which could be kept current for 3 - 4 years.
- The PACS System has 7 servers in a group and The Call Center and CRM System has 4 servers in a group. All of them are older than 2 years.
- The SSB Interface System has 4 servers in a group. Although they are new machines they are desktop PCs.
- The Print Queue System has 5 servers in a group. Although they are new machines they are desktop PCs.
- There are 13 servers which are more than 3 years old.
- There are 5 servers awaiting decommission

**Plan and Justify the Requirement for an Information System**

| | |
|---|---|
| **Strategic Requirement** | - Reduce operating costs and improve business processes |
| **Operational Requirement** | - Improve reliability, availability, and serviceability<br>- Cost reduction |
| **Social & Regulatory Changes** | - Support JCI standard: Management of Communication and Information (MCI) |
| **Customer Demands** | - |
| **Status of Competitors and Industry** | - No-one in the industry implements it; can be considered a competitive advantage |
| **Supplier Terms and Conditions** | - |
| **IT Availability and Acquirability** | - Model for virtualization technology<br>- High-performance server |

**Identify Development Strategy**

Option1: Maintain

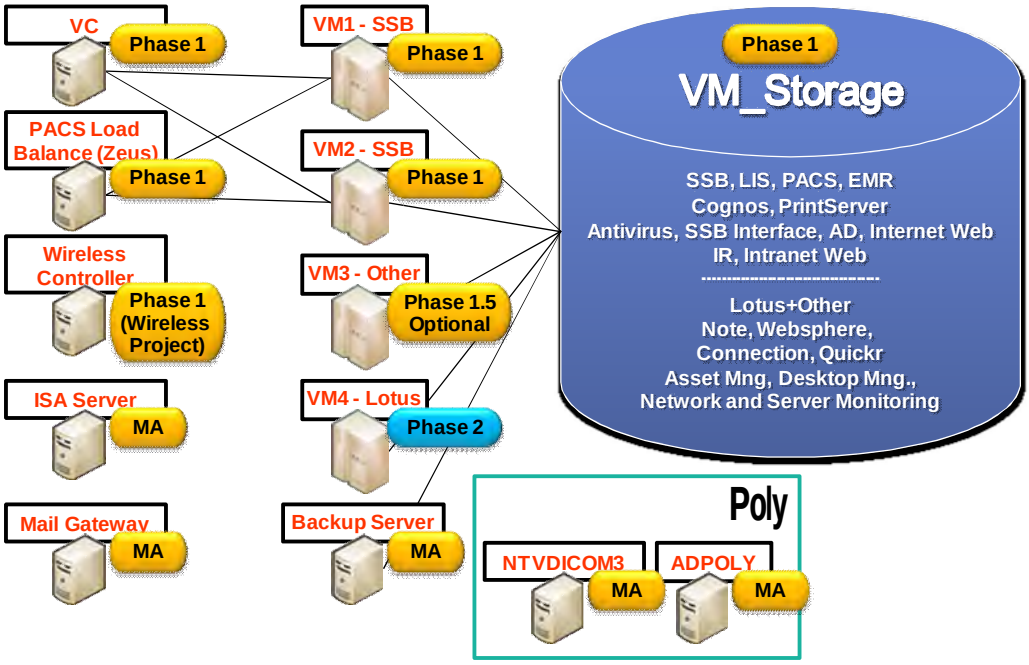
Option2: Replace

**Identify Dependency Level of Systems / Projects**

- EMR
- Lotus (Mail)
- Monitoring System
- Wireless EDMS
- IS Project
- Lotus Connection
- Desktop Management
- Web Portal

- Asset Management
- Nurse Activity
- IPD Doctor

## Design / Restructure Information System Architecture




## Identify a Mode for System Acquisition

- Purchase commercially available solution

## Readiness Review

| | |
|---|---|
| **Architecture / Infrastructure** | Network and location are available |
| **Data** | - |
| **People** | 2 system admins |
| **Business Process** | - |
| **Timeframe** | 3 months |
| **Policies** | - |
| **Technology** | - Virtualization technology support for the existing application (all are supported) |

| | |
|---|---|
| **Funding (Financing)** | Within budget |
| **Risk** | Option1- Low, Option 2 - Medium |

## Perform the Selection Procedure

Financial comparison

| Replace+New Server | | | | VM+New Server | | | |
|---|---|---|---|---|---|---|---|
| | Qty. | Price | Total | | Qty. | Price | Total |
| High Spec. Server | 21 | 350,000 | 7,350,000 | High Spec. Server for VM1+2-SSB | 2 | 1,000,000 | 2,000,000 |
| Medium Spec. Server | 23 | 200,000 | 4,600,000 | High Spec. Server for VM3-Other | 1 | 1,000,000 | 1,000,000 |
| SAN Storage 8 TB. | 1 | | 3,500,000 | Medium Spec. Server | 1 | 100,000 | 100,000 |
| - SSB 1 TB.<br>- EMR 6 TB.<br>- EDMS 1 TB. (Quickr) | | | | - Virtual Machine Console | | | |
| MA IBM Server | 1 | 50,000 | 50,000 | SAN Storage 8 TB. | 1 | 3,500,000 | 3,500,000 |
| - LISServer | | | | - SSB 1 TB.<br>- EMR 6 TB.<br>- EDMS 1 TB. (Quickr) | | | |
| Trade Out | 41 | 30000 | 1,230,000 | MA IBM Server | 5 | 50,000 | 250,000 |
| | | | **14,270,000** | VMWare Implementation | | 1,000,000 | 1,000,000 |
| | | | | VMWare Licenses Enterprise Plus | 3 | 600,000 | 1,800,000 |
| | | | | | | | |
| | | | | Trade Out | 37 | 30000 | 1,110,000 |
| | | | | | | | |
| | | | | | | | **8,540,000** |

## Assign Implementation and Control Metrics

- Percentage of Progression
- Percentage of Pending Issues

## Assign Post-Implementation Metrics

- Maintenance Cost
- System performance
- System Downtime

# Biography

Jitraporn Boonkitticharoen earned her Bachelor of Science, major of computer and technology, from Thammasat University. Later, she got Mater of Science, major of Information Technology in Business, from Chulalongkorn University. She worked as a consultant in information technology planning and strategy.