GREEN IT/IS Investments Evaluation within the Aviation Industry – A Focus on Indirect Costs

A thesis submitted for the degree of Doctor of Philosophy

by

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Abstract

Worldwide concerns over environmental issues and air travel's continuous expansion have increased in recent years. This is due to rising carbon emissions caused by the aviation industry's reliance on information technology and systems (IT/IS), which affects the environment. The review of the IT/IS and Green IT/IS investments evaluation literature has highlighted that there is a dearth of research on Green IT/IS evaluation regarding to the aviation industry. Most Green IT/IS evaluation studies focus mainly on benefits; however, cost is reported as one of the most crucial difficulties preventing organizations from adopting Green IT/IS. Generally, the focus is on the direct costs rather than the indirect costs because the latter are intangible and therefore hard to identify and quantify. However, they can have a great impact on the overall cost/budget and possibly on profitability. Although the traditional IS appraisal techniques are being used in the evaluation process, their incapability to capture the impact of intangibles and non-financial issues are apparent, which noticeably affects overall projects' success.

This research aim is to develop a model for Green IT/IS investments evaluation that enhances the understanding and management of the indirect cost associated with Green IT/IS investments within the aviation industry. The novel aspect of the model is its incorporation of the institutional theory, key internal organizational factors, together with human, organizational and environmental indirect cost factors into one model. This model was validated in the aviation industry in Thailand which had adopted and implemented Green IT/IS. The findings from an in-depth case study reveal that despite, Green IT/IS indirect costs not being perceived as costs and hence not being incorporated into the evaluation process, their effects remain, and lead to issues such as costs overruns, under-optimized budgets, and consequently projects failure. In addition, new Green IT/IS indirect cost factors have emerged which were missing from the current normative literature. Therefore, this research provides decision-makers with a useful model, a comprehensive taxonomy, a set of indirect cost factors that can be utilized during the evaluation process, and management strategies to assist in managing and controlling the impact of Green IT/IS indirect costs.

Keywords: Green IT/IS Investments Evaluation, Indirect Costs, Costs Management, Costs overrun, Sustainability, Aviation Industry.

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Declarations

I declare that, to the best of my knowledge, no portion of the work referred to in the thesis has been submitted in support of an application for another degree, or qualification to any other university, or institute of learning.

The thesis conforms to British Standard BS 4821: 1990, the 'British Standard Recommendations for the Presentation of Thesis and Dissertations', and follows the Harvard referencing system.

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Chapter 1

Introduction

This chapter provides an overview of the environmental sustainability, concerns regarding the impact of IT/IS operation upon the environment and an introduction to the main thesis research areas. It will detail the reasons for organisations to adopt and implement Green IT/IS, and explore the ways in which Green IT/IS seeks to provide solutions to the problem of the impact of IT/IS on the environment (in particular the importance of Green IT/IS evaluation). The chapter will also deal with the evaluation of costs associated with Green IT/IS investments, particularly indirect costs implications within the aviation industry.

The chapter presents and discusses the aforementioned need within this research domain for developing a cost management of Green IT/IS investments evaluation within the aviation industry in order to reduce the impacts of Green IT/IS indirect costs. The aim, objectives and an outline of the background of each chapter in this thesis are also offered in this chapter.

1.1 Introduction

Global warming and climate change are the major threats that challenge the sustainability of business and society because of factors related to the rising cost of energy, scarce resources, and increased power consumption (Molla *et al.,* 2009; Esfahani *et al.,* 2015). Those concerns require individuals and organizations to consider better ways to produce, consume, and use products, services, and technologies (Sarkis *et al.,* 2013). Besides, shareholders and legislators put organizations and business under pressure to improve their environmental sustainability activities (Murugesan, 2008; Melville, 2010; Butler, 2011b). The review of the normative literature highlighted that the continuous growth of IT/IS is considered to be one of the main considerations for the increase in energy consumption and emission (Esfahani *et al.,* 2015).

As business directors anticipate that environmental issues will become dominant, thus they have already commenced to monitor environmental or Green IT procedures surrounding economic, environmental, and social impacts of organizations (Ozturk *et al.*, 2011; Ijab, 2012). A rising number of industries and businesses have focused on Green initiatives to diminish the effect of IT/IS operation on the environment and to improve the environmental sustainability of their businesses (Molla, 2009; Watson *et al.,* 2010b Sarkis *et al.,* 2013). It would be valuable for organizations to determine the benefits and costs to reach positive outcomes and discover better ways to manage their Green IT/IS investments to improve environmental and economic performance (Sarkis *et al.*, 2013). Consequently, IT/IS managers are also under pressure to reduce the entire cost of IT operations as well as to pursue energy efficiency practices so as to improve the environmental sustainability of their businesses (Molla, 2008; Murugesan, 2008; Melville, 2010, Bulter, 2011a; Hertel and Wiesent, 2014). The fact is that being green is not essentially cost-efficient, since Green IT/IS nevertheless creates financial concerns, as they may lead to cost reduction or at the same time may incur additional expenses (Chen *et al.,* 2011; Esfahani *et al.,* 2015).

Thus, there is a need to enhance a better understanding and broaden the perspectives surrounding indirect costs implications of Green IT/IS investments within this research domain. This challenging research area requires effort from academics, scholars, and practitioners and, above all, assistance among professionals in the areas of science, politics, industry, and society (Piotrowicz and Cuthbertson, 2009; Bengtsson and Agerfalk, 2011; Bai and Sarkis, 2013; Hertel and Wiesent, 2013; Eshafani *et al.*, 2015).

1.2 Trends of Environmental Sustainability

While the environment is continuing to degrade, individuals, organizations, communities, and nations are all concerned with environmental sustainability issues and their impact on future generations (Sarkis *et al.,* 2013; Esfahani *et al.*, 2015). The United Nations Environment Program (UNEP) reports on the Green Economy mention the "*growing recognition that achieving sustainability rests almost entirely on getting the economy right"* (UN-DESA, 2012). It is possible for economic growth and environmental stewardship to be strategically complementary, but somehow it is a challenging task, and it concerns that there are substantial trade-offs between these two objectives – in other words, the synergies overcome the trade-offs (UN-DESA, 2012). The concept of environmental sustainability is growing in importance among both practitioners and academics.

A global United Nations (UN) survey identifies sustainable economic development as an unresolved issue (Watson *et al.,* 2010b). Therefore, sustainable development is a key element for organizations looking to achieve competitive advantages (Berns *et al.,* 2009). The term sustainable development is defined as "*practicing sustainability within organizations, and it is essential to meet and understand the needs of an organization's stakeholders; rather than compromising the capacity of future generations in meeting their needs by concentrating on three dimensions comprising of: economic, social and environment dimensions"* (WCED, 1987; Sabbaghi and Vaidynathan, 2012). Hence, a successful organization needs to balance all of the dimensions mentioned above to be sustainable (Ijab, 2011).

As Gartner (2011) claimed that sustainability would become one of the top five concerns of Chief Executive Officers (CEOs) by year 2015, in response to that in recent year, a growing number of stakeholders envisage organizations to integrate Green and sustainability-related initiatives into their main business operations and strategies rather than viewing them just as supplementary any longer (Lacy *et al.,* 2010; Bai and Sakris, 2013; Gartner, 2015). Hence, Corbett (2010) supports the view that business practices and strategies should accept their effect on environmental sustainability in order to be acceptable in the society. Consequently, organizations can commence environmental sustainability while improving productivity and reducing costs; however, their incompetence of environmental practices, including unused supplies, energy inefficiency, noise, and emissions, are environmentally harmful waste products that reduce economic efficiency (Watson *et al.,* 2010b; Gartner, 2015). Therefore, it is essential for organizations to realize how a sustainable environment could impact on their organizational sustainability in all aspects.

1.3 Worldwide Concerns over IT/IS and Sustainability Issues

The adoption of the Green or environmental-friendly technology within organizations has comprehensively commenced. The technological development plays a crucial role in the levels of carbon emitted from hardware, as the advancement of technology indicates that emissions will be reduced through energy efficiency gains and other means (Fernando and Okuda, 2009; Brook *et al.,* 2012; Hertel and Wiesent, 2014). IT/IS solutions used within organizations can have both positive and negative consequences on environmental sustainability (Piotrowicz and Cuthbertson, 2009; Watson *et al.,* 2010b; Sarkis *et al.,* 2013; Esfahnani *et al.,* 2015). IT has been actively used in quite a large number of fields including industry, transportation, business, and households, and helps to reduce the environmental burden greatly by improving the operational efficiency of these areas (Meti, 2008; Esfahani *et al*., 2015).

Nevertheless, IT operations inherently have a negative effect on the environment; IT equipment consumes large amounts of electricity, which contributes to greenhouse gas emissions (Murugesan, 2008) as well as, the production and disposal of IT hardware can lead to harmful pollution and toxic materials being released into the environment (Dedrick, 2010; Molla and Abareshi, 2012; Gartner, 2015). By the year 2025, the amount of data traffic on the internet will be approximately 100–200 times its present value due to the consumption of electricity in the use of IT devices (servers, network equipment, PCs and displays) and is predicted to increase fivefold (20% of total generated electricity power) than that of today by 2025 (Meti, 2008). The advent of information societies leads to the high usage of technology on IT device/systems, power consumption, resulting in numerous issues such as great power consumption (Guster *et al.,* 2009) and the increase in carbon footprint has a harmful consequence on the environment (Fuchs, 2008). The persistent growth of IT/IS is considered to be one of the key aspects for the rise in carbon dioxide emissions and energy consumption, resulting in a carbon footprint that stimulates global warming (Hertel and Wiesent, 2014). Consequently, business activities related to IT are considered to be a contributor for environmental deterioration; however, IT can be beneficial in providing the solution to enhance business processes (Elliot, 2011; Gartner, 2015).

Therefore, customers, policymakers, and business partners need to inspect and report organizational effects on sustainability (Piotrowicz and Cuthbertson, 2009; Gartner, 2015). Those poor environmental practices could be improved by Green IT/IS initiatives (Huang, 2008; Melville, 2010; Watson *et al.*, 2010b; Butler, 2011b; Esfahani *et al.*, 2015), and they can be a driving force for sustainability growth (Watson *et al.*, 2012). Obviously, IT/IS from an environmental perspective is new for an organization and is also considered as an emerging knowledge field (Jenkin *et al.*, 2011; Esfahani *et al.*, 2015).

1.4 Background to the Research Issues on Green IT/IS Adoption and Evaluation within the Aviation Industry

As aforementioned, the significant issues facing organizations, governments, and societies are concerned with adopting and implementing environmentally sustainable practices including Green IT/IS. There is a growing opportunity for organizations to exploit ‘Green’ IT/IS initiatives and use IT/IS more proficiently, either directly or indirectly, so as to reduce adverse effects towards the environment (Watson *et al.,* 2008; 2010b; Esfahani *et al.,* 2015). Although IS literature and studies began to realize the importance of sustainability, and proposed the concept of ‘Green IT/IS’ to better understand the role of IT/IS in dealing with sustainability (Melville, 2010; Watson *et al.,* 2010b; Brooks *et al.,* 2012), the Green IT/IS concept is still lacking in all recognizable management information systems (MIS) journals (Elliot and Binney, 2008; Brook *et al.,* 2012; Loeser, 2013; Esfahani *et al.,* 2015). This is a demand for the IS community to achieve the social responsibility, which has been extensively inadequate (Watson *et al.,* 2010b; Sarkis *et al.,* 2013; Esfahani *et al.,* 2015).

Adopting Green IT/IS initiatives and practices brings benefits to businesses and individuals, including reduction of power consumption, lower costs, lesser carbon emissions and environmental impact, and improved systems performance and use, respectively (Murugesan, 2008; Butler, 2011a). Likewise, Green IT has become a critical response to the environment, and brings with it new changes and values within organizations especially reduce the negative effects towards the environment (Corbett, 2010; Butler, 2011b; Jenkin *et al.*, 2011; Lei and Ngai, 2013b; Esfahani *et al.*, 2015). Furthermore, Bose and Luo (2011) assert that the European Commission called on the IT industry to increase efforts to cut carbon emissions by 20% by 2020, and 40% by 2030 (EU, 2012). Despite the importance of this issue, academic researchers of IS have paid little attention to the adoption studies of Green IT/IS (Lei and Ngai, 2013a/b; Esfahani *et al.*, 2015) as well as few of them examined the formation of the Green IT/IS evaluation by organizational decision makers (Gholami *et al.*, 2013; Lei and Ngai, 2013b).

Correspondingly, IS practitioners and industries, such as the Green Grid, Energy Star, Standard Performance Evaluation Corporation, and Climate Savers, are greatly alert to the environmental issue and emphasize on Green IT/IS initiatives due to the new standards and regulations were created to diminish the emissions, control hazardous wastes used in computing equipment and dispose them in environmentally friendly manners (Sayeed and Gill, 2008; Brands, 2014; Gartner, 2015). By adopting Green IT practices, organizations can lessen the harmful environmental impact of their IT/IS operations on the environment (Murugusen, 2008; Daly and Butler, 2009; Brans, 2014). In the past, some organizations do not consider environment issues in their organization's strategy; however, it is comprehended that Green IT/IS initiatives aid in cost savings and efficiency benefits, thus organizations commence to go Green (Jenkin *et al.,* 2011). Nevertheless, Gartner (2015) reported that recently, more organizations attempt to integrate Green IT/IS initiatives into their main business operations, and involve in the strategic decisions (Bai and Sakris, 2013).

Within the adoption aspects of Green IT/IS, it emerges that there is also a need for organizations to add IT/IS into their environmental assessments (Huang, 2008; Lei and Ngai, 2013b). There is also need to investigate current barriers that prevent organizations from integrating IT/IS into their environmental assessments and evaluate how organizations develop knowledge and understanding of the benefits and costs associated with Green IT/IS practices (Siegler and Gaughan, 2008; Daly and Butler, 2009; Jenkin *et al.,* 2011). Most of the studies pay more attention to the benefits and design of Green IT/IS (Califf *et al.,* 2012; Esfahani *et al.,* 2015), as they are among the main reasons for organizational adoption; nevertheless, these are not the only reasons to adopt Green IT/IS from the viewpoints of practitioners and academics (Brooks *et al*., 2012).

Within the aviation industry, there is a lack of Green IT/IS studies and theoretical underpinnings, with only a small number of Green/Sustainable/Corporate Social Responsibility (CSR) studies (Lynes and Andrachuk, 2008; Smith and Grosbois, 2011; Chen, 2012; Sarkar, 2012; Amini and Bienstock, 2014) having been carried out, not for the Green IT/IS domain. This stimulating research area needs effort from academics, scholars, and practitioners (Piotrowicz and Cuthbertson, 2009; Bengtsson and Agerfalk, 2011; Bai and Sarkis, 2013; Hertel and Wiesent, 2013; Eshafani *et al.,* 2015) to understand the implications of Green IT/IS evaluation particularly on indirect cost implications. The adoption of Green IT/IS and environmental technologies is considered to be a driver to build a green economy and sustainable growth (Gartner, 2015); thus, future research in this area particularly the aviation industry (Carlini, 2013) would be crucial for both academics and practitioners. This could lead to increased environmental awareness in achieving sustainable development in the IT/IS field among IT/IS practitioner within the aviation industry.

The significance of this research lies in the expansion of knowledge and understanding of the factors that support or hinder organizations surrounding Green IT/IS investments evaluation that fulfills the requirements of their stakeholders. Essentially the indirect costs following its implementation of Green IT/IS need to be considered if organizations are to be cost-effective and efficient in the long run. Thus, the proposed conceptual model in this thesis will be developed and served as a comprehensive tool and, therefore guide management and decision makers when taking decisions, particularly on indirect cost implications, regarding Green IT/IS investments within an aviation industry.

1.5 Issues Regarding Costs related to Green IT/IS Investments

The cost of Green IT solutions is one of the most critical impediments to organizations as highlighted by Molla *et al.* (2009) particularly, indirect cost implications associated with Green IT/IS investments are among the most crucial barriers preventing organizations from adopting them (Daly and Butler, 2009; Dedrick, 2010; Butler *et al.,* 2011; Bai and Sakris, 2013). The fact is the problems related to cost/budget overruns remain concerning large-scale IT/IS projects; for instance, the research conducted in collaboration with the University of Oxford on cost, budget and value of large-scale IT projects reports that on average, huge IT projects are experiencing budget overruns and over time approximately 45% and 7% respectively, as well as delivering less value than foreseen around 56 % (Bloch *et al.* (2012).

Organizations and IT executives have not recognized that through Green or Green IT/IS initiatives, costs can be diminished and benefits/profits improved such as Chief Information Officers (CIOs) are cautious once they need to make investments in Green IT/IS with uncertain costs and payoffs (Daly and Butler, 2009; Nidumolu *et al.,* 2009; Dedrick, 2010). Hence, IT managers perceive Greening IT operations to be a costly process and find it difficult to evaluate their intangible aspects (Webber and Wallace, 2009; Murugesan, 2011; Bai and Sarkis, 2013). This is because Green or environmental issues are problematic for managers to understand as they are too complex and scientific which makes them undetectable and incalculable (Garling *et al.,* 2003; Esfahani *et al.,* 2015).

However, in the event of stakeholder calls, stricter environmental regulations, competitiveness, corporate brand image, and social responsibility, it might be better for organizations to consider going ‘Green’ in order to diminish the cost implications (Murugesan, 2013). It is an undeniable that organizations should move forward with Green IT/IS investments; however, they should be aware that those decisions may include spending in new and environmental friendly technologies and tools, training employees for Green IT/IS practices, altering existing processes, and hiring new mangers and top management who have a clear environmental visions (Murugesan, 2011; Sharma, 2012). The abovementioned activities within organizations are in line with the effect of IT/IS and Green IT/IS on organization and people, which related to indirect costs. Hence, it is necessary for organizations to take the indirect cost implications into account as their effect would lead to problems in identifying and quantifying the indirect costs and add more complexity to the overall investments justification and appraisal as such indirect costs are problematic to measure and quantify in financial terms (Ghoneim, 2007; Bai and Sakris, 2013).

Consequently, indirect costs associated with Green IT/IS investments, are critical for organizations because of the difficulty to identify and quantify the indirect costs (Bai and Sarkis, 2013), which then might lead to issues of cost/budget overruns and the project's failure in the long run (Molla *et al.,* 2009; Murugesan, 2008; Webber and Wallace, 2009; Melville, 2010, Bulter, 2011a; Hall, 2012; Hertel and Wiesent, 2014). Apparently, there is a need to evaluate Green IT/IS investments as well as to develop an understanding of the identification and management of Green IT/IS indirect costs within the aviation industry.

1.6 Environmental Issues within the Aviation Industry

In the transportation sector, which includes aviation, marine, road, and other modes of transport, aviation is one of the fastest-growing industries in the world (Sarkar, 2012). Other means of transportation (rail, sea, and road) are not as speedy as air travel (Capoccitti *et al.,* 2010). However, it is interesting to see that despite efforts to limit emissions from international transport, emissions from aviation and marine bunkers, together about 80% higher in 2011 than in 1990, grew even faster than those from the road sector (OECD, 2012). Therefore, Green initiatives have become more prevalent and several airports gradually plan the implementation of several sustainability programs (Carlini, 2013). As a result, policymakers are attempting to implement measurements to encourage or require improved transportation sector efficiency, as the United States (US) has recently done and the European Union (EU) are presently doing as a follow-up to the voluntary agreements.

Although aviation is considered to be a vital sector in the transportation and tourism industry, it also has negative impacts, such as air pollution and noise, and contributes to climate change and other economic and social issues (Chang *et al.*, 2015). Various concerns over the aviation industry, owing to the continuous expansion of air travel, have increased, leading to climate changes and increased carbon emissions into the environment (Smith and Grosbois, 2011; Brown, 2013; Mirazova, 2014). Anxiety regarding such environmental pressures has led numerous stakeholders to encourage both researchers and practitioners to investigate corporate greening solutions (Sarkis *et al.*, 2013). For instance, aviation growth (i.e. airports/airlines) increased rapidly throughout the 1990s, and this then led to adverse impacts on the environment, causing concern for local communities and resulting in environmental regulators creating requirements (NASA, 2014). The elimination of such potential harm to the environment should be carried out quickly; therefore, they have taken many actions with government, industry, and university partners on some environmental issues, including fuel burn, emissions, noise, and innovative improvements in new technology (NASA, 2014). Accordingly, the vision of the International Air Transport Association (IATA), a group that represents a number of the world's airlines and plays a crucial role in aviation policies, particularly on environmental protection within this industry, is to achieve carbon-neutral growth by 2020, 50% reduction in carbon emissions by 2050, and zero-emission aircraft in 50 years (IATA, 2009).

For example, global aviation supports 8% of the world's economic activity regarding Gross Domestic Product (GDP); however, they contribute 2% of global Carbon Dioxide (CO2) emissions, which leads to global warming (Sarkar, 2012; Walala and Mutinda, 2013). Despite its small contribution to environmental issues, air travel is considered the world's fastest-mounting greenhouse gases' source through gases like carbon dioxide that affect climate change (Capoccitti *et al.*, 2010). Undeniably, air travel has become a crucial part of today's advancement, but the magnitude of the impact on the environment that this industry trigger is also substantial (Smith and Grosbois, 2011). Consequently, the aviation industry needs to find ways to meet the rapid increase in demand for civil air transport while reducing its environmental impacts.

The aviation industry is embracing the Green trend in many ways (Brown, 2013). Airport operators across the regions are established to implement sustainability programs and initiatives within their airports (Carlini, 2013). For instance, there are environmental or Green projects that are associated with the development of new technologies and harnessing existing ones within this industry that strive to combat climate changes and reduce emissions (Brown, 2013; Weir, 2013). By improving airlines' operational efficiency, including reducing costs and improving processes, technological advancement has been an influential factor through its use of advanced aircraft engine technology, IT solutions, and mobile technology (Cederholm, 2014). Clearly, every party need to be alert of the advances that manufacturers are making since the industry received adverse press and claims concerning the environment (Weir, 2013).

There is an unquestionable and urgent need to address and improve the environmental concerns and performance of air transportation because within the aviation industry emissions are increasing more swiftly than in any other sectors (OECD, 2012; Sarkar, 2013; Mirazova, 2014). The aviation industry undoubtedly needs to adopt and implement Green initiatives and practices in all aspects including the IT/IS domain, as the aviation industry is growing rapidly and that it is highly dependent on IT/IS, which has negative impacts on the environment. Thus, the outcome of this thesis will be to contribute to the overall global environment, and the aviation industry especially, in a meaningful and timely manner.

1.7 Research Aim and Objectives

1.7.1 Research Aim

Many scholars and practitioners (Butler, 2011b; Jenkin *et al.*, 2011; Lei and Ngai, 2013b; Esfahani *et al.*, 2015; Gartner, 2015) suggest that Green IT/IS investments evaluation are of undoubted significance for organizations looking to reduce the adverse impact from IT operations upon the environment as a whole, and the aviation industry in particular (Brown, 2013; Weir, 2013). However, the challenge for those organizations is in evaluating Green IT/IS investments, in particular to the indirect costs, and exploring the extent of their relevant factors (Gholami *et al.*, 2013, Lei and Ngai, 2013b; Bai and Sakris, 2013). As already mentioned, the number of studies concerned with the Green IT/IS research domain is still limited, especially Green IT/IS evaluation. Also, there is a dearth of this particular research in the Green IT/IS domain focusing on

Green IT/IS evaluation including indirect costs implications associated with Green IT/IS investments in the context of aviation, and a lack of theoretical underpinning/model and backing of empirical research. Indirect costs are evidently one of the main concerns of scholars and practitioners for Green IT/IS investments. Therefore, this research attempts to fill the above-mentioned voids. Thus, the aim of this thesis is as followed:

"To develop a model for Green IT/IS investments evaluation that enhances the understanding and management of the indirect cost implications associated with the Green IT/IS investments. By doing so, a comprehensive cost management model will be created, which may assist aviation organizations."

To achieve this aim, the following research question is addressed:

- How are the indirect costs considered and managed within IS evaluation for organizations pertaining to Green IT/IS initiatives and practices within the aviation industry?

1.7.2 Research Objectives

The research aim can be achieved through the following objectives:

Objective 1: To critically review the literature in the area of IS evaluation and the Green IT/IS research area including adoption, investments evaluation and indirect cost implications of the research areas with a particular focus on the aviation industry.

Objective 2: To identify factors affecting Green IT/IS evaluation including external factors, internal organizational factors and IS evaluation (i.e. indirect costs factors) associated with Green IT/IS investments.

Objective 3: To propose and develop a conceptual model for Green IT/IS investments evaluation focusing on indirect costs within the aviation industry.

Objective 4: To analyze the empirical results and validate the model to the proposition, for a revised cost management model for Green IT/IS investments evaluation, focusing on indirect costs.

1.8 Thesis Outline

The structure of the thesis follows the methodology suggested by Phillips and Pugh (2010) and consists of four main elements: (1) background theory; (2) focal theory; (3) data theory and (4) novel contribution.

The background theory emphasizes on establishing a comprehensive research domain in the particular field of research (Chapter 1), assesses the existing literature, and identifies research problems, ranges of issues and gaps (Chapter 2). The second portion of the thesis (focal theory) associates with a conceptual model's development, which is revealed in Chapter 3. The data theory reports concerns including the use of most suitable epistemological stance, a proper research methodology to be developed and the limitations concerning the selected research strategy, which are illustrate in details in Chapter 4. Besides, data theory involves with the data collection process, analysis, and discussion, which are indicated in Chapter 5. Lastly, novel contribution is related to the thesis's finding to the development of the discipline being researched so as to embark on the research's contribution (chapter 6). Chapter 7 summarizes the research presented, a concise summary of contributions and discussion of the possible grounds for future research are provided. Therefore, the thesis outline is illustrated and explained in the following sections:

1) Background Theory

Chapter 1: Introduction

This chapter provides an introduction to the main issues of this research, presenting a background to the research domain and its significance. Fundamentally the overview and concerns of environmental sustainability and the operation of IT/IS, Green IT/IS investments evaluation particularly indirect costs, Green and environmental initiatives and practices within the aviation industry. Thereafter, the aim, objectives and the research question of this research were indicated. This chapter closes with a summary of the thesis' structure.

Chapter 2: Literature Review: IS Evaluation, Green IT/IS Investments Evaluation and Indirect Costs within the Aviation Industry

This chapter critically reviewed the existing research on IS evaluation, Green IT/IS investments evaluation, and Green/sustainable/CSR within the aviation industry. It then explores the IS evaluation techniques focusing on indirect cost implications for Green IT/IS investments within aviation industry. Finally, it presents the literature findings in the shape of a set of indirect Green IT/IS costs as well as the relevant external and a comprehensive taxonomy of internal organizational factors affecting the adoption and implementation of Green IT/IS. This allows identification of gaps in the existing literature and a conceptual model that can be validated.

2) *Focal Theory*

Chapter 3: Developing a Conceptual Model – A Cost Management Model for Green IT/IS Investments Evaluation within the Aviation Industry.

As reported in Chapter 2, one important issue to adopt and implement Green IT/IS is the dilemma of whether to invest through ambiguous costs and payoffs. Chapter 3 attempts to overcome this issue by drawing on the theme in the literature review and proposes a cost management model for Green IT/IS investments evaluation within aviation industry (Figure 3.3). The conceptual model contributes towards a better understanding of factors influencing Green IT/IS investments evaluation then assisting in the identification and management of indirect cost implications associated with such investments. It is here that the necessity for a rigorous Green IT/IS evaluation process and indirect costs are focused.

3) Data Theory

Chapter 4: Research Methodology – A Qualitative Case Study Approach

Chapters 2 and 3 have aided the researcher in understanding and identifying research issues by presenting the background of this thesis. Chapter 4 reviews the rationale for the research design used. The appropriateness of the research approach, regarding the epistemological stance that meets the research aims of this thesis, is reviewed. A chosen qualitative in-depth case study as a research strategy is analyzed and justified. The problems within the various research methods are specified, and the justification of the methodology is given. Lastly, the research methodology is thoroughly reviewed, and the case study protocol is then indicated.

Chapter 5: Case Study Empirical Data Analysis and Discussion

This chapter provides a detail of the case study conducted for this research. It starts with a background of a chosen aviation organization (referred to as APTH) and describes and analyzes the key issues including: (a) Green initiatives, practices and projects, (b) the non-IT managerial perspectives of the organizational culture, (c) the motivation for Green IT/IS adoption and implementation, (d) external and internal organizational factors influencing Green IT/IS, (e) the evaluation techniques of Green IT/IS, (f) the costs evaluation of Green IT/IS, (g) the overall justification process of Green IT/IS investments evaluation within the aviation industry, (h) the management strategies and mechanisms to reduce cost impacts from Green IT/IS investment on each stage of the IS development life cycle, and (i) the implications of indirect costs' management on the success of Green IT/IS projects. The empirical data collected were analyzed and discussed and then, compared and contrasted to the model developed from the literature review.

4) Novel Contribution

Chapter 6 – Revised Model for a Cost Management Model for Green IT/IS Investments Evaluation within the Aviation Industry.

Based on the case study's empirical findings and the literature review, Chapter 4 revises the conceptual model proposed in Chapter 3. This includes revising the existing factors influencing the decision-making process for Green IT/IS investments evaluation as per case organization, identifying and describing new factors obtained from the empirical findings. Then, it maps the model's factors with the case study's finding to the factors extrapolated from literature. This contributes to one of the aims of this thesis by proposing the practitioners and researchers a revised cost model for Green IT/IS investments evaluation within an aviation industry. The model can be used as a guideline or comprehensive decision making tool to support management and decision-makers when taking decisions regarding Green IT/IS investments, particularly when focusing on indirect cost implications within the aviation industry. Lastly, the contribution of this revised model is indicated.

Chapter 7 – Conclusions

In drawing the discussion to an end, Chapter 7 summarizes the overall research presented. It first describes how this thesis has met the research aim and objectives and then sets up the overall research findings and a demonstration of the key findings. The novel contribution of the thesis is also presented in this chapter together to both theory and practice. Finally, the research limitations and the possible future areas of research are discussed.

Chapter 2

IS Evaluation, Green IT/IS Investments Evaluation and Indirect Costs within the Aviation Industry

This chapter critically reviews the normative literature on the area of IS evaluation, Green IT/IS investments evaluation focusing on indirect costs and Green/sustainable/CSR within the aviation industry for the purpose of establishing a more profound understanding that will be used to develop a conceptual model in chapter 3. The literature review identifies there is a dearth of Green IT/IS evaluation studies and a lack of theoretical frameworks/models, particularly touching on the indirect costs of Green IT/IS investments and other sustainable practices. This chapter, therefore, provides a theoretical underpinning for Green IT/IS investments evaluation, presenting and discussing in detail the relevant factors affecting it with particular emphasis on the aviation industry. The result provides a comprehensive taxonomy of internal organisational factors.

Organizations face a dilemma over whether or not to spend a large sum of money on Green IT/IS investments. Indirect cost implications surrounding such investments have to be taken into account and comprehensively justified. An additional Green IT/IS indirect cost category has therefore been introduced, as well as factors to assist in a more effective evaluation process. The chapter then critiques and identifies possible gaps in this research domain.

The chapter draws a conclusion that would inquiry the level of awareness and understanding of decision-makers within the aviation industry about the importance of relevant factors, such as Green IT/IS indirect costs implications and the need for guidelines to assist in considering such costs in practice during Green IT/IS investment appraisals.

2.1 Introduction

Globalization and IT/IS advancement have had a tremendous effect on how organizations function throughout the world (Gunasekaran *et al*., 2006; Irani and Love, 2008; Ghobakhloo *et al*., 2011). Organizations need to invest in IT/IS infrastructures and evaluate their IT/IS operations so that they can respond to the fast-growing and changing business environments (Gunasekaran *et al*., 2001; Hallikainen and Chen, 2005; Love and Irani, 2008). The IS evaluation research domain has been emerging for more than two decades, the continuous demand and needs for IS evaluation and the development of comprehensive frameworks and models are still critical for organizations, especially those facing enormous IT/IS expenditure for new IT/IS infrastructure investments (Bjornsson and Lundegard, 1992; Gunasekaran *et al.,* 2006; Irani and Love, 2008; Joshi and Pant, 2008; Jukic and Jukic, 2010; Bernroider *et al*., 2013).

Most organizations employ traditional financial/economic-based evaluation for IT/IS justification, such as Costs and Benefits Analysis (CBA), Payback Approaches (PB), Return on Investment (ROI), Net Present Value (NPV), and Internal Rate of Return (IRR); however, it is argued that such techniques do not consider the impact of intangibles and non-financial criteria, which noticeably affect economic and overall project outcomes (Lefley and Sarkis, 1997; Irani and Love, 2001; Gunasekaran *et al*., 2006; Stockdale and Standing, 2006; Irani and Love, 2008; Bernroider *et al*., 2013).

Therefore, the emerging issues surrounding IS evaluation and sustainability/Green are considered to embrace a new dimension in this field, as organizations, particularly IT managers, require frameworks that can assist them to measure and assess the organizational impact on sustainability (Piotrowicz and Cuthbertson, 2009); for example, the evaluation process of costs and payoffs associated with Green IT/IS investments are still doubtful (Daly and Butler, 2009; Dedrick, 2010; Bai and Sakris, 2013). Accordingly, the literature identified that there is a need for Green IT/IS evaluation studies, theoretical frameworks/models (Lei and Ngai, 2013b; Zheng, 2014; Esfahani *et al.,* 2015) particularly on indirect costs implications surrounding the implementation and continuation of the sustainable practices (Butler *et al.,* 2011, Bai and Sakris, 2013).

As referred to by Bannister (1999), within the IS literature, when deciding their IT/IS budgets, mostly direct costs often take into consideration; however, it would appear crucial to identify all the related costs specifically indirect costs before any efforts to evaluate IT/IS, or for this case, Green IT/IS. It is also argued by Bai and Sarkis (2013) that traditional IT/IS evaluation techniques alone are not sufficient to justify Green IT/IS investments on account of intangible and strategic aspects within the evaluation process. For instance, the difficulty, complexity and implications to identify and manage Green IT/IS indirect costs are as the main reasons for Green IT/IS projects' failure. Consequently, this chapter indicates the need to recognize the softer issues (i.e. human, organizational and environmental) associated with developing Green IT/IS infrastructures, and showing the inclusion of such factors in developing a comprehensive cost management model.

2.2 The Importance of IS Evaluation

Willcocks (1992) and Farbey *et al*. (1993) take a managerial perspective and define IS evaluation as "*the inquiry of establishing by quantitative and qualitative means the worth of IT to the organization*". Likewise, Song and Letch (2012) define IS evaluation as "*a process used to identify, measure, and evaluate the value of an object in a certain context*". In other words, it is an important process of evaluating or justifying the value of IS for organizational decision-making in some emphasizing discourse (Smithson and Hirschheim, 1998; Irani and Love, 2001), and evaluation is considered a substantial element of decision-making within organizations (Brown, 2005) as it connects with the outcomes of the success and failure of a project.

For instance, Farbey *et al*. (1992) state that evaluation can occur either at a particular point in time or constantly throughout the IS development life cycle, can be conducted prior to the implementation (ex-ante), and after the implementation (ex-post), or it can be a continuing process, which is carried out at various stages of IT/IS development and implementation. Symons (1991) claims that the life cycle of evaluation should be extended from pre- through to post- implementation, as it would demonstrate the system and learning processes that need to incorporate the evaluation and assist in the adjustment of organizational objectives. Thus, organizations gradually need to assign significant resources and mechanisms to manage the project both ex-ante and ex-post (Irani *et al*., 2006). Besides, stakeholders' involvement/commitment should not be neglected while conducting of both formative and summative evaluation (Stockdale and Standing, 2006).

As aforementioned, although managers have been utilizing the traditional appraisal techniques surrounding IT/IS investments, such techniques are insufficient for strategic decision making as it neglects intangible and other factors (Lefley and Sarkis, 1997; Bernroider *et al.,* 2013), which affects the overall project outcomes (Irani and Love, 2008). Besides, Andresen *et al.* (2000) suggest that when used these traditional techniques to evaluate IT investments are perceived to be inadequate due to their use of only one measure (monetary value). The reliance on a single technique of IT/IS evaluation could lead to the failure of IT/IS project assumptions (Milis and Mercken, 2004).

Therefore, scholars are paying attention to evaluation with the main concerns being how to evaluate IS using different approaches, methods, frameworks, models, and interests (Hirschheim and Smithson, 1999; Irani *et al*., 2001; Stockdale and Standing, 2006; Lagsten and Goldkuhl, 2012; Bernroider *et al.*, 2013). This is because, as systems become more complex and dependent, the need for evaluation processes that take into account the real significant involvement of an IS has increased (Stockdale and Standing, 2006). There are arguments by Lagsten and Goldkuhl (2012) concerning different ways to evaluate IS, as well as debates about the traditional versus interpretive means of evaluation. According to Avgerou (1995), interpretive IS evaluation involves reaching a consensus when making decisions for the development of a future system; this is done by emphasizing participation in the evaluation process, which allows all stakeholders to share their opinions and supports them in upholding their positions.

Henceforth, Stockdale and Standing (2006) claim that there is motivation to develop valid generic IT/IS evaluation frameworks with a broad range of applications but adequately detailed so as to deliver effective guidance, such as an interpretive approach to IT/IS evaluation, which has been found academically and theoretically to offer potential advantages. For instance, there are well-known IT/IS evaluation frameworks/models such as the Content, Context, and Process (CCP) model and the IS success (D&M) model to name but two; such models are widely used or adapted in several studies and applied as measurement and served as evaluation tools (DeLone and McLean, 2003; Piotrowicz and Irani, 2008; Yusof *et al*., 2008b; Bernroider *et al*., 2013). This illustrates that these IS evaluation frameworks/models prove the necessity to incorporate other factors to assist in evaluating IT/IS investments strategically. This supports that traditional appraisal techniques alone are not enough for more effective project outcomes as it involves several intangible and non-financial factors.

Lagsten (2011) notes that organizations conduct an IS evaluation to identify the results of the evaluation and take further action for improvement within the business. Well-managed IT/IS investments can assist in benefits, costs, and risk evaluation to advance an organization's performance, for example, by reducing costs and improving profit levels, together with refining its operational efficiency (Gunasekaran *et al.*, 2001). Therefore, IS investments evaluation need to be considered as a parallel management activity to projects management, where investment decisions demonstrates the benefits, costs, and the risk that are used to support when taking investment's decisions (Irani, 2010).

2.2.1 The Dilemma of IT/IS Investments Justification

As referred to by Irani and Love (2008), it is considered that benefits, costs and risks underpins many IS evaluation decisions, and managers also need to understand IS evaluation as it related to the financial and social capital investments of IT infrastructures' development. Justifying IT/IS spending is an enduring challenging; for this reason, managers are more concerned regarding the value that organizations are truly gained from a large-scale IT/IS investments (Gunaskaran *et al*., 2006; Yaseen *et al*., 2006, 2008). Hence, it is necessary that IS investments should be evaluated and how much benefits should be expected as there is excessive spending on IS, increasing usage, together with unrealistic expectations about its impact (Irani and Love, 2008). However, managers have seldom adopted more complex or IS-specific evaluation methods to capture the full magnitudes of an IS investments (Bernroider and Stix, 2006). Those complications are originated from the effort of understanding the multifaceted aspects when taking a decision to evaluate, such as scope and effect of the decision, the notion of value and its multidimensional aspects, types of IS benefits, costs, and risks, strategy alignment, human and organizational aspects or political matters (Bernroider and Stix, 2006).

A review of the normative literature (Gunasekaran *et al*., 2001; Love *et al*., 2004; Bernroider and Stix, 2006; Gunasekaran *et al.*, 2006; Irani and Love, 2008; Bernroider *et al*., 2013) indicates that IS evaluation projects and enormous IT projects investment are usually carried out using traditional financial evaluation techniques to justify the IT/IS investments; however, the estimated costs and benefits of these approaches are moderately imprecise as they lack the intangibles and non-financial information accrued within investing in IT/IS, which affect the overall project outcomes. For instance, strategic implications and stakeholder concerns related to IT/IS cannot be accommodated within traditional appraisal frameworks (Irani and Love, 2008). There are also the issues of IT/IS benefits being intangible and non-financial, and the costs are hidden, which make them inappropriate for inclusion within traditional appraisal techniques (Irani and Love, 2008). Those evaluations are often ignoring intangible or strategic consequences and softer issues associated with employees and stakeholders but concentrate greatly on tangible elements (Irani, 2001; Bernroider *et al*., 2013). Thus, during the decision-making process, management’s decision-making skill is considered to be an important aspect, as it delivers the precise value, effectiveness, and relevance of its evaluation implementations (Brown, 2005; Närman *et al*., 2009).

Hence, it often results in the uncertainty and dilemma of decision-makers in taking a decision to evaluate massive IT/IS investments particularly on costs. The important thing is all IT/IS investments need to be regularly re-evaluated on their potential business value individually from how well they are being performed (HP, 2009).

2.3 IT/IS Cost Taxonomies and Factors

Powell (1992) mentions that there is a need for a mechanism/tool for IS costs identification and allocation. Bannister *et al*. (2001) contend that within IT costing, cost identification issues often cause complications for managers; as often, they do not have inadequate understanding and expertise to identify and manage such costs (Irani and

Love, 2000; Ghoneim, 2007). For instance, the problematic of costs identification, which can result into costs or budget overruns for IT/IS investments remains an ongoing issue for over a decade (Love *et al.*, 2004; Ghoneim 2007; Hall, 2012). Thus, it is apparent that the insufficiency of IT/IS cost identification is considered as an ongoing problem as there are limitations in the capabilities and awareness of managers (Irani *et al*., 2006; HP, 2009; CIMA, 2013).

Hall (2012) reported that out of 2,200 IT projects worth an estimated total of $260 billion, the average cost overrun was 27% in the United States and Europe, 35% of which was for the private sector, and the remainder was for the public sector. Similarly, in a report regarding cost overruns on IT projects, the Chartered Institute of Management Accountants (CIMA) (2013) also stated that over 5,400 projects experience an average of 45% budget overspend. In other words, most IT projects have a cost overrun; however, it is probable that it will end up running over budget and over time, with each extra year contributing to the project's cost overruns (Bloch *et al.*, 2012). This shows that organizations are struggling to endure the strain of cost/budget and schedule overruns for a long period of time, and this ongoing manner can affect an organization's survival.

Moreover, managers do not completely understand IT cost management portfolios, and there is an absence of suitable frameworks to assist in evaluating IT investment decisions on costs particularly indirect costs implications (Irani and Love, 2002; Ghoneim, 2007; Bernroider *et al.*, 2013). Thus, when it comes to the justification process of IT investments evaluation, managers tend to be narrow-minded (Irani *et al*., 2000) and often take into account mainly direct costs when deciding their IT/IS budgets (Remenyi *et al.,* 2000). For instance, during a critical period, several CIOs are now required to lower capital spending and control the costs of IT operations while they prepare for restoration. Poor decisions associated with IT operations and investments can lead to unsmooth business operations as well as devastating costs. Thus, cost optimization/effective and competitiveness are said to be the most important elements (HP, 2009). Consequently, it is crucial for decision-makers and IT managers to increase the quality of decisions, particularly regarding costs associated with IT operations and investments, in order to be competitive and avoid impacts (Närman *et al*., 2009).

Kursters and Renkema (1996) categorize IT/IS costs as being either financial or non-financial by the activities that impact them. Financial activities, in other words, are direct costs, including the development, implementation, and operation of a system (Irani *et al*., 2006). On the other hand, non-financial activities might happen throughout several stages of a system's life cycle as they are associated with the human and organizational dimensions of development; once employing a new system, the magnitude of these activities cannot be foreseen (Irani *et al*., 2006). For example, it is likely that non-financial factors have a substantial effect on most IT/IS implementation processes and indirectly give rise to costs (Irani and Love, 2008). This is involved with lack of understanding or resistance to change by employees who prefer to continue with the old system, thus leading to the system not being utilized efficiency (Irani *et al*., 2006). In other words, the costs surrounding IT/IS investments are hard to determine; although the benefits have been shown, they are difficult to recognize (Love *et al*., 2004). The following table 2.1 is a summary of the list of costs that provide and broaden the understanding of several cost perspectives.

Taxonomy	Description	Authors
Initial/On-going costs	Costs identified and assigned during systems' lifecycle. However, they tend to be reflective, which makes their consideration during ex-ante evaluation challenging. Such cost taxonomies warrant tighter consideration regarding identifying their respective cost elements while legacy systems and business solutions become more combined.	Dire and Mooney (1994)
Financial/Non-financial activities	These costs are allocated to the activities causing them, thus highlighting a causal relationship. Hence, reactive in nature.	Kusters and Renkema (1996)
Initial investment/On-going costs	Based on costs relating to an IS' development infrastructure (initial investment) and its operation (on-going cost).	Remenyi *et al*. (1995)
Development/Hidden costs	Costs associated with purchasing, installing, training, and testing system.	Anandarajan and Wen (1999)
Social subsystem costs	Costs that reflect changes in social subsystem brought about by new IT Infrastructure.	Ryan and Harrison (2000)
Direct/Indirect costs	Direct cost element assigned to IT component, whereas indirect element relates to the effect of IS on organization and people.	Irani and Love (2001)
IS cost divisions – Management, Employee, Finance, and Maintenance	Identifies set of cost factors and sub-systems that impact on organization. However, falls through of identifying performance measures.	Mohamed and Irani (2002)
Acquisition/Administration: Control and Operation costs	Identifies set of cost factors that establish Total Cost of Ownership of IT.	David *et al.*, (2002)
Life cycle cost	Involves several factors. Many of these factors are of a technical nature, such as development costs or integration costs. An extensive part of the costs are; however, triggered by organizational factors such as the changes the establishment of an IT-system imposes on business processes and the provisional loss of productivity this causes, or the cost of training before taking the system into operation.	Närman *et al.*, (2009)

Table 2.1: Summaries of Cost Classification Models (Adapted from Ghoneim *et al.*, 2003)

Table 2.1 presents the various cost factors listed in the different taxonomies that may assist in identifying the similarities and differences between the various models and their cost elements; however, it mainly identifies and includes the directly quantifiable costs related to IT investments. Ghoneim *et al.* (2003) claim that cost taxonomies are regularly insufficient because other cost taxonomies do not successfully identify the indirect costs excepting (i.e. Remenyi *et al*., 1995; Irani and Love, 2001; Mohamed and Irani, 2002). It can be noted that indirect costs have effects for both the overall systems' costs and the employees within the organization (Ghoneim *et al*., 2003). Nevertheless, a life-cycle cost of IT is proposed by Närman *et al*. (2009) and is added to the cost classification model (Table 2.1). Noticeably, although such cost is considered as technical in nature, the prominent part is that the features of this cost apparently indicate that it is usually caused by the changes of organizational factors. To some extent, this cost involves several similarities of the indirect costs proposed by (Irani and Love, 2001; Ghoneim, 2007).

Accordingly, Irani (1999) advises that the IS evaluation process is comprehensively complex because there is the set of indirect costs involved with the deployment, which make IS evaluation challenging to evaluate. Consequently, it would be stimulating to understand how indirect costs challenge Green IT/IS investments, and allow the inclusion of the full multitude of intangible consequences.

2.3.1 Indirect Costs Associated with IT/IS Investments Evaluation

While addressing the state of research in the IS domain regarding costs, it is apparent that traditional financial methods still remain for over a decade (Byrd *et al*., 1997; Love *et al*., 2004; Ghobakhloo *et al*., 2011), but there is neglect when it comes to evaluating the intangible and non-financial aspects (Bernroider *et al.*, 2013). IT investment appraisals were depended on less sophisticated techniques than other capital investments because they typically concentrate only on the most obvious costs (Ballantine and Stray, 1998; Närman *et al.*, 2009).

Irani and Love (2008) conclude that within IT evaluation, the associated indirect costs are more substantial than the direct costs because the nature of these costs that makes their identification, management and control challenging. Irani *et al*. (2006) illustrate that the direct cost factors are those that commonly relating to the operation and implementation of new IT/IS, and, consequently, are considered mainly throughout the use of traditional appraisal techniques by decision-makers. Hence, Bannister (2001) claims that indirect costs are considered greatly intangible and hard to quantify directly in financial terms; thus many IT/IS managers are challenging of not being able to identify and manage such costs within organizations.

Anandarajan and Wen (1999) claim that traditional financial techniques that used to justify new IT investment are simply for cost saving and not for justifying complex investments as those techniques do not include indirect/hidden costs surrounding IT investments. Love *et al*. (2006) advocate that costs of redundancy and resistance are also considered as the indirect cost factors that added into their framework. For instance, when it comes to the evaluation process, it is mostly indirect/hidden costs, which are often overlooked. Hence, Ghoneim (2007) supports the notion that the indirect costs are problematic to identify, quantify, manage, and then control; however, they cannot be avoided or overlooked, as their effects are troublesome as well as they cannot be accommodated within the existing traditional appraisal techniques that are only depended on accountancy methods. The following (Tables 2.2, 2.3) provide the classification of indirect human and organizational costs proposed by Irani and Love (2001).

Indirect Human Costs	Cost/Factors/Drivers
Management/staff resources	Incorporating the new system into work practices
Management time	Formulating, approving and amending IT strategies
Cost of ownership: system support	Vendor support/trouble shooting costs
Management effort and dedication	Exploring the potential of the system. Linking and integrating new systems together
Employee time	Detailing, approving new systems together
Employee training	Being trained to operate the system and training others
Employee motivation	Interests in using the system reduces as time passes
Personnel issues	Changes in salaries: increase pay base on improved employee flexibility Staff turnover: increases in interview costs, induction costs, training costs based on the need for skilled human resources
Software disposal	The removal of all software before disposal

Table 2.2: Indirect Human Costs (Irani and Love, 2001)

Indirect Organizational Costs	Cost/Factors/Drivers
Productivity loss	Developing and adapting to new systems, procedures and guidelines
Strains on resources	Maximizing the potential of the new technology through integrating information flows and increasing information availability
Business process re-engineering	The re-design of organizational functions, and procedures
Organizational re-structuring	Covert resistance to change
Covert resistance	Unwilling to make the change from the old system to the new system
Opportunity, cost and risk	-
Hardware disposal	The deletion of all hardware before environmentally friendly disposal

Table 2.3: Indirect Organizational Costs (Irani and Love, 2001)

The tables (2.2, 2.3) above demonstrate the classification of indirect human and organizational costs, as they are crucial to IT/IS investments within organizations. The investment of IT projects affects both human and organizational factors as users begin to change their regular routines such as altering the organizational process (Irani and Love, 2001; Närman *et al*., 2009).

Furthermore, the indirect costs of IT/IS implementation are more significant than the direct costs, as they involve human factors and organizational issues that are, for instance, related to the shift from existing to new work practices, as well as how the new system affecting organization's activities (Irani and Love, 2001; Love *et al*., 2004; Närman *et al*., 2009). Furthermore, Willcocks (1992) states that human and organizational costs were revealed that they are usually originated and accounted for IT investments proposals, including management and staff time, extra staff and staff turnover, losses in productivity, training, and organizational restructuring throughout an alteration. As noted by Irani and Love (2001), numerous organizations are agreed that management time (such as leading, planning, and organizing the synthesis of new systems into existing business process) are considered as the most significant indirect costs incurred. Moreover, when employees are to acquire new skills so as to increase their flexibility or overall involvement towards the organization; as their skills develop, they may request that their salary adjusts accordingly or else they will leave to join a competitor; therefore, this is also considered as indirect costs within organizations (Love *et al*., 2004). The aforementioned indirect costs are critical surrounding IT/IS investments.

Correspondingly, Ghoniem *et al.* (2003) assert that organizations and personnel are affected by the interaction between the implementation of new IT/IS, leading to a set of indirect human and organizational costs, and this, in turn, provides a stimulus for the overall success of any system. In order to conduct an effective evaluation process, decision-makers should incorporate indirect/hidden costs into the IS justification process as well as classify these associated costs and certify that this shapes part of the organizational knowledge for future IS adoption (Irani *et al*., 2006). For instance, it is also necessary to improve and manage IT cost transparency management practices so as to prevent organizations overspending on IT budgets, which could hinder organizations to achieve profits from the investment (Gartner, 2013). Thus, well-managed IT cost transparency also aids in cut costs in the right way. The rationale behind is that such overhead or indirect costs can be identified but they should never be entirely eliminated as it could have negative consequences to the overall profitability. Hence, in the case of decision-makers can identify them, then they can be managed effectively (HP, 2009) so that they can justify the outcomes of the overall project more effectively and efficiently on the success of projects' implementation.

2.3.2 Consequences of Ignoring Indirect Costs

Generally, when organizations adopt or implement IT/IS, they are intensely attentive of the strategic benefits (Ghobakhloo *et al*., 2011). However, several of them are uncertain about investing in the technology, given the indirect costs associated with the investments (Mohamed and Irani, 2002; Ghoneim *et al*., 2003). As Hochstrasser (1992) highlights, the total cost of IT/IS investments is underestimated due to the complications in classifying indirect costs into the overall project's investments justification. For instance, he also highlights that the consequences of both indirect human and organizational costs could be up to four times larger than direct costs. Significantly, the implications of ignoring 'indirect' costs can result in extensive effects for organizations (Love *et al*., 2004; Hall, 2012). Thus, an organization may experience failures with IT, in the sense that IT features do not match users' expectations, which highlights the significance of the soft issues including the humans and organizations involved in IT (Irani and Love, 2001).

Furthermore, indirect costs are problematic to identify, and also they are not being able to support their control and reduction appropriately, which creates difficulties for many managers (Irani *et al*., 2006). Although some managers may be inexperienced with indirect costs, others merely decide to overlook them by trying to reduce this cost portfolio, while increase the benefits portfolio instead in order to gain management's support (Alshawi *et al*., 2003). Hence, the effect of such costs remain. For instance, poor IT/IS investment decision-making can lead to financial losses, resulting in loss of competitiveness, with customers having to take in these costs (Love *et al*., 2004; Irani *et al*., 2006). Ghoneim (2007) confirms that the reason for the increasing in projected budget would be that some managers are not fully aware of the full cost implications particularly the indirect costs surrounding IT/IS investments. For example, employees who have not been adequately trained, as well as loss of skilled employees, may cause decreased productivity (Love *et al*., 2004).

Consequently, managers prefer to avoid the indirect costs by not trying to incorporate them in the complete cost portfolio are only holding up the consequence of these costs and not eliminating them (Ghoneim, 2007). Remenyi (1999) concludes that being costly in economic terms, IS project failures can affect staff morale and organizations' performances, which implicitly means that indirect costs incur and lead to IT project failures. Supported by Hall (2012) that the projected average cost overrun for ICT was 27% of 2,200 projects worth a total of 260 billion US dollar in US and EU, the main reason has to do with projects' complexities, mainly organizational resistance or ineffective structures, and those are hard to estimate. Added to that, Irani *et al*. (2002) and Ghoneim (2007) clarify that indirect costs cannot be withdrawn because their consequence could emerge following the project's implementation. Thus, by incorporating indirect costs into a full cost portfolio aid to reduce the financial consequences derived from them specifically, organizations can avoid overrunning costs/budgets. This illustrates the importance of indirect costs associated with IT/IS investments; therefore, it should also be included in evaluation process of Green IT/IS investments.

2.4 Definitions of Green IT and Green IS

In the research on the link between IS and environmental sustainability or eco-sustainability, several terms such as Green IT, Green IS, Green IT/IS, and IS for eco-sustainability are used interchangeably. These variations in terminology can occasionally lead to ambiguity in the theory and practice of the Green concept. Exploration of existing IS literature illustrates that some notions among IS researchers are used in which 'Green' and 'IS' are combined and some use 'Sustainability of IT' (Elliot and Binney, 2008; Elliot, 2011) and 'Eco-sustainability' (Chen *et al*., 2008; Mann *et al.*, 2009; Dao *et al.*, 2011).

Similar to IS, IT and Information and Communication Technologies (ICT) are sometimes used interchangeably (Elliot and Binney, 2008; Elliot, 2011; Lei and Ngai, 2013a). A few prefer Green IT/IS (Chen *et al.*, 20011; Jenkin *et al.*, 2011), Green ICT (Ozturk *et al.*, 2011) and recently, others prefer to use 'Green IT/IS' (Sarkis *et al.*, 2013; Lei and Ngai, 2013a; Esfahni *et al.*, 2015). To sum up, it can be noticed that most scholars prefer to use the term ‘Green’ instead of ‘Sustainability’ or ‘Eco-sustainability.’ Hence, Green IT/IS is a term that ranging a mixture of initiatives (Lei and Ngai, 2013a). The following Table (2.4, 2.5) illustrates the definitions of both Green IT and Green IS.

Definition of Green IT	**References**
1) “The study and preparation of designing, manufacturing, consuming, and disposing of computers, servers, and related subsystems including monitors, printers, storage devices, and networking and communications systems – efficiently and effectively with marginal or no impact on the environment. Green IT also strives to achieve economic feasibility and improved system performance and usage, while enduring by our social and ethical responsibilities”.	Murugesan (2008)
2) “Green IT is the systematic application of principles associated with environmental sustainability to the organization’s design, manufacture, sourcing, usage and removal of IT to be more environmental friendly”. “It also related to human and organizational/managerial components of the IT infrastructure”.	(Molla *et al*., 2009; Dedrick, 2010; Molla, 2013; Esfahani, *et al*., 2015)

Table 2.4: Definition of Green IT

Definition of Green IS	References
1) "Green IS integrates the notion of Green IT and contains a greater variation of possible initiatives to support sustainable business processes. Also, it is the systematic application of practices that enable the minimization of the environmental impact of IT, maximize efficiency and allow for company-wide emission reductions based on technology innovations".	(Watson *et al.*, 2010b; Sarkis *et al.*, 2013; Esfahani *et al.*, 2015)
2) "The initiatives to utilize IT infrastructure to alter organizational processes and/or practices to improve energy efficiency and reduce the environmental impacts, and to introduce environmentally healthier products and/or services".	Brooks *et al.* (2012)

Table 2.4: Definition of Green IS

To conclude, 'Green IT' is primarily concentrated on and addresses energy consumption, equipment utilization and waste related to hardware and software's usage to be more environmentally friendly (Boudreau *et al.*, 2007; Dedrick, 2010; Sarkis *et al.*, 2013; Esfahani *et al.*, 2015). Whereas 'Green IS' tends to have an indirect impact as their mainly emphasis on supporting environmental management processes on the designing and implementing systems (Watson *et al.*, 2008; Esfahani *et al.*, 2015). In IS literature, no general meaning of Green IS exists (Ijab *et al.*, 2010; Bose and Luo, 2011; Bulter, 2011a).

Although some researchers (Dedrick 2010; Brooks *et al.*, 2012) have distinguished between Green IT and Green IS, most regard them as the correlated concepts; however, they have their individual purposes and two terms can be used interchangeably (Huang, 2008; Mithas *et al.*, 2010; Lei and Ngai, 2013a; Esfahani *et al.*, 2015). Green IT has been recognized by various names as abovementioned, and probably a few other names, also it has also seen as portion of CSR (Brans, 2014).While it can be implied that Green IT and Green IS are interconnected concepts; nevertheless, their focuses and purposes are equivalent. Therefore, this thesis uses the term "Green IT/IS" for better interpretation.

2.5 Green IT/IS Initiatives and Practices

As aforementioned, IT operations affect the world's environment in many different ways, from its manufacturing, during its usage, and into its disposal, resulting in environmental concerns (Murugesan, 2008), whereas IT can significantly support sustainable economic development (Watson *et al.*, 2008). Organizations are prone to choose various Greening practices while putting strategic Green IT elements into practice (Mann *et al*., 2009). Fundamentally, Green IT/IS refers to environmentally friendly IT/IS (Murugesan, 2008). The range of possible activities of Green IT initiatives and practices includes data center efficiency, Green procurement, e-waste management and more (see Table 2.4). The magnitudes of environmental sustainability, energy efficiency, and the total cost of ownership, comprising the disposal and recycling, are accounted for by Green IT (Murugesan, 2008 Molla, 2008; Melville, 2010; Hertel and Wiesent, 2014). Not only does Green IT concern the use of technology, but also the assembly of strategic and tactical initiatives so that organizations can realize the ways in which they are dealing with their carbon footprint to diminish environment impacts (Eastwood, 2009). As previously mentioned in Section 1.6, most Green IT definitions mainly emphasis on the hardware and other tangible features of environmentally friendly IT. On the other hand, Green IS can be defined as organizational practices and processes that aim to improve environmental sustainability in the conduct of information process tasks such as environmental information systems (Sayeed and Gill, 2008; Esfahani *et al.*, 2015). Examples of Green IT/IS initiatives and practices are summarized in Table 2.6:

Green IT/IS Initiatives and Practices	References
Virtualization	(Brooks *et al.*, 2012; Bose and Luo, 2011; Unhelkar, 2011; Harman *et al.*, 2010; Corbett, 2010; Iacobelli *et al.*, 2010; Mann *et al.*, 2009; Murugesan, 2008; Watson *et al.*, 2008)
Airflow management systems to lessen cooling requirement	(Vykoukal *et al.*,2009; Murugesan, 2008)
Adopting environmentally friendly (eco-friendly) designs of products/hardware (e.g. data centres), automated energy	(Hasan *et al.*, 2014; Brook *et al.*, 2012; Murugesan, 2008; Watson *et al.*, 2008;)

conservation system	
Procedures to control data centers' energy consumption (e.g. CO2 emission measurement)	(Brook *et al.*, 2012; Murugesan, 2008; Corbett, 2010)
Thin client computers	(Mann *et al.*, 2009; Murugessan, 2008; Watson *et al.*, 2008)
Power and workload management software (e.g. software that turns off devices automatically)	(Hasan *et al.*, 2014; Harman *et al.*, 2010; Iacobelli *et al.*, 2010; Molla *et al.*, 2009; Murugesan, 2008)
Recycling computers, reuse components and water reduction (e.g. e-waste management)	(Ansari, 2010; Corbett, 2010; Watson *et al.*, 2008)
Cloud computing	(Harmon *et al.*, 2010; Olson, 2008; Watson *et al.*, 2008)
Data center reconfiguration	(Harmon *et al.*, 2010; Erek *et al.*, 2009; Molla *et al.*, 2009; Mann *et al.*, 2009)
Telecommuting, teleconferencing, video/mobile conferencing	(Hasan *et al.*, 2014; Corbett, 2010; Hasan *et al.*, 2009, Vykoukal *et al.* 2009; Watson *et al.*, 2008)
Improved power management on new computing systems	(Chetty *et al.*, 2009)
Paperless policy	(Hasan *et al.*, 2009; Vykoukal et al. (2009); Watson *et al.*, 2008)
Less printing, printing on both sides (i.e. duplex), or using default settings for black and white printing	(Unhelkar, 2011; Ansari *et al.*, 2010; Vykoukal *et al.*, 2009; Watson *et al.*, 2008)
Education and training (e.g. Green IT/IS in the curriculum)	(Hasan *et al.*, 2014 ; Unhelkar, 2011; Herrick and Ritschard, 2009)
Changing attitudes, belief and behaviour towards Green IT within the organization	Chow and Chen, 2009; Hasan *et al.*, 2014
Extended desktop and laptop life cycle	(Iacobelli *et al.*, 2010)
Purchasing products from IT vendors who operate in an environmentally friendly manner (e.g. end-of-life/recycling programme/using/disposing of IT equipment)	(Brook *et al.*, 2012; Molla *et al.*, 2011; Unhelkar, 2011; Erek *et al.*, 2009; Mann *et al.*, 2009; Murugesan, 2008)
Managing toxic and hazardous materials and e-waste, designing environmentally friendly products, re-designing environmental friendly business processes to be more environmentally friendly, and energy consumption amenities	(Butler, 2011a)

Table 2.5: Examples of Green IT/IS Initiatives

The detailed Green IT/IS initiatives and practices within organizations at individual and organizational level presented above are drawn from the literature that attempt to reduce the negative consequences of IT/IS operations to the environment. For example, the airport in Berlin (GmbH, 2016) has started the new computer center control using outer air for cooling, which decreases electricity costs and the emission of toxic gases, the power consumption of the computers is continuously monitored. Thus, energy used is saved up to 50%.

2.5.1 Motivation to Adopt Green IT/IS

As referred to by Bansal and Roth (2000), organizations go Green because of three major motivational factors that induce organizations to take responsibility for environmental sustainability: *competitiveness, legitimation,* and *social responsibility*. These main reasons are similar to the reasons behind Green IT/IS adoption (Molla, 2008; Murugesan, 2008; Chen *et al*., 20011; Mann *et al*., 2009). Sharma (2012) elaborates by saying that there are various reasons to adopt Green IT/IS, including reducing the negative effect on the environment, competitors, regulations, or due to pressure from consumers, partners or neighbors. Shareholders and legislators are the main motivators to improve their environmental sustainability activities of any organizations (Butler, 2011a; Esfahani *et al.*, 2015). Moreover, social responsibility motivation has a greater impact on the organization compared to the other two factors in terms of the magnitude of the use of Green IT initiatives (Kuo and Dick, 2010; Molla, 2009: Sayeed and Gill, 2008). Also, Daly and Butler (2009) emphasize that business and IT executives adopt Green IT/IS to enhance their image and attract Green investors. The result from the study by Molla *et al.* (2009) has shown that the motivations to adopt Green IT/IS are: cost-saving, corporate strategy and environment consideration respectively. Thus, it is noticeable that organizations are prone to adopt Green IT/IS because of law and regulations, environmental and social responsibility, and competitive advantages.

2.5.2 Benefit of Greening IT/IS

Adopting Green IT/IS initiatives/practices obviously brings along economic and other benefits to businesses and individuals (Murugesan, 2008). Given the potential direct and indirect benefits, many organizations view Green initiatives as a feasible way to achieve sustainable competitive advantage (Sharma and Vredenburg, 1998; Franklin, 2008).

Brooks *et al.* (2012) claim that two broad groups of benefits derived from Green IT/IS adoption are: environmental and cost reduction benefits. Dealing with Green issues, organizations prioritize environmental, energy efficiency, and cost management requirements (Murugesan, 2008). Green IT initiatives can be categorized into three primary drivers which are: diminishing costs due to lowering budgets, reducing consumption as resource constraints, and complying with laws and regulations (Bose and Luo, 2011). Correspondingly, Murugesan (2008) has agreed that the three drivers of Green IT are: economic, regulatory and ethical. For instance, Green IT/IS investments not only expect increasing energy efficiency but also improving business practices and processes, and increasing business efficiency (Hertel and Wiesent, 2013). When individuals start to value the environmentally friendly characteristics of IT, Green IT will become a standard fundamental in organizations bringing an extensive range of new Green/environmentally friendly products and services, and then new business opportunities will appear shortly (Muguresan, 2008). Therefore, it is clear that there is a broad array of benefits to Greening IT/IS that stimulate organizations to adopt and implement.

2.6 Green IT/IS Investments Evaluation

The persistent growth of IT/IS is considered to be one of the key factors for the rise in carbon emissions and energy consumption, resulting in to a carbon footprint that harms the environment (Hertel and Wiesent, 2014). A rising number of industries and businesses have adopted Green or Environmental initiatives to diminish the impact of IT/IS on the environment (Molla, 2009; Watson *et al*., 2010b; Sarkis *et al*., 2013). However, a growing number of reports express doubt about the benefits and value associated with Green IT/IS initiatives from the start of the adoption; the actual benefit realization that Green IT/IS brings about remains unknown and is not promising (Molla, 2008; Esfahani *et al*., 2015). Jenkin *et al.* (2011) contend that organizations may not understand these benefits entirely and may not have developed adequate knowledge or understanding regarding Green IT/IS implementation, thus hindering the development. Hence, Green IT investments are started with the expectation on the positive environmental impacts, thus a greater responsibility and higher expectations are placed on these initiatives (Corbett, 2010).

Apparently, Green IT/IS investments, and traditional IT/IS investments have similar characteristics because their effects are consistently multidimensional and share some features that are analogous to those of traditional IT investments (Hertel and Wiesent, 2013). Typically, IT/IS and Green IT/IS adoption and evaluation are rather similar to some extent. Nevertheless, several dissimilarities have been pinpointed by (Olson, 2008) including the fact that when taking decisions to implement Green IT/IS, the setup cost is high, it takes longer to break even, and there are soft issues (e.g. employee morale, community goodwill and lower attrition), legislative actions, government incentives, and changes associated with such alterations that need to be taken into account. It is also argued by Corbett (2010) that there are some differences in four essential areas: engagement of new stakeholders (e.g. the sustainability office or facilities management), environmental inconsistency (to ensure that there is an absolute net benefit over IT portfolio), increased complexity in terms of measuring environmental and business impacts (i.e. new expectation placed on these initiatives), and more public concern (Corbett, 2010). Thus, Green IT is increasingly adopted by organizations, and research in the area has suddenly emerged because there are clearer distinctions between Green IT and traditional IT investments (Corbett, 2010).

In addition to cost saving, Green IT practices can mitigate some of the environmental risks associated with the emergence of a Green economy, thus organizations that mitigate these risks more effectively than their competitors can gain a competitive advantage (Lash and Wellington, 2007). Therefore, it is important for organizations to determine the financial cost savings and efficiency benefits that acquire from Green IT/IS initiatives (Dedrick, 2010; Jenkin *et al*., 2011). However, it is argued by Daly and Butler (2009), business and IT executives are not recognized that Green IT strategies can apparently reduce costs and increase profits. Moreover, Murugesan (2008) asserts that the actual costs related to Green IT/IS tools and activities for the environment are much greater than predicted, and it is likely that implementing Green IT/IS are incurred additional costs that need to justify (Murugesan, 2011). Besides, Corbett (2010) indicates that the need to evaluate Green IT/IS investments in supporting business requirements, reducing costs, or complying with regulatory requirements should be considered; however, other factors should also be considered to make the evaluation of such investments less problematic.

2.6.1 The Complexity of Green IT/IS Investments Evaluation

Evaluation of IT/IS is already considered a complex phenomenon because of its involvement of many intangibles and non-financial criteria (Gunasekaran *et al.*, 2001; Irani, 2002; Love *et al.*, 2006; Ghoneim, 2007; Närman *et al.*, 2009). Organizations face difficulties to determine the range of intangible concerns, such as indirect costs related to IT/IS implementation (Gunasekaran *et al*., 2001; Irani, 2002; Love *et al.*, 2006; Bai and Sarkis, 2013). Correspondingly, Piotrowicz and Cuthbertson (2009) claim that sustainability involved with IS increases the complexity even more, as it comprises environmental aspects to enhance better understanding of environmental or Green IT/IS investments evaluation (Piotrowicz and Cuthbertson 2009; Melville, 2010; Bai and Sakris, 2013).

Typically, decision-making involved with Green IT/IS investments is considered a multifaceted decision (Chen *et al*., 2008, 2011; Daly and Butler, 2009) because it takes intangible or non-financial (i.e. environmental) factors into consideration (Bai and Sarkis, 2013). Environmental issues are complex and systematic for managers due to their untraceable and incalculable nature, plus they are characteristically direct effects of business activity; therefore, managers need to deal with the difficulties of taking the burden and altering business procedures to counter the harmful consequences of their products and processes (Gärling *et al*., 2003). The environmental sustainability research field is distinguished by its exploration of extent, complexity, and urgency; therefore, IS researchers also need to cover these emerging phenomena (Melville, 2010). Green IS offers a socio-technical view on the various, complex phenomena of organizational sustainability that assists in solving environmental issues (Hasan *et al*., 2012). It can be claimed that the complexity of such factors in IS use, mainly in organizations, demands a new way of exploring IS use in this context (Ijab, 2011). Additionally, Bai and Sakris (2013) illustrate that Green IT strategic evaluation and management are related to a complex decision-making process because these decisions combine multiple strategic decision-making dimensions. There are many parties involved in decision-making processes, including multiple decision-makers, a range of functions, and organizations, thus increasing the complexity of the processes (Bai and Sarkis, 2013).

Adding Sustainability and Greening into IT/IS evaluation investment further increases the complexity of decision-making that managers and decision-makers must accomplish effectively (Piotrowicz and Cuthbertson, 2009; Bai and Sakris, 2013; Hertel and Wiesent, 2014). Due to its complexity, everyone with different positions within an organization should take into account environmental sustainability (Molla *et al*., 2014); however, the resilience to deal with this issue and the variation of taking actions would be considerably different (Esfahani *et al*., 2015). Undoubtedly, both IS evaluation investment and Green IT/IS evaluation investment are considered complex phenomena within the IS fields.

2.6.2 Green IT/IS Indirect Cost Implications

Despite the points raised, researchers focus more on the benefits of Green IT/IS initiatives, as they are among the key reasons for the adoption within organizations; however, they are not the only reasons (Brook *et al*., 2012; Califf *et al*., 2012; Esfahani *et al*., 2015). While the potential of these innovative technologies is explored somewhat in IS research, more research effort is still needed to quantify the true costs and real benefits of Green IT/IS investments (Dedrick, 2010). Consistent with Molla *et al.* (2009), although organizations are ready to adopt Green initiatives, they are still uncertain about the costs of Green IT/IS as well as their business value. Murugesan (2008) asserts that the actual costs related to the design, manufacture, transport, and disposal of IT in the environment are much greater than predicted. Murugesan (2011) also claims that perhaps Green initiatives appear to incur additional costs associated with Green software or tools needed to decrease energy consumption, achieve environmental ratings, create awareness among stakeholders, and re-engineer the business process to reduce the organization’s carbon footprint. This links with the effects of indirect costs associated with Green IT/IS investments. Incorporating the features of these Greening/environmental indirect costs into traditional investment appraisal techniques is a challenging managerial task for organizations in their investment evaluation (Bai and Sarkis, 2013).

Likewise, Molla *et al.* (2009) affirm that the cost of Green IT solutions is one of the most crucial obstacles to organizations trying to adopt them. Nonetheless, Webber and

Wallace (2009) claim that Green IT operations are to be costly and challenging processes for IT managers in determining and measuring the value the intangible aspects (e.g. benefits/costs). According to Chen *et al.* (2011), Green IT/IS generates financial anxieties since they may result in cost reduction or the incurrence of additional expenses; therefore, being Green is not essentially cost-efficient, although in several cases it is (e.g. Watson *et al*., 2010a). IT/IS managers are also under pressure to reduce the total cost of IT operations and to pursue energy efficiency practices so as to improve the environmental sustainability of their businesses (Molla, 2008; Murugesan, 2008; Melville, 2010, Bulter, 2011a; Hertel and Wiesent, 2014).

Despite this fact that the implementation costs of innovative, environmentally sustainable technologies naturally cause anxiety for CEOs who worry that it may not be cost-effective and that the organization might not be achieve a competitive advantage compared to their competitors (Nidumolu *et al.*, 2009). Thus, it is crucial that ecologically beneficial investments need to support economic benefits for the organization (Hertel and Wiesent, 2013). Within aviation industry, the concerns regarding to investments' funding and budgeting is considered as one of the key obstacles to prevent sustainable initiatives and practices of airport operators (Carlini, 2013). Also, to add to the value of Green IT/IS to businesses, organizations need to limit costs and inefficiencies (Sarkis *et al*., 2013); this includes revenue generation, risk mitigation, business continuity, and image and reputational benefits (Sarkis, 2009).

Therefore, it is apparent that those cost considerations, particularly true/hidden/indirect costs or cost (Bai and Sarkis, 2013), are crucial and should be taken into account by management during the decision-making process when taking a decision towards Green IT/IS investments evaluation.

2.6.3 Indirect Environmental Costs Associated with Green IT/IS

Bai and Sarkis (2013) mention that Green decisions and factors relating to various costs and benefits are still a concern particularly indirect costs (i.e. hidden/indirect environmental costs). According to the United States' Environmental Protection Agency's (EPA) (1995), environmental costs are one of the many different types of costs that organizations incur when providing goods and services to their customers. Every organization may designate environmental costs differently, depending on how they intend to utilize the information such as capital budgeting, cost allocation, process or product design, and other management decisions and on the scale or scope of the exercise (EPA, 1995). In general, environmental costs have both a monetary and non-monetary impact, resulting from activities affecting environmental quality incurred by a firm or an organization (Graff *et al*., 1998). Likewise, Okarfor *et al*. (2013) clarify that environmental cost accounting is a characteristic of environmental management accounting, which supports better decision-making in every organization. This highlights the consequences and re-classification of environmental impacts and costs.

As Okarfor *et al.* (2013) state, the accounting systems do not fully reveal environmental cost management and the associated benefits, and they are usually grouped under the general overhead of accounts. Correspondingly, the environmental costs are hidden, so managers or decision-makers have little information on such costs and are unwilling to manage and diminish them, but they can be a substantial element of an organization's overall cost structure (Okarfor *et al*., 2013). For instance, it appears that such hidden environmental costs cannot be identified thoroughly with certain methods, thus managers must also use other techniques to incorporate and assess them (Joshi *et al.*, 2002). As such, apparently similar manners to indirect human and organizational costs are associated with IT/IS investment, as proposed by Irani and Love (2001). Without the identification of these hidden costs, the product/process and inappropriate allocation of environmental costs, imprecise accounting of volumes and costs of wasted raw materials, and the real deficiency of significant environmental costs in the accounting system within the organization affect the outcome and result in less cost-effectiveness (Bai and Sarkis, 2013; Okarfor *et al*., 2013).

Accordingly, EPA (1995) organizes environmental costs that are incorrectly allocated to cost centers, or are merely ignored, as: hidden, contingent costs, liability or less tangible costs. There is also a combination of fairly tangible costs to less tangible costs. Hence, under the environmental accounting system, these costs have been categorized as: potentially hidden costs including upfront environmental costs, regulatory and voluntary environmental costs, back-end environmental costs, contingent costs and image and relationship costs (EPA, 1995).

Bai and Sarkis (2013) claimed that by incorporating these costs into traditional appraisal techniques is reflected as a difficult task for mangers, as such appraisal techniques are short sighted and considered as ineffective tools for taking intangible and strategic factors into account (Lefley and Sarkis, 1997; Ghoneim, 2007; Irani and Love, 2008; Bai and Sakris, 2013). Therefore, this research has attempted to adopt and adapt and further categorized these hidden/indirect environmental costs from (EPA, 1995; Bai and Sakris, 2013; Okarfor *et al.*, 2013). These costs are going to be used as a part of the conceptual model development in Chapter 3 in order to assist in broadening the understanding of indirect costs implications surrounding Green IT/IS investments.

Indirect Environmental Costs		
	Descriptions	**Examples**
Upfront Environmental Costs	• Incurred ***before*** the operation of a process, system, or facility. • Either categorized as overhead or Research and Development (R&D), these costs can simply overlook while managers concentrate on the operating costs of processes, systems, and facilities.	• Costs related to siting and design of environmentally desirable products or processes, site studies and preparation, permitting, installation, procurement. • Qualifications of suppliers. • Evaluation of alternative pollution control equipment.
Regulatory Costs	• Acquired in running/operating a process, system, or facility; as many organizations have traditionally prescribed these costs as overheads, they may not receive proper consideration from decision makers that are responsible for daily operations and business decisions. Also, the extent of these costs may be more complicated to manage as a consequence of their being pooled in overhead accounts.	• Regulatory costs related to notification, studies, reports, plans, inspection, manifesting, labeling, record keeping, insurance, financial assurance, pollution control, spill response, waste management, and taxes/fees. • Voluntary costs related to community relations, training, monitoring/testing, audits, annual environmental reports, recycling, R&D, landscaping, other environmental projects.
Back-end Costs	• These environmental costs of current operations are *prospective*, meaning they are likely to occur at some points in the future. • Such costs may be neglected if they are not well recorded or accrued in accounting systems.	• The *future* cost of closure, decommissioning, disposal of inventory, closing a landfill cell, replacing a storage tank used to hold hazardous substances, post-closure care that complies with regulations that are not yet in effect but have been notified.

Contingent Costs	• Costs that can or cannot be provoked at any point in the future can properly be described in probabilistic terms: their expected value, their range, or the likelihood of their exceeding some amount of budgets. These costs may also be named "contingent liability costs" and may not need to be acknowledged for other purposes; they may not receive enough concentration in management accounting systems internally and forward-looking decisions.	• Examples include the costs of remedying/restoring and compensating for future accidental releases of contaminants into the environment (e.g., oil spills), fines and penalties for future regulatory infractions, and future costs due to unexpected consequences of permitted or intentional releases, property damages, legal expenses, natural resource damages, economic loss damages, and personal injury damages.
Image and Relationship Costs	• Such costs are considered 'less tangible' or 'intangible' because they are incurred to influence subjective (though predictable) management, customers, employees, communities, and regulators' perception. These costs have further been named "corporate image" and "relationship" costs. • The costs themselves are not "intangible", except the direct benefits that occur from relationship/corporate image expenses usually are.	• Examples such as corporate image, relationships with customers, investors, insurers, suppliers, host communities, regulators, workers, and costs incurred for award/recognition programs.

Table 2.6: The Classification of Indirect Environmental Costs (Adapted from EPA, 1995; Okarfor *et al.*, 2013).

Thus, the proper identification, recognition and allocation of these environmental costs to products, processes and services should be considered when appraising projects related to any environmental or Green investments to avoid making the wrong decision and enhance the decision-making process (Okarfor *et al*., 2013; Bai and Sarkis, 2013).

Incorporating the features of these Greening/environmental indirect costs into traditional investment appraisal techniques is a challenging managerial task for organizations in their investment justification (Bai and Sarkis, 2013). Consequently, organizations need to recognize the importance of such costs relating to Green initiatives associated with the Green IT/IS investments to justify the outcomes of the overall project more effectively and efficiently. Therefore, it would be worthwhile to incorporate the indirect environmental cost into the Green IT/IS investments evaluation process for a more effective cost management.

2.7 The Use of Theory within Green IT/IS Adoption Studies

As previously mentioned that Green IT/IS adoption/evaluation is in a nascent state, and there is a dearth of academic research within this domain; thus, the references from the research stream of IT adoption/evaluation can be drawn to understand the phenomenon of Green IT/IS adoption/evaluation (i.e. theoretical grounding) (Zheng, 2014). However, research in Green IT/IS is generating new models or frameworks, which should be stimulated to grow and develop as the field matures (Molla, 2013). A number of studies (Molla, 2008; Piotrowicz and Cuthbertson, 2009; Bose and Luo, 2011; Lei and Ngai, 2013a; Tushi *et al*., 2014; Esfahani *et al*., 2015) have argued that research in the Green IT/IS investments evaluation domain lacks theoretical and methodological thoroughness as well as there being limited theory development/testing, which is considered a major gap in Green IT/IS literature. For instance, Nanath and Pillai (2012b) claim that of the overall publications, only 22% contribute to specific theory. Also, there are limited numbers of Green IT publications that present theories, thus there is a need for more investigation and development of existing theory in this research area (Tushi *et al*., 2014).

Equally significant, the continuous academic development of this emerging field need new knowledge and insights to be created (Esfahani *et al.*, 2015). It is then vital to be able to utilize existing and developing theory at an organizational level; therefore, organizational theory provides sufficient instances to advance within this field (Sarkis *et al*., 2011). Otherwise, insight from Green IT/IS-related literature would provide understanding and growth of these and other organizational theories. A considerable number of Green IT studies draw from organizational theory, such as Diffusion of Innovation (DOI), Institutional Theory (INT), Natural Resource-Based Views (NRBV), and Transaction Costs (referred to in Table 2.6), which assist and offer useful clarifications on Green IT reserach. However, they need to be extended to gain a deeper understanding of the cooperation between various viewpoints and further help to explain Green IT/IS's decision-making within organizations. Therefore, scholars have tried to utilize the theoretical lens of organizational and IS disciplines to underpin their studies, which support organizations for undertaking Green IT/IS initiatives.

Table 2.6 presents a taxonomy of theories used in Green IT/IS domain in order to understand the use and development of theory in this domain. Most of the theories were simply used at one time, and others use more than one framework/model and perspective to integrate and analyze a certain issue of Green IT/IS research. As claimed by Lei and Ngai (2013a), there are fifteen theoretical frameworks identified, and the theoretical frameworks are classified into the following categories: taxonomy, general Green IT initiatives, and a particular type of Green IT initiatives. It is argued that these theoretical models are differences regarding their target and are intended to use in various aspects of Green technology adoption (Zoysa and Wijayanayake, 2013). Theories that have frequently been used include 'TOE', 'INT', and 'NRBV', which were used by numerous types of research streams (Table 2.8). The following sub-section will illustrate the frequent use of theory in the Green IT/IS research domain in detail.

2.7.1 Theory of Reasoned Action (TRA)

TRA, originally introduced by Fishbein in 1967 and extensively refined and tested by (Fishbein and Ajze, 1975), was developed to define the connections between the beliefs, attitudes, norms, intentions, and behaviour of individuals (Fishbein and Ajzen, 1975). TRA was designed for the purpose of studying the relationship between attitudes and behaviour (Fishbein and Ajzen, 1975; Werner, 2004) to understand the behaviour of a person by considering the effects of personal feelings (attitude) and the perceived social pressure (subjective norm). In particular predicting behaviour to the computer use (Mishra et al., 2014).

TRA also assesses generally what defines people's choices, and what and how external variables influence their decisions (Fishbein and Ajzen, 1975). Ajzen (1991) proposed an additional factor, which is perceived behavioural control of Theory of planned behaviour (TPB), an individual perception of how easily a specific behaviour will be performed. Accordingly, TPB has also been applied to describe IT adoption and is similar to the use of Technology Acceptance Model (TAM) (Riemenschneider *et al*., 2003). As referred to by Fishbein and Ajzen (1975), TAM is adapted from TRA, which explores how attitudes impact behaviour. Davis (1989) proposes that TAM is an information systems theory that attempts to understand why people accept or reject information systems. Since TAM was introduced in 1989, researchers have applied this model to numerous research streams and fields with the intention of predicting IS acceptance and identifying design problems before users experience the system or after an on-going process with the system (Davis, 1989). TAM is considered to be the most extensively cited and tested model in IT/IS adoption (Oliveira and Martins, 2011).

In Green IT/IS studies, TRA use by Sarkar and Young (2009) as the theoretical foundation for the study of managerial attitudes concerning environmental issues. It is applied to understand the attitudes of top individual managers towards particular issues (such as Green IT policy drivers) that establish the focus in implementing relevant corporate policy (Sarkar and Young, 2009). The research model (see Figure 2.1) applies TRA as the theoretical lens for Green IT/IS research domain by Sarkar and Young (2009).

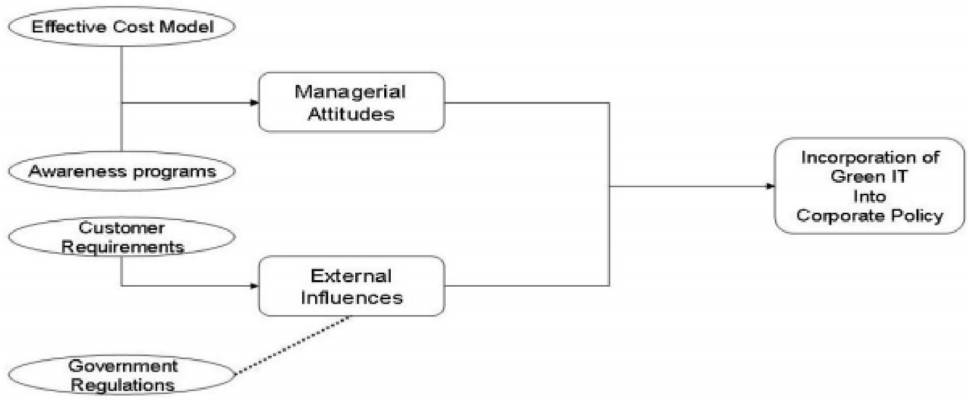

Figure 2.1: TRA Research Model (Sarkar and Young, 2009).

Accordingly, Mishra *et al.* (2014) also used TRA to investigate human behaviour and to analyze the acceptance of the adoption of Green IT. TRA, TPB, and TAM usually predict the acceptance of or behaviour towards innovations as a statistical combined of respondents' responses (Sarosa, 2009). Also, it can be seen that TRA neglects some of the social factors that are significant in determining individual behaviour (Werner, 2004). Also, TRA does not specify the particular behaviour beliefs. Moreover, although TPB assists indirectly in determining individual behaviour, it has some limitations in its inability to reflect environmental and economic effects.

2.7.2 Technology-Organizational-Environmental Theory (TOE)

TOE framework formed by Tornatzky and Fleischer (1990) characterizes the influence of organizational adoption and implementation of technological innovations by three components, namely technological, organizational, and environmental contexts. It is postulated that these three elements interact with each other to influence technology adoption or Green IT/IS adoption decisions (Bose and Luo, 2011).

- Technological context refers to the general characteristics of technologies that are available for an organization's adoption (Tornatzky and Fleischer, 1990; Bose and Luo, 2011; Lei and Ngai, 2013a).
- The organizational context consists of the organizational structure, the presence of innovation-enabling processes such as information communication and

strategic management of top management, and the size and slack resources of the organization (Bose and Luo, 2011).

- Environmental context merges elements such as market structure and characteristics, external support ready to adopt new technologies and government laws and regulations (Bose and Luo, 2011).

In IT/IS adoption, TOE has been used extensively (Zhu *et al*., 2006). For instance, Molla (2008) stated that from the review of existing innovations, Green technologies, IT, and e-commerce adoption literature, TOE has been used with the Perceived E-readiness Model (PERM) (Molla and Licker, 2005), which is widespread and combines the primary and secondary characteristics of the four crucial areas of adoption, that is, technological, managerial, organizational, and institutional. Therefore, Molla (2008) proposed the Green IT Adoption Model (GITAM), which incorporated both TOE and PERM as the theoretical background for understanding determinants of innovation adoption and emerging innovation in particular.

TOE assists in the classification of the static and primary contextual variables for Green IT, while PERM is beneficial in capturing the dynamic and perceptual readiness dimensions (Molla, 2008). The GITAM model consists of Green IT contextual variables, Green IT readiness dimensions, and Green IT drivers that can predict Green IT adoption intention and justify a certain portion of the difference in the practice of Green IT (Molla, 2008). The Green IT readiness model is useful for IT-using organizations to estimate Green IT's development level in terms of attitudes, policy, practice, technology, and governance in IT functions, but offers little insight into the measurement of the capability for eco-sustainability performance that such organizations possess (Molla, 2013).

For instance, Lei and Ngai (2013a) have carefully selected TOE theory to aid in identifying antecedents of Green IT adoption, as the theory itself covers all of the identified antecedents, namely technological, organizational, and environmental. The research model (see Figure 2.2) applies TOE as the theoretical lens for Green IT/IS research domain by Lei and Ngai (2013a).

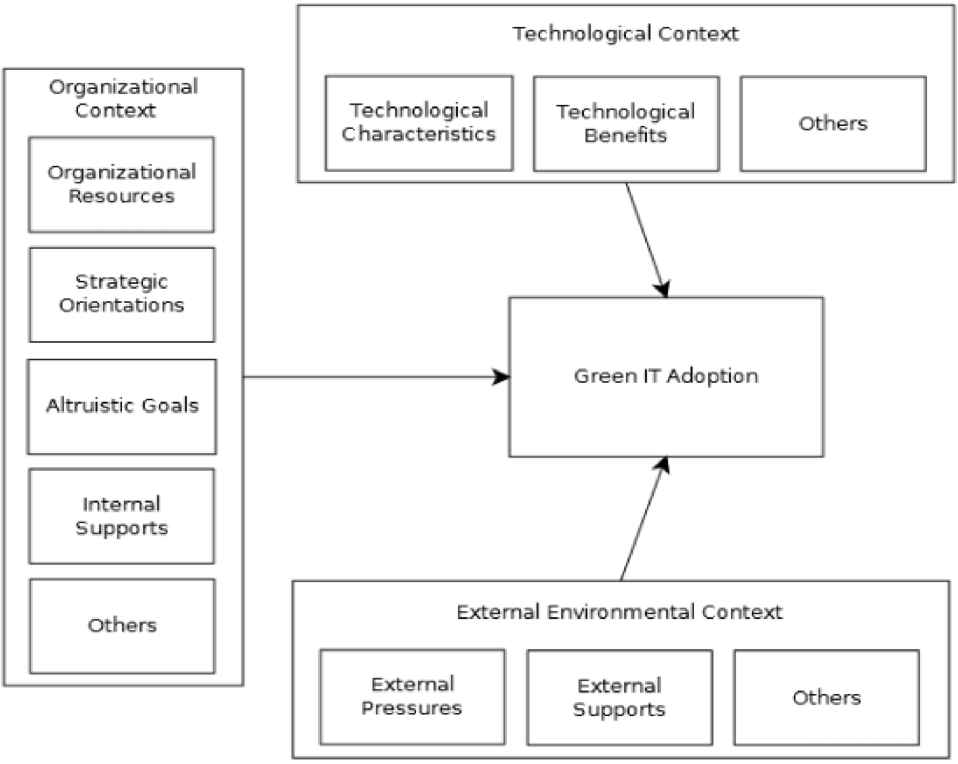

Figure 2.2: TOE Research Model (Lei and Ngai, 2013a)

Despite TOE theory often being used in the study of innovation adoptions; however it does not give a detailed model explaining the factors influencing the organizational adoption decision; rather, it gives a taxonomy for organizing factors related to the adoption in the similar context (Bose and Luo, 2011).

2.7.3 Diffusion of Innovations (DOI)

Rogers (1995) proposed a five-stage model of the innovation-decision process, which consists of knowledge, persuasion, decision, implementation, and confirmation. Innovation is linked across certain channels, over time, among the participants of a social system (Rogers, 1995). Also, DOI theory offers clear reasons that in what way innovations are adopted, through which adoption decisions are influenced by attitudes of the technology and the characters of the organization that adopted and its background (Bose and Luo, 2011). Accordingly, it describes five significant factors that lead to a successful implementation or adoption of technology, including relative advantages, compatibility, trialability, observability, and complexity (Roger, 1995). Thus, it allows others to extend this theory in understanding in each of the different stages.

DOI theory has been used with other theories within both technology adoption studies and Green IT/IS adoption studies (Tornatzky and Fleischer, 1990; Bose and Luo, 2011; Nedbal *et al.*, 2011; Lei and Ngai, 2012), and it is based on studying the process of technology diffusion and the factors influencing Green IT/IS adoption decisions. For example, Bose and Luo (2011) have developed a theoretical framework that assists in studying the factors that contribute to the assessment of an organization's readiness to undertake Green IT initiatives via modern technological means (e.g. go Green via IT-enabled virtualization). Their framework is based on three IS theories: TOE, DOI, and process virtualization theory (PVT). According to Bose and Luo (2011), DOI theory is used when an organization is determined to go Green, and it has shown that it has entered each stage of Green IT adoption – initialization, integration, and maturation. Each stage will aid organizations to generate better proficiencies at each level of experience. The research model (see Figure 2.3) applies DOI as the theoretical lens to understand Green IT/IS process by Bose and Luo (2011).

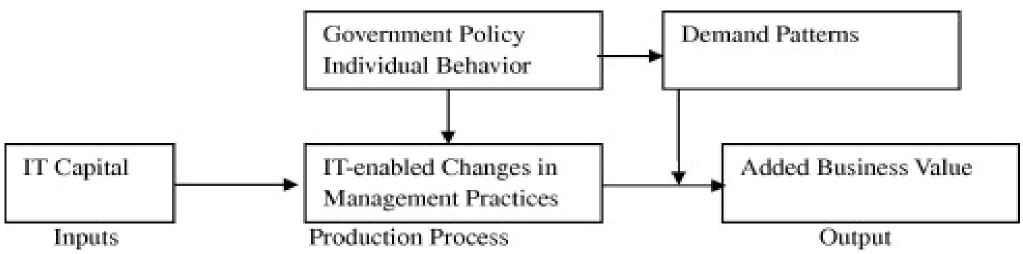

Figure 2.3: DOI Research Model (Bose and Luo, 2011)

Moreover, Nedbal *et al.* (2011) have undertaken to analyze the contribution of outsourcing to environmental sustainability. They take a theory-based approach, linking outsourcing with sustainable IS to study the likelihoods of organizations engaging in Green/sustainable initiatives by utilizing existing IS theories. The model is built on TOE, spread with DOI to incorporate implementation success, technology acceptance, and transaction cost theory (TCT) to combine outsourcing success into the model to understand how it impacts sustainable IS initialization (Nedbal *et al.*, 2011). According to Nedbal *et al.*'s (2011) model, DOI applications (e.g. technical compatibility and perceived complexity) have been selected to draw to affect the organization's decision to introduce sustainable measures and stay competitive by outsourcing.

Additionally, Oliveira and Martins (2011) indicate that according to TOE theory and DOI theory, individual characteristics, as highlighted by Rogers (1995), and both the internal and external features of the organization, are drivers of organizational innovativeness. In other words, the technology and organizational context of the two frameworks are indistinguishable, but the TOE framework contains a new and significant element, which is the environmental dimension. Despite the favourable of the DOI theory, researchers have critiqued on the technological component of the adoption process (Bose and Luo, 2011). For instance, it is argued that the DOI theory should also contain other factors except the technical features of innovation so as to provide a broader understanding (Fichman and Kemerer, 1997). Therefore, the theory should be extended or applied to technology transition and other contexts (Bose and Luo, 2011).

2.7.4 Natural-Resource-Based-View Theory (NRBV)

Hart (1997) proposes an NRBV of firms by integrating the natural environment into the Resource-Based View (RBV) theory. Organizations have focused on social, economic, political, and technological factors but have neglected the natural environment. Generally, NRBV drives eco-sustainability strategies of pollution prevention, product stewardship, and sustainable development to provide a better and more structured conceptual foundation for organizational eco-sustainability practices (Hart, 1997). Chen *et al*. (2011) indicate that an organization's competitive advantage is built on capabilities to engage in Green economic activities. NRBV seems to be an appropriate theoretical lens through which to investigate Green IT value and IT about the environment, and thus it assists in the decision-making process (Corbett, 2010). Moreover, organizations need to acknowledge that the natural environment is a critical resource and that they are faced with environmental constraints regarding standard product regulations and more aggressive forms of carbon limitation (Corbett, 2010). Thus, if organizations can overcome these limitations, they can achieve a sustained competitive advantage. The research model (see Figure 2.4) applies NRBV as the theoretical lens for Green IT/IS research domain by Dao *et al.* (2011).

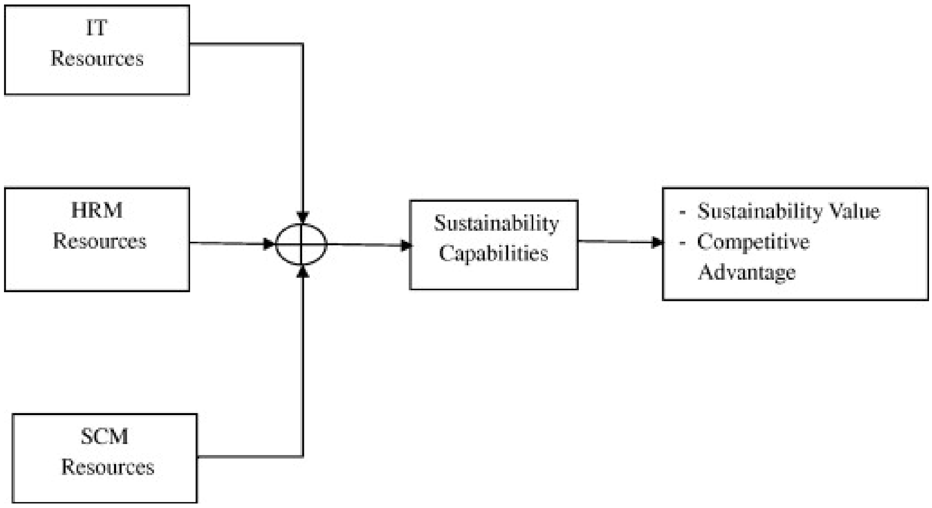

Figure 2.4: NRBV Research Model (Dao *et al.*, 2011)

Many scholars have used NRBV in the Green IT/IS research domain. Dao *et al.* (2011) develops an integrated sustainability framework to explain the incorporation of IT resources, human resources, and supply chain in enabling organizations to progress sustainability competences. Thus, organizations can then bring in sustainable values to their stakeholders and achieve sustained competitive advantage. Also, Ijab *et al.* (2011) use NRBV and Bourdieu's Theory of Practice in understanding how Green IS as a practice occurs in organizations through practice-based evidence; Corbett (2010) applies NRBV and environmental embeddedness to assist in explaining organizations' justification and choice of Green IT and how they realize value from these investments; and Chen *et al.* (2008) assess how institutional pressures affect Green IT/IS adoption by using institutional theory together with examining Green IT/IS practices with strategic attentions from NRBV.

However, Corbett (2010) claims that NRBV describes different strategic approaches that organizations may take to achieve a completive edge, but it does not explain why organizations adopt particular strategies and how the environment shapes environmental actions. Moreover, NRBV focuses mainly on making a decision on a single dimension of Green IT value, which is a competitive advantage (Corbett, 2010). Despite its limitation, NRBV is helpful in that it offers a new perspective for understanding the value of Green IT particularly in achieving competitive advantages.

2.7.5 Institutional Theory (INT)

According to Scott (2001), institutions are a critical component in the environment. Institutions have been identified as '*regulative, normative, and cognitive structures and activities that provide stability and meaning to social behaviour'* (Scott, 2001). For example, institutions include laws, regulations, customs, social and professional norms, culture, and ethics. Institutions have a confining influence on organizations, called isomorphism, which forces organizations in the same group to become like other organizations that face a similar set of environmental conditions (Hawley, 1968). Institutions exert three types of isomorphic pressure on organizations: coercive, normative, and mimetic (DiMaggio and Powell, 1983; Scott, 2001). Imitation or isomorphism can occur intentionally or unintentionally and have a socially communicable quality (DiMaggio and Powell, 1983; Oliver, 1997). Then, new institutionalism (Di Maggio and Powell, 1983; Scott, 2001), corresponding to the prevailing practices, is a process for organizations to obtain legitimacy within their organizational field. An organizational field is '*a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products'* (DiMaggio and Powell, 1983; Scott, 2001).

INT has been comprehensively used in the literature on Green IT adoption (Daly and Butler, 2009; Chen *et al*., 2011; Bulter, 2011a; Ijab *et al*., 2012; Gholami *et al*., 2013; Lei and Ngai, 2012). Chen *et al.* (2011) state that institutional forces have been recognized as significant predictors of IS adoption and diffusion regarding products and practices. This is the reason why organizations initiate change is to seek legitimacy and political power (DiMaggio and Powell, 1983; Lei and Ngai, 2012) in order to respond to the environmental issues (Bansal and Roth, 2000). The research model (see Figure 2.5) applies INT as the theoretical lens to study Green IT/IS adoption by Chen *et al.* (2011).

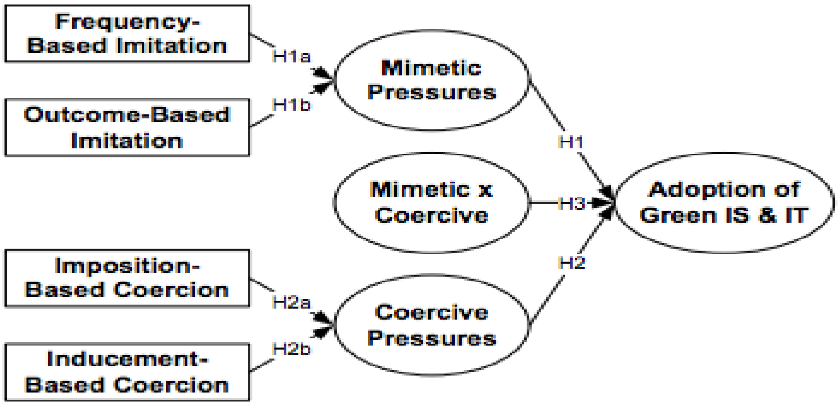

Figure 2.5 INT Research Model (Chen *et al.*, 2011)

INT offers a reasonable foundation for clarifying the consequences of coercive and mimetic (regulatory pressures and competitor pressures), and normative (customer pressures) (Daly and Butler, 2009; Chen *et al.*, 2011). Gholami *et al*. (2013) mention that such theories have been formulated to help in understanding both forces and relevant factors influencing organizational Green IS initiatives.

Coercive Pressure

Coercive isomorphism describes a pressure from entities that have resources on which an organization depends on and is operated by both formal and informal forces exerted by other organizations upon which an organization relies (DiMaggio and Powell, 1983; Scott, 2001). Also, the pressure to which an organization is subjected complies with law and regulation. The empirical evidence suggests that, at the organizational level, coercive pressures may occur from a variety of sources, including regulatory agencies, suppliers, customers, parent corporations, and other key constituents (Teo *et al*., 2003). Zhu and Sarkis (2007) state that coercive pressure resulted from regulatory bodies would happen predominantly in the most regulated fields. Environmental issues are deemed as significant externalities, which drive managers to develop the environmental performance of their organizations.

Normative Pressure

Normative isomorphism indicates professional standards and practices placed by education/training methods, professional networks, and the movement of employees among firms (DiMaggio and Powell, 1983; Scott, 2001). Therefore, isomorphism occurring by such pressures is associated with professionalism causing organizations to correspond by taking legal organizational undertakings Also, it indicates that the stakeholders' expectation in the same social network that influence the organization to take proper actions (Chen *et al*., 2008).

Mimetic Pressure

Mimetic isomorphism is usually a firm's response to ambiguity once the course of action is uncertain (DiMaggio and Powell, 1983; Scott, 2001) and when organizations attempt to replicate leading firms from being the successful first movers in a particular industry on certain movements (Gholami *et al*., 2013).

While DOI, TOE, and INT are intended for use at an organizational level, both DOI and TOE are more suitable for understanding taxonomy. NRBV focuses mainly on making a decision on a sole dimension of Green IT value, which is a competitive advantage. Therefore, INT is selected amongst other theoretical groundings, as it provides a rich and complex view of how organizations become standardized in comprehensive institutional environments (DiMaggio and Powell, 1983; Scott, 2001) and produces a beneficial theoretical lens through which to study the organizational response to external environmental issues, which promotes Green practices. The fact is that organizational actions originate not only from the organization itself but also mainly from external environmental pressures (Chen *et al*., 2011; Lei and Ngai, 2012). INT is used to depict how new practices are adopted in organizations, recognizes that institutional forces are exceeding the market, and plays a crucial role in producing organizations responsive to the interests of others (Scott, 2001). It has been applied to several Green IT/IS studies as it directly influences the complex decision concerning Green IT/IS adoption (Chen *et al*., 2008; Daly and Butler, 2009; Chen *et al*., 2011).

Thereby, INT, is considered as the most suitable theoretical lens of this thesis, as its use will serve as a useful indicator to help decision makers within this thesis, by showing the effects of certain factors on the internal organizational setting in which Green IT/IS costs occur. In the following (Table 2.8) provides an overview of other organizational and IS-related theories and frameworks that have been used within the boundaries of Green IT/IS studies and identifies chances for this research trend.

Green IT/IS Theory/Framework	Examples of Studies	Descriptions of Green IT/IS Related Study and Theory Application
Technology Organization Environment (TOE)	(Molla, 2008; Bose and Luo, 2011; Nedbal *et al*., 2011; Lei and Ngai, 2013a; Zheng, 2014)	• To study determinants of Green IT adoption. • To classify Green IT adoption's antecedents into the classifications: technological, organizational, and environmental contexts (Nedbal *et al.*, 2011). • To determine Green IT initiatives and Green IT's implementation stages at the organizational level (Bose and Luo, 2011). • To investigate Green IT adoption (Lei and Ngai, 2013a). • To explore the factors of business strategy, and three aspects (regulations, competitiveness and ecological responsibility of Green IT/IS motivations under the instruction of a CSR theoretical perspective (Zheng, 2014).
Motivational Theory	(Molla, 2009; Molla and Abareshi, 2012; Koo *et al.*, 2013)	• To explore Green IT matrix and motivation classifications of organizations towards Green IT adoption (Molla, 2009). • To investigate the motivational factors influencing Green IT adoption within organizations (Molla and Abareshi, 2012). • To describe the causal relationship between motivation aspects and perceived usefulness (i.e. the relationships between motivation and Green IT device use) (Koo *et al.*, 2013).
Institutional Theory	(Liang *et al*., 2007; Daly and Butler, 2009; Molla, 2009; Sarkar and Young, 2009; Chen *et al.*, 2011, Bulter, 2011; Ijab *et al*., 2012); Gholami *et al.*, 2013; Lei and Ngai, 2012)	• To explain how top management intervenes the effect of external institutional pressures on the extent of usage of the enterprise resource planning (ERP) system (Liang *et al.*, 2007). • Three types of institutional pressure originating from the environmental context, which motivates organizations to adopt Green IT (Chen *et al.*, 2011). • Institutional forces can influence and/or regulate the behavior of firms through mimetic, coercive, and normative pressures on the evolution of an organization's Green IT adoption (Molla, 2009). • To explain the drivers of corporate environmentalism and to analyze the way in which the external pressures influence an organization's behavior and policy-making (Sarkar and Young, 2009). • To analyze the outcomes that how such pressures influences in framing environmental responsibility in organizations (Daly and Butler, 2009). • To explain the forces acting upon organizations from both within the institutional environment and the organizational fields in relation to environmental sustainability and regulatory compliance (Butler, 2011a).

		• To investigate the local actions set against the external origins, which shape and reshape Green IS practice in the case organization (Ijab *et al.*, 2012). • To study the effects of external pressures on Green IS adoption (Lei and Ngai, 2012).
Diffusion of Innovations (DOI)	(Bose and Luo, 2011; Nedbal *et al.*, 2011; Lei and Ngai, 2012)	• To evaluate Green IT initiatives and implementation stages at the organizational level (Bose and Luo, 2011) • Nedbal *et al.*, (2011) use two (i.e. technological compatibility and complexity) of the five factors including: relative advantage, compatibility, observability, trialability, and complexity) to explain Green IT adoption so as to incorporate implementation success and technology acceptance. • To illustrate the varying stages of implementing Green IT in organization including initiation, adoption, and routinization in which the different stages of assimilation are proposed to be affected by different groups of factors (Lei and Ngai, 2012).
Natural Resource-Based View (NRBV)	(Chen *et al.*, 2008; Corbett, 2010; Dao *et al.*, 2010; Nishant *et al.*, 2013)	• To classify Green IT initiatives into the following categories: pollution prevention, product stewardship, and sustainable development (Chen *et al.*, 2008). • To provide complementary insights, which may help to explain organizations' justification and choice of Green IT and how they realize value from the investments (Corbett, 2010). • To illustrate the integration of human, supply chain, and IT resources, which influences firms to develop sustainability capabilities to gain a sustained competitive advantage (Dao *et al.*, 2011). • To analyze the various dimensions of various sustainability practices that can create a competitive advantage (Nishant *et al.*, 2013).
Theory of Reasoned Action (TRA)	(Sarkar and Young, 2009; Mishara *et al.*, 2014)	• To understand the way in which managerial attitudes and subjective norms affecting the strategic initiatives of an organization (Sarkar and Young, 2009). • To investigate human behavior when adopting Green IT (Mishara *et al.*, 2014).
Process Virtualization Theory (PVT)	(Bose and Luo, 2011)	• To predict the compatibility of an organization in adopting a specific type of Green IT initiative, specifically IT-enabled virtualization involving data center virtualization and telecommuting, aiding managers to adopt Green IT.
Reference Group Theory	(Koo *et al.*, 2013)	• To analyze how the reference group moderates the motivations and perceived usefulness relationship.

Transaction Cost Theory	(Nedbal *et al.*, 2011)	• To integrate outsourcing success into the model to investigate the likelihoods of organizations joining in Green and sustainable initiatives.
Stakeholder Theory	(Cai *et al.*, 2013)	• To classify the political factors (public concerns and regulatory forces) and economic factors (cost reduction and differentiation) for Green IT adoption.
Resource Dependency Theory	(Datta *et al.*, 2010)	• To facilitate sustainable IT and IT management practices adoption in client organizations informed by resource dependency for a better understanding of the role of the IT Service providers and client organizations in driving sustainable IT adoption.
Contingency Theory	(Opitz *et al.*, 2014)	• To illustrate the fit between contingencies and the company-specific configuration of Green IT. This is to enhance the understanding of Green IT governance is shaped by contingency factors, organizations are able to select the most successful Green IT governance form.
Theory of Practice	(Ijab *et al.*, 2012)	• To explain the emergence and the recurrent use of Green IS practice in organizations.
Actor Network Theory (ANT)	(Bengtsson and Agerfalk, 2011)	• To explore the development of sustainability initiatives in the municipality area and to understand the driving forces for such initiatives and the roles of human and nonhuman actants in the process of that initiative.
Belief-Action Outcome (BAO)	(Melville, 2010; Mithas et al., 2010; Gholami *et al.*, 2013)	• To investigate the motivational drivers for Green IS adoption and to classify the impact on the organizational's environmental performance (Gholami *et al.*, 2013). • To explore the way in which society and organizations shape beliefs on Green products (belief), the behaviors to be taken to develop Green products (action), and the impacts associated with belief and actions, environment and organization (outcome) (Melville, 2010). • To investigate the antecedents and outcomes of implementing Green IT, and investigate how top management plays a vital role in Green IT implementation in organizations (Mithas *et al.*, 2010).
Green IT Alignment Framework	(Erek *et al.*, 2011)	• To provide guidance for decision-makers for selecting the most suitable Green IT strategy in achieving corporate sustainability targets and competitive edges.
Social, Economic and Environmental Sustainability Framework	(Piotrowicz and Cuthbertson, 2009)	• To explain sustainability-oriented IT/IS evaluation for industry, society and policymakers that are formed through three main dimensions: social (health and safety, noise and employees), economic (quality,

		efficiency and responsiveness) and environmental (emissions, natural resources utilization, and waste/recycling).
G-readiness Framework	(Molla *et al.*, 2008)	• Based on the concept of e-readiness frameworks, it is a measurement of preparedness to be environmentally responsive and competitive, to aid organizations assess their readiness for adopting Green IT.
Green IT Balance Scorecard	(Wati and Koo, 2011)	• To incorporate an environmental aspect of technology into the scorecard measurement method for Green IT investment.
Green IT/IS Research Framework	(Jenkin *et al.*, 2011)	• To identify the adoption of particular environmental strategies and practices because of the intensity of the motivating forces, which vary in the degree to which, their business operations incorporate environmental or Green IT/S practices. The framework is used for examining the employee level of analysis towards environmental orientation.

Table 2.7: Taxonomy of Theoretical Frameworks/Models Associated with Green IT/IS studies.

The classification above is useful for existing literature reviews of Green IT/IS that focus on the exploration of both theories and frameworks exploited by Green IT/IS researchers. There are two general categories of theory and framework within the confines of IS and Green IT/IS research areas. It tries to incorporate recent studies to serve as a taxonomy of theoretical frameworks or models associated with Green IT/IS studies. The review of the literature and the theoretical lens of Green IT/IS studies are utilized in order to increase understanding and knowledge within this research domain.

To conclude, as aforementioned the gap concerning theory linking adoption and implementation is also a significant issue. Many studies have tended to report on the use of several theoretical underpinnings, which provide a valued foundation of theoretical underpinnings for investigating and expanding research in the Green IT/IS research domain, and this shows that gaps remain in the literature, particularly the need to develop a more theoretical framework/model to understand various aspects of Green IT/IS.

2.8 Organizational Factors influencing Green IT/IS adoption within the Aviation Industry

Implementing Green IT/IS within any organization can have a substantial consequence on the current organizational and procedural components. Green IT/IS involves a new set of practices associated with environmental or Green procedures, while it brings about a change in new and environmental friendly technologies and tools, training employees for Green IT/IS practices, altering existing processes, and hiring new mangers and top management who have a clear environmental visions (Sharma, 2012). Such investments apparently play a significant role in altering internal organizational processes.

Drawing on literature from IS evaluation, organizational factors are noticeably found to be important and highlighted in several IS evaluation studies, particularly in enhancing the understanding of the IS evaluation process within organizations (DeLone and McLean, 2003; Love *et al.*, 2004; Stockdale and Standing, 2006; Piotrowicz and Irani, 2008; Yusof *et al.*, 2008b; Närman *et al.*, 2009) and for exploring the IS evaluation process. For example, several articles have reviewed the importance of organizational factors and effects of organizational characteristics variables such as quality of human resources, stakeholders, top management's leadership skills, organizational support, organizational culture, organization size, capabilities, structures, policies, and financial considerations concerning technical innovation (Tornatzky and Fleischer 1990; Jenkin *et al.*, 2011).

Within Green initiatives and practices literature, organizational factors are revealed as significant in enriching understanding and examining the effects surrounding Green investments. For example, top and senior management support and employee participation are meaningful to the success of Green IT/IS investments (Molla, 2008; Nedbal *et al*., 2011; Jenkin *et al*., 2011). In the study undertaken by Huang *et al.* (2010), organizational factors are of fundamental importance in studying the impact of Green new product development and the connection between Green product innovation and economic performance. Hottenrott *et al.* (2014) support that there are studies associated with environmental technology that considerably ignored organizational factors (e.g. organizational changes or skills) that are regarded as necessary for organizations. For example, through an understanding of organizational factors and changes, organizations can obtain more efficient use fundamentally from Green technologies (Hottenrott *et al.*, 2014). Petruzzelli *et al.* (2011) also reveal that through the collaborations of both external and among internal aspects establish the Green innovations' development to a magnificent degree. Correspondingly, organizational dimensions can have a considerable influence on Green IT/IS adoption studies, and scholars have attempted to take into account internal and external organizational factors to assist in understanding the factors or motives that influence Green IT/IS adoption and evaluation (Nedbal *et al*., 2011; Lei and Ngai, 2013a; Hertel and Wiesent, 2013; Bai and Sarkis, 2013). An effective Green IT/IS evaluation process examines internal organizational perspectives, as evaluation takes place within an organization.

Further, IS or Green IT/IS literature indicates that dependence on traditional financial evaluation techniques alone is not sufficient to justify the complex decision-making process of Green IT/IS investment such as internal organizational factors also influence the decision-making process. Närman *et al.* (2009) claim that organizational factors have a wide-ranging effect on the costs occurring within organizations, such as the alterations an IT system imposes on business processes and the tentative loss of productivity, or the cost of a training scheme for relevant users before taking the system into process. These key internal organizational factors have implications in evaluating Green IT/IS investments, particularly regarding how to manage and control the associated indirect costs. However, there might be other factors recommended by scholars; however, it is vital to select the main factors reliant on the system that is to be investigated and its specific purposes. Some factors may be suitable for some studies, while for other studies, this may not directly relevant to them. The key emphasis of this research is the understanding of external and internal organizational factors influencing Green IT/IS investments within the aviation industry and assisting their internal operations to assist in managing and controlling the indirect costs (i.e. human, organizational, and environmental) related to Green IT/IS investments.

Therefore, a comprehensive taxonomy (Table 2.9) presents the internal organizational factors identified from the literature of three difference streams, including: '*IS evaluation'* (Irani *et al.*, 2000; Love *et al.*, 2004; Irani *et al.*, 2006; Stockdale and Standing, 2006; Yusof *et al.*, 2008b) and '*Green IT/IS adoption/initiatives/practices*'

(Molla, 2008; Sayeed and Gill, 2008; Sarkar and Young, 2009; Watson *et al.*, 2010b; Butler, 2011b; Jenkin *et al.*, 2011; Nedbal *et al.*, 2011; Lei and Ngai, 2013a). However, in the context of the aviation industry, there is a lack of Green IT/IS adoption/evaluation studies or models that have been developed. Thus, for this context and in particular, the factors identified and applied in the aviation context are associated with '*Green/Sustainable/CSR within the aviation industry'* (Amaeshi and Crane, 2006; Lynes and Dredge, 2006; Lynes and Andrachuk, 2008; Capoccitti *et al.*, 2010; Kivits *et al.*, 2010; Smith and Grosbois, 2011; Kemp and Vinke, 2012; Chen, 2012; Walada and Muinda, 2013).

Hence, the factors that originate from the comprehensive taxonomy of internal organizational factors within three different streams will be incorporated into developing the conceptual model of this research. Details of each of the key organizational factors are discussed in chapter 3.

	IS Evaluation					Green IT/IS Initiatives/Adoption									Green/ Sustainable/CSR within the Aviation Industry									
Internal Organizational Factors / **References**	Irani et al., (2000)	Love et al., (2004)	Irani et al., (2006)	Stockdale and Standing, (2006)	Yusof et al., (2008b)	Molla, (2008)	Sayeed and Gill, (2008)	Sarkar and Young (2009)	Watson et al., (2010b)	Jenkin et al., (2011)	Bose and Luo, (2011)	Butler (2011b)	Nedbal et al., (2011)	Lei and Ngai, (2013a)	Amaeshi and Crane (2006)	Lynes and Dredge (2006)	Lynes and Andrachuk (2008)	Capocciti et al., (2010)	Kivits et al., (2010)	Smith and Grosbois (2011)	Kemp and Vinke (2012)	Chen (2012)	Walada and Muinda (2013)	**Total Count**
Employee involvement	●	●	●	●	●		●			●	●	●		●	●	●	●			●	●	●	●	17
Resource development e.g. education/training	●	●	●		●		●	●	●	●	●	●				●				●	●	●	●	15
Top management support/commitment	●	●	●		●	●	●	●		●	●		●	●		●						●	●	14
Organizational culture (e.g. Green organizational culture)	●	●	●	●	●	●	●		●	●	●	●				●	●						●	14
Strategies and goals				●	●	●	●	●	●	●		●		●			●							10
Leadership	●	●			●			●	●	●		●				●	●	●						10
Financial considerations	●	●				●		●		●	●		●	●		●	●		-					10
Organizational resources (e.g. human, assets, capabilities/skills)			●		●	●	●	●		●	●	●	●	●										10
Good corporate citizenship (e.g. social responsibility, moral obligations)						●	●		●	●				●		●	●					●	●	9
Stakeholders relationships				●						●		●			●	●	●		●		●		●	9
Communication	●	●			●						●	●		●			●							7
Organizational policy (e.g. environmental/Green policy)								●	●	●	●						●	●			●			7
Employee wellbeing/health/safety																	●		●	●	●	●	●	6
Organizational structures			●		●		●			●														4
Organizational size						●					●		●	●										4
Organizational image																●	●		●			●		4
Strategic orientations /directions (e.g. IT governance, environmental management orientation)							●			●				●				●						4
Diversity in workforces																	●			●	●			3
Organizational politics		●	●		●																			3
Teamwork				●	●																			2
Management processes					●		●																	2
Management structures				●									●											2
Joint decision making	●																							1
Transaction costs													●											1
R&D activities																			●					1
Sunk costs for infrastructures																			●					1

Table 2.8: Taxonomy of Studies from IS Evaluation, Green Initiatives/Adoption and Sustainable/Green/CSR within Aviation Context

Despite the significance of the internal organizational factors presented, all of them are not integrated in the proposed model, as factors have already been prioritized and selected based on their significance and repetition according to the literature as mentioned that are specific to the aviation industry. Also, selection has been based on how well each of the internal organizational factors can assist in managing and controlling the indirect costs associated with Green IT/IS investments. However, there are also other factors to be placed and considered within the key internal organizational factors, which are deemed to be meaningful, especially within the aviation context. According to a comprehensive taxonomy (Table 2.9), it can be concluded that the most significant factors influencing IS evaluation and Green IT/IS initiatives/adoption within aviation industry are: employee involvement, resources development (e.g. education/training), top management support/commitment, and Green organizational culture respectively. Details of the key internal organizational factors and sub-factors will be illustrated and discussed in Chapter 3.

As highlighted, Green IT/IS investments can have an important effect in altering organizations. It is, therefore, beneficial to consider the effect of such issues regarding the organizational elements to confirm an investigation of Green IT/IS investments, particularly concerning indirect costs. Notwithstanding this, there still appears to be a little focus, knowledge, and understanding among managers and also a lack of academic knowledge surrounding Green IT/IS investments evaluation within organizations as well as how to manage and control the associated indirect costs from such investments. This is discussed in this section to draw together the existing literature. Then, a summary of the investigation of Green IT/IS investments particularly on indirect costs factors that form the conceptual model developed in this study are presented in details in Chapter 3.

2.9 Green/Sustainable/CSR Initiatives within the Aviation Industry

Global aviation contributes 2% of global CO_2 emissions and supports 8% of the world's economic activity regarding GDP as aviation industry has made a significant input to globalization and the economic growth (Chen, 2012; Sarkar, 2012). The aviation industry is expected to generate a severe upsurge in greenhouse gas emissions through 2050 more rapidly than other sectors, which increases global warming (OECD, 2012; Sarkar, 2012). Owing to that increase, governments are likely to act according to the pressures that face them to take action to limit harmful emissions (OECD, 2012). The fact is that aviation is one of the fastest-growing industries among other transportation modes in the world (Sarkar, 2012). Other means of transportation (rail, sea, and road) are not as speedy as air travel (Capoccitti *et al.,* 2010). In Asia, there is the likelihood of growing continuously due to the growth of flight and passenger travel (OECD, 2012). Albeit aviation is considered as a substantial sector in the transportation and tourism industry, it has also generated negative impacts, such as air pollutants and noise, and contributes to climate change and other economic and social issues (Chang *et al.,* 2015).

The sector has been increasingly pressured to undertake environmental or Green initiatives that would reduce or mitigate these negative effects while maintaining or increasing its positive impacts (Smith and Grosbois, 2011). Because the demand for air travel is ever growing, it is undeniable that the industry needs to develop ways to become sustainable and decrease environmental footprints (Weir, 2013). The pressures come from various aviation groups including EU, IATA, International Civil Aviation Organization (ICAO), and the Federal Aviation Administration (FAA) to reduce CO2 emissions instantly to attain carbon-neutral growth by 2020 (Chang *et al*., 2015). Also, economic and social concerns need to be taken into account along with the environmental issues to achieve a competitive edge (Chang *et al.,* 2015).

There has been a drastic change in the aviation industry latterly, and there is an urgent need to address the Greening issues of the industry (Weir, 2013). Sustainable or Green aviation are terms being used when addressing the technological and socioeconomic issues within the aviation industry to reach the environmental calls (Sakar, 2012). The global aviation industry is increasingly showing sensitivity toward environmental concerns and is choosing to invest in Green technology products (Sarkar, 2012). Both academics and practitioners have investigated notions related to CSR including corporate social performance (CSP), corporate sustainability (CS), and environmental management (EM) (Amini and Bienstock, 2014); and corporate social and environmental responsibility (CSER) (Lynes and Andrachuk, 2008). Few have concentrated on this industry's CSR projects (Chang *et al.,* 2015). In this manner, CSR is defined as Green initiatives or adoption and usage of these being considered as patterns of corporate social and ecological responsibility (Hemingway and Maclagan, 2004; Esfahani *et al.,* 2015). Due to the limited literature on Green IT/IS within the aviation industry, common themes and terms emerge that help further defines Green initiatives within this industry, including CSR, Greening, Sustainable, environmental management/protection, regulatory/environmental compliance, and ecological and social issues. Thus, this thesis is going to discuss Green IT/IS as in one broad term grounded on discussions about Green/Sustainable/CSR initiatives and practices within the aviation industry.

The concept of Greening aviation organizations can be described as the diminishing of emission levels (CO2), concern over air safety, introduction of stricter emission control norms and standards, more consistent enforcement of those standards, route optimization and network development, efficient air traffic management, coercive legislative policies, changing vehicle design standards, and improvements to emission testing (Sarkar, 2012). Consequently, those initiatives can assist in reducing negative environmental consequences within the aviation industry. According to Chen (2012), there are several motivations for organizations to promote environmental management. They are categorized into four main categories: the market drivers (e.g. cost-reduction advantage), social drivers (e.g. community/employee expectations), financial drivers (e.g. insurance coverage, financial reimbursements), and regulatory drivers (e.g. environmental regulations, public disclosure obligations) (Bansal and Howard, 1997; Chen, 2012).

Nevertheless, there is currently very little research addressing environmental practice and reporting of the aviation industry (Chang *et al.,* 2015). The industry's adoption of CSR has been relatively slow, with the number of airlines formally reporting CSR information consistently for more than ten years being small relative to the size of the sector (Tsai and Hsu, 2008). Previous research on CSR efforts in this industry is limited and mostly at a high level (Smith and Grosbois, 2011). Mainly in Asia, some airlines, are not implementing sufficient and comprehensive environmental/CSR strategies (Chang *et al.,* 2015).

The number of stakeholders within the aviation industry is immense, and it will take more collaboration between them to agree on a strategic direction that can influence change towards the environment; thus in embracing sustainable development in the aviation industry, all participants involved must take action (Capoccitti *et al.*, 2010). This industry attracts the most academic attention regarding its contributions to climate change, and there are various aspects to airlines which are comparable to those of production/manufacturing businesses: strong regulation, high entry barriers, huge capital costs, and tendencies to oligopolies (Lynes and Andrachuk, 2008). The important steps in this process could involve enhanced awareness and acceptance of such practices and changing the public's mindset within this industry (Capoccitti *et al.*, 2010). Therefore, the quicker environmental objectives become part of common organizational practices in particular the aviation industry, the sooner the world will tackle the rapid rate of environmental reserve consumption.

2.10 Gaps in the Literature

As previously reviewed, Green IT/IS has become the main emphasis on a number of research studies in assisting to reduce negative impacts from IT operations towards the environments; within IS literature, the existing literature highlights that there is a dearth of research on numerous Green IT/IS adoption and evaluation issues, thus more research within this area are still needed.

Within the aviation industry, several Green projects (e.g. virtualization, thin client computer, solar farm) have been attempted within both private and public organizations, and these are related to the development of new technologies and harnessing existing ones that strive to combat climate changes and reduce emissions (Smith and Grosbois, 2011; Brown, 2013; Weir, 2013). Airport operators across the regions are strived towards the implementation of sustainability programs and Green initiatives (Carlini, 2013). As is apparent, the aviation industry is shifting and depending heavily on IT/IS, and this obviously affects the environment. However, literature surrounding Green IT/IS within the aviation industry is deficient, which essentially means that there needs to be more effort in this regard for this particular industry. There is a need to address the environmental effects of air transportation because the emissions and pollution from the aviation industry are spreading swiftly (Weir, 2013). Undoubtedly, further adoption and implementation of Green initiatives and practices is required in all areas of the aviation industry, including IT/IS, as the operation processes of aviation are highly supported by

IT, which affects the environment. Gunasekaran *et al.* (2014) claim that in the recent literature, within the boundaries of organizational management for sustainable development, only a small number of studies concentrate on the presence of organizations from developing countries. That is also backed up with this research resonant on in developing counties such as Thailand that strive to develop a sustainable information economy within the IT segment.

Accordingly, the existing IT/IS evaluation frameworks/models still lack metrics on environmental sustainability as well as intangible aspects (Stockdale and Standing, 2006; Yusof *et al.*, 2008b; Bernroider *et al.*, 2013). For instance, Piotrowicz and Cuthbertson (2009) advocate that environmental and social aspects in IS evaluation are often neglected in comparison with purely economic benefits. It is also argued by Bai and Sarkis (2013) that traditional IT/IS evaluation techniques are not sufficient to justify Green IT/IS investments due to lack of intangible and strategic aspects. Tushi *et al.* (2014) claim that within Green IT literature, the lack of a theoretical framework/model has been distinguished as a main gap; since limited numbers of publications present theories related to Green IT (Bose and Luo, 2011; Tushi *et al.*, 2014; Zheng, 2014; Esfahani *et al.*, 2015). For instance, overall publications contributing to theory within Green IT/IS literature were slight in percentage, as mentioned by Nanath and Pillai (2012b).

In addition, future research should highlight that for organizations considering Green IT/IS, prerequisite knowledge should include an understanding of the benefits and costs associated with Green IT/IS and the expertise to implement these initiatives (Jenkin *et al.*, 2011). Most of the studies on Green IT/IS are focused on the benefits of such investments (Califf *et al.*, 2012; Hertel and Wiesent, 2013; Esfahani *et al.*, 2015). The benefits noticed are twofold; both resources and projected future spending for peripheral business processes are protected and diminish substantially (Mann *et al.*, 2009). For example, the major reasons for adopting Green IT initiatives, in a survey by Sun Microsystems Australia, are the reduction of power consumption and lowering costs (Murugesan, 2008). However, costs of associated with Green IT/IS implementation are one of the most crucial difficulties that prevent organizations from adopting them (Molla *et al.*, 2009; Mann *et al.*, 2009; Webber and Wallace, 2009). IT/IS managers are also under pressure to reduce the total cost of IT operations and pursue energy-efficiency practices to improve the environmental sustainability of their businesses (Molla, 2008; Murugesan, 2008; Melville, 2010, Bulter, 2011a; Hertel and Wiesent, 2014). Similarly, business and IT executives (e.g. CIOs, CEOs) are ambiguous about whether costs can be diminished and profits increased through Green IT strategies and are cautious when they need to make investments in Green IT/IS with uncertain costs and payoffs, which may result in competitive disadvantage (Daly and Butler, 2009; Nidumolu *et al.*, 2009; Dedrick, 2010).

Contributing to Green operational initiatives and practices can improve organizational appeal for stakeholders; however, it has an impact on the organization's profitability because of the indirect/hidden costs that result from implementation and prolongation of sustainable practices (Butler *et al.*, 2011). Although being Green IT/IS can be cost-efficient, it is not necessarily the case since Green IT/IS can also create financial concerns from the time when they may lead to reducing costs or the incurrence of additional expenses (Chen *et al.*, 2011; Esfahani *et al.,* 2015). It could be argued that a deficiency of understanding of Green IT/IS indirect costs is a main issues concerning this phenomenon. Practically, organizations, IT managers in particular, require frameworks and tools that can assist them in measuring and assessing the organizational impact on sustainability (Piotrowicz and Cuthbertson, 2009) as well as reducing the impacts from Green IT/IS investments related to cost overruns, under-optimized budgets and increase the possibility of projects' success.

To conclude, indirect costs are considered significant because they include human, organizational (Irani and Love, 2001; Mohammed and Irani, 2002; Ghoneim *et al.*, 2003), and environmental aspects (EPA, 1995; Okarfor *et al.*, 2013) due to the fact that they are problematic to identify, quantify, manage, and control. Traditional IS appraisal techniques alone are not enough to accommodate intangible non-financial factors especially environmental and strategic aspects for Green IT/IS investments evaluation (Bai and Sakris, 2013). Nevertheless, indirect costs cannot be avoided or ignored as the consequences of ignoring can lead to the failure of projects (Ghoneim, 2007), whereas they also occur in the case of Green IT/IS (Butler *et al.*, 2011). Hence, (Table 2.10) below illustrates research gaps of Green IT/IS adoption/evaluation particularly concerning on indirect cost associated with Green IT/IS investments.

Research Gaps	References
• Organizations are ready to adopt Green initiatives; however, they are still uncertain about the true costs of Green IT/IS as well as business value.	Molla *et al.* (2009)
• Prerequisite knowledge should include an understanding of the benefits and costs associated and the expertise to implement these Green IT/IS initiatives for future research that emphasizes organizations considering Green IT/IS.	Jenkin *et al*., (2011)
• Contributing to Green operating initiatives and practices can enhance organizational appeal for stakeholders; however, it has an impact on the organization's profitability as well because of the extra/hidden costs that result from implementation and continuation of sustainable practices.	Butler *et al.*, (2011)
• The existing IT/IS evaluation frameworks/models are still lacking metrics on environmental sustainability. For instance, intangible, social and environmental aspect in IS evaluation are often neglected in comparison with purely economic benefits.	(Stockdale and Standing, 2006; Yusof *et al.*, 2008b; Pitotrowicz and Cuthbertson, 2009; Bernroider *et al.*, 2013).
• Traditional IS appraisal techniques alone are not enough to accommodate intangible and non-financial factors especially environmental and strategic aspects (e.g. Green IT/IS investments evaluation).	(Bai and Sarkis, 2013; Bernroider *et al.*, 2013)
• Green IT/IS generates financial anxieties since they may result in cost reduction or the incurrence of additional expenses; therefore, being Green is not essentially cost-efficient.	(Chen *et al.*, 2011; Murugesan, 2011)
• Business and IT executives are not recognized that Green IT strategies can apparently reduce costs and increase profits. For example, CIOs are vigilant when they need to make investments in Green IT/IS with uncertain costs and payoffs.	(Daly and Butler, 2009; Nidumolu *et al.*, 2009; Dedrick, 2010).
• Green IT/IS studies have not examined the formation of the evaluation of Green IT/IS by organizational decision-makers.	Lei and Ngai (2013b)
• Within IS literature, there is a lack of Green IT/IS adoption studies as well as theoretical frameworks.	(Lei and Ngai, 2013b; Zheng, 2014; Esfahani *et al.*, 2015)

Table 2.9: Research gaps

Accordingly, there still remains a void in the normative literature of IS evaluation pertaining to Green initiatives/practices undertaken by organizations within the aviation industry as summarized below:

(a) Lack of theoretical frameworks in the Green IT research domain.

(b) The formation of the evaluation of Green IT/IS by organizational decision-makers has been lacking.

(c) None of the previous studies on Green IT/IS adoption/evaluation attempted to investigate factors that influence Green IT/IS adoption particularly as absence within the aviation industry.

(d) There is a dearth of studies that seek to understand the indirect cost implications as well as the identification and management of such indirect costs associated with Green IT/IS investments within the aviation industry, thus indicating gaps in the literature.

There is a need to address these literature gaps as well as to develop a conceptual model for Green IT/IS investments evaluation particularly indirect costs implications that enhances a better understanding of the identification and management of Green IT/IS indirect costs for a more effective evaluation process. This would contribute to the knowledge of the academic community as it has limited involvement in research regarding sustainability within the flourishing field of Green IT/IS and IS evaluation (Pitorwicz and Cuthbertson, 2009; Sarkis *et al.*, 2013). Overall, this study will be of substantial relevance to the aviation industry and IS researchers, policy makers, and practitioners when investing in Green IT/IS for the sake of organizations themselves and the environment, in terms of costs awareness and management. It is credible that provision should be made to develop Green-oriented IT/IS evaluation.

2.11 Conclusions

This chapter has drawn together the literature on the existing issues of Green IT research in the IS discipline by utilizing a search engines technique for over two decades in order to get a wide range of literature. The review of literature highlights the area of IS evaluation, Green IT/IS initiatives/adoption/evaluation, and Green/Sustainable/CSR within aviation industry domains with a particular focus on discussions concerning the significance of Green IT/IS adoption and investments evaluation particularly on indirect cost implications within the aviation industry. There are growing opportunities for organizations to exploit Green IT/IS initiatives as it is a matter of fact that IT/IS are drivers to create a Green or sustainable economy for the next generation; thus future research in this area would be crucial for both academics and practitioners.

The review of the literature highlights that scholars are increasingly concerned about this research domain, and more effort is needed to fully understand the challenges and urgent need to investigate several aspects of Green IT/IS. Generally, Green IT/IS is a nascent area particularly within the aviation industry that needs further investigation and development as the industry itself depends heavily on IT/IS to endure, and this can create adverse effects on the environment as a whole. Organizations are becoming increasingly aware that Green technological architecture can actually help their bottom-line, which is directly in line with the business strategy. The difficulty in addressing these areas reflects the increasing pressures for all relevant stakeholders in the aviation industry.

As seen in the aforementioned attempts, it is obvious that there are numerous research scholars trying to develop comprehensive frameworks and models related to IT/IS evaluation, environmental sustainability, and Green IT/IS adoption. Evaluation of Green IT/IS investments is considered to be a complex phenomenon, and organizations experience difficulties in determining those indirect costs. For instance, it is necessary to consider the degree to which organizations and decision-makers have fundamental knowledge and understanding of the true or indirect costs associated with Green IT/IS investments, as well as the knowledge to implement these initiatives.

When addressing the current state of research in the IS and Green IT/IS adoption and evaluation domain towards indirect costs implication, it is seen that in general a traditional financial methods/techniques are used; their use is frequently limited to a number of IT/IS or Green IT/IS investments because of their incapability to apprehend many human, organizational, and environmental aspects. Consequently, it fails to evaluate the non-financial and intangible aspects resulting in undesirable financial consequences (Webber and Wallace, 2009; Murugesan, 2011; Molla *et al.*, 2009; Butler *et al.*, 2011; Chen *et al.*, 2011; Bai and Sarkis, 2013; Bernroider *et al.*, 2013; Okafor *et al.*, 2013). Although Green operating initiatives can enhance stakeholders' attitudes of an organization, but also there are indirect/hidden costs, of which there is the need to be considered, that are consequences of the implementation of these sustainable practices (Butler *et al.*, 2011; Bai and Sarkis, 2013; Esfahani *et al.*, 2015). This emphasizes the need for decision-makers to recognize the softer issues related to developing Green IT/IS infrastructure and illustrates that such concerns should be included within a comprehensive costs management model for more effective Green IT/IS investments evaluation within organizations in order to reduce the impacts related to cost overruns or under-optimized budgets and increasing the possibility of projects' success.

A number of theoretical underpinnings (Molla, 2009; Bose and Luo, 2011; Chen *et al.*, 2011; Gholami *et al.*, 2013; Lei and Ngai, 2013a; Zheng, 2014) within this research domain were considered; however, INT has been selected as the most suitable theoretical lens for understanding this complex phenomenon and to gain a better perspective on Green IT/IS studies that are utilized to develop and extend knowledge of this research field. Consistently, the internal organizational factors have been identified from the comprehensive taxonomy of the literature (see Table 2.9). This then results in the identification of key internal organizational factors, which can be used to assist in managing a set of indirect cost factors including human, organizational, and environmental that should also be considered during the evaluation process. Lack of studies and theoretical models as reported particularly in indirect costs implications surrounding Green IT/IS investments evaluation is apparent; this research is going to fill the above void.

Therefore, the need for appropriate frameworks or models for investigating, identifying, and managing indirect costs of Green IT/IS investments is widely apparent in the existing literature, as is the necessity for theoretical development of the reasons for indirect/hidden costs concerning such investment. This suggests that research needs to take into consideration of the challenges facing practitioners and to emphasize on understanding the internal organizational perspective regarding Green IT/IS adoption and implementation. Thus, the conceptual model in Chapter 3 is then developed. As decision-makers lack understanding and guidelines regarding Green IT/IS investments, particularly in the management strategies/mechanism for indirect costs management, this research is designed to assist both academics and practitioners in order to construct a conceptual model for theory development within this research domain.

Chapter 3

Developing a Conceptual Model:

A Cost Management Model for Green IT/IS Investments Evaluation Within the Aviation Industry

The literature review in Chapter 2 recognised the need for further understanding of the factors influencing Green IT/IS investments evaluation while highlighting the cost issues surrounding such investments. One of the dilemmas facing Green IT/IS decision-makers is the identification and management of indirect costs, including environmental, organisational, and human associated with Green IT/IS investments. This chapter critically reviews the need for a theoretical framework or model surrounding Green IT/IS evaluation studies, particularly in the context of aviation. The chapter presents and discusses in detail the use of Institutional Theory (INT) as a theoretical grounding for this research, as it provides a rich and complex view of how to study organisational responses to environmental issues.

The chapter goes on to propose and discuss a conceptual model for decision-makers when taking into account Green IT/IS investments. The conceptual model presented incorporates various considerations: external organisational factors derived from institutional theory, internal organisational factors resulting from a comprehensive taxonomy, and a comprehensive list of indirect human, organisational, and environmental costs. This conceptual model assists in the identification and management of indirect costs. It does this particularly by proposing management strategies and mechanisms to manage and control the impact of indirect costs surrounding Green IT/IS investments evaluation within the aviation industry.

3.1 Introduction

Green IT/IS represents a transition for organizations to more emphasis on an environmental perspective. However, it takes time, effort, and enormous investment; thus it requires careful planning with vibrant strategies and goals to prepare entire IT infrastructures so that they are ready for use (Agrawal and Agarwal, 2012). Hence, organizations need to respond by integrating environmental initiatives and practices within their organizations or to develop environmental-related infrastructures by way of investing in the development of Green IT/IS. However, most managers are not entirely comprehended in incorporating environmental considerations into the decision-making process (Poltorzycki, 2001). In consequence, implementation of Green IT/IS practices within aviation organizations poses a challenging task due to the environmental issues and the nature of this industry affecting the environment in broad-spectrum (Capoccitti *et al.*, 2010; Sarkar, 2012). Thus, it is vital to assess the need of this investment through evaluation followed by a clear reflection on important key factors (i.e. external, internal organizational factors, and indirect costs factors) when taking the decision to adopt and implement Green IT/IS.

As previously mentioned, the literature advocates that it is significant for IT managers to evaluate IT/IS and Green IT/IS investments (Gholami *et al.*, 2013; Lei and Ngai, 2013b), in particular in understanding the indirect costs implications (Ghoneim, 2007; Irani and Love, 2008; Okarfor *et al.,* 2013; Bai and Sakris, 2013), as their effects are four times more than direct costs in developing related infrastructures (Hochstrasser, 1992). Ignoring or failing to understand such costs can lead to devastating effects for organizations such as cost overruns or projects' failure (Love *et al.*, 2004; Ghoneim, 2007; Hall, 2012). Although there are tradition IS techniques and several models exist for regular IT/IS to use for the evaluation and justification process; however, such techniques and models cannot accommodate a greater number of social factors, intangible and non-financial aspects including indirect costs (Lefley and Sarkis, 1997; Irani and Love, 2008; Bai and Sarkis, 2013). It is then apparent that organizations or decision-makers need to take into account the indirect costs implications associated with Green IT/IS investment as costs are critical issues to consider in order to undertake this investment successfully (Murugesan, 2008; Molla *et al.*, 2009; Dedrick, 2010; Butler *et al.*, 2011; Bai and Sakris, 2013; Esfahani *et al.,* 2015). Therefore, the proposed model seeks to provide the organization with understanding and broaden CIOs, IT managers or decision-makers' knowledge and perspective concerning the influential factors as well as indirect costs implications associated with Green IT/IS investments to assist them more effectively and efficiently.

A review of the literature in Chapter 2 surrounding Green IT/IS evaluation and Green initiatives within the aviation context reveals a lack of theoretical underpinning and empirical grounding (Lei and Ngai, 2013b; Zheng, 2014; Esfahani *et al.*, 2015). The fact is that Green IT/IS is an emerging phenomenon and is still in its early stages, so a theoretical model for Green IT/IS investment evaluations is still needed. Thus, Institutional Theory (INT) is selected amongst other theoretical groundings to be used in this research, as it provides a rich and complex view of how organizations become standardized in comprehensive institutional environments (DiMaggio and Powell, 1983; Scott, 2001). INT is used to represent how new practices are adopted in organizations and has been applied to Green IT/IS studies, in which it directly influences a complex decision concerning Green IT/IS investments (Chen *et al.*, 2008; Daly and Butler, 2009; Sarkar and Young, 2009; Chen *et al.*, 2011; Butler, 2011a; Lei and Ngai, 2012).

Correspondingly, the proposed model is presented by incorporating three key components (external pressures, an organization's internal factors, and indirect costs factors) into one model, which results in a cost management model for Green IT/IS investments evaluation by focusing on indirect costs within the aviation industry. The proposed model can assist organizations when taking decisions to have a better understanding on the key factors in developing Green IT/IS infrastructures within the aviation industry. Additionally, it enhances the understanding and managing of indirect costs and awareness of how these costs concern with the transformation of Green IT/IS, as well as presenting how they can be managed and controlled so as to reduce the consequences of these costs and their financial impacts for Green IT/IS investments such as cost or budget overruns and increase the likelihood of projects' success. Thus, the articulation of factors including external pressures, an organization's internal factors, and indirect costs related to Green IT/IS within the aviation industry fill in the aforementioned voids, creates a novel contribution at the conceptual level as reported in Section 2.10.

3.2 Conceptual Model Evolution

This section offers a roadmap to the evolution of the conceptual model discussed in this research (refer to Figure 3.3). The proposed model is presented through the incorporation of the external pressures, internal organizational factors, and the comprehensive lists of indirect costs factors into one model. The model is segmented to meet the aim and objectives of the research.

The first section (Section 3.4) utilizes the components of institutional theory to apply as part of a theoretical underpinning for understanding various external pressures, namely coercive, normative, and mimetic, to assist in understanding the effects of the external environment on the institutions (organization and people, which in this case are internal organizational factors. The reasoning behind the choice of this theoretical grounding is discussed in detail in Section 2.7.5.

Then, Section 3.5 discusses the key internal organizational factors surrounding IS evaluation, Green IT/IS initiatives/practices and Green/Sustainable/CSR within aviation industry literature. The key internal organizational factors are drawn from the literature of three difference streams as previously mentioned; consequently, a comprehensive taxonomy of internal organizational factors is developed (as referred to in Table 2.9, Section 2.8).

Finally, the last segment (Section 3.6) presents the indirect cost implications' component of the proposed model, which have been categorized into indirect organizational, human, and environmental costs (refer to the literature review Sections 2.3.1 and 2.6.3). Lastly, Section 3.7 presents the contribution of the conceptual model to the existing Green IT/IS research domain especially evaluation within aviation industry literature. Once again, the classification development and the relevant factors are discussed in more detail in Sections 3.4, 3.5, and 3.6.

3.3 The Conceptual Model – A Cost Management Model for Green IT/IS Investments Evaluation within the Aviation Industry

Theory development within the research domain surrounding Green IT/IS evaluation is lacking. As previously mentioned, costs are also a critical issue with regard to Green IT/IS investments, and obviously, traditional IS evaluation techniques are inadequate to justify with investment effectively. Hence, organizations seek to find suitable framework and tool to assist in this complex evaluation process associated with Green IT/IS investments because it involves with strategic, social and many intangible and non-financial aspects. This has been one of the main reasons for the development of a conceptual model that incorporates various significant factors from the normative literature using the existing previous research including institutional theory, a comprehensive taxonomy of internal organizational factors (Table 2.9, Section 2.8) and IS evaluation techniques (indirect costs factors). Hence, the conceptual model seeks to enable a better understanding of factors influencing Green IT/IS investments as well as assist in managing the indirect costs associated with such investment within the aviation industry.

A review of the existing literature as presented in Chapter 2 focusing on IS evaluation and Green IT/IS investments evaluation within the aviation industry highlights that there is a dearth of theoretical models and frameworks in this research domain within the aviation industry (see Section 2.10). Therefore, Figure 3.3 depicts the proposed model, which consists of two main parts:

- *Factors associated with Green IT/IS investments evaluation within the aviation context* – a set of external pressures that have been applied to understand an organization's decision to adopt and implement Green IT/IS as well as the internal organizational factors that play a crucial role and finally, help to manage the associated indirect costs.

- *Evaluation of Green IT/IS investments, emphasizing on the identification and management of indirect costs within the aviation industry* – a cost evaluation of Green IT/IS investments, highlighting the indirect cost implications associated with Green IT/IS investments.

Figure 3.3 is specify to indicate the full array of the conceptual model that is developed and is formulated the parts and connected the model development to the literature review in Chapter 2. As illustrated in the conceptual model (Figure 3.3), with the aim of testing this model in the practical setting, a proposition has been developed to study Green IT/IS investment evaluation within the aviation industry as follows:

The proposed conceptual model adopts INT, as its use will serve as a useful indicator to help decision-makers by showing the effects of certain factors on the internal organizational setting in which Green IT/IS costs occur. Hence, three main external factors within INT have been identified, and hypotheses have been formed to predict the influence that each of them will have on internal organizational factors. For instance, the internal organizational factors will help to manage and control the associated indirect costs. Correspondingly, the conceptual model as presented in Figure 3.3 provides a comprehensive list of indirect cost factors specifically for Green IT/IS investments within the aviation industry that will affect its implementation**.**

The conceptual model presents itself as a comprehensive model that articulates the main factors and detailed cost evaluation (a comprehensive list of indirect costs) that need to be considered when adopting and implementing Green IT/IS within the aviation industry. The aim is to propose a comprehensive tool that is of particular relevance to aviation organizations and seeks to provide them with an in-depth understanding of factors that may hinder or encourage Green IT/IS investments. It will not only provide them with a decision-making tool for implementation but also help assist and formulate the organization's strategies that have an emphasis on the environment. Therefore, it may assist aviation organizations to understand the indirect costs associated with such Green IT/IS investments and to prepare mechanisms or strategies in reducing the impacts associated such costs and the significance of in what way this investment may offer to them and all stakeholders.

3.4 External Pressures

The proposed conceptual model utilizes components from INT as a theoretical lens for understanding various external pressures – namely coercive, normative, and mimetic (Scott, 2001). According to Jennings and Zandbergen (1995), INT can be used to comprehend how organizations tackle Green issues because of external environments or forces. As earlier mentioned, INT provides a useful theoretical grounding to study organizational responses to environmental issues, in particular how significant institutional forces are beyond market forces, and whether this has substantially influenced organizations to respond (Scot, 2001). This is attained by taking into account the external pressures from outside organizations that are important in illuminating the effects of coercive and mimetic (regulatory pressures and competitor pressures) as well as normative (customer pressures) isomorphism (DiMaggio and Powell, 1983; Scott, 2001). Within the boundaries of the Green IT/IS domain, scholars exploit INT within their research (Chen *et al.*, 2008;2011; Daly and Butler, 2009; Sarkar and Young, 2009; Butler, 2011a; Lei and Ngai, 2012). It also shows promise for understanding in what way organizations may embrace Green or sustainability issues though this theoretical lens within several research domains. Within the aviation industry, Chen (2012) claimed that although airlines regard external pressures as a threat, they are also considered as an opportunity for better changes within the organization. Thus, it is important to understand how external pressures influence the internal organizational factors and how institutions including organizations or people react in response to those pressures regarding Green IT/IS investments. This proposed tool is; therefore, to help investigation and enhancing the better understanding prior to such investments by aviation organizations. The rationale and descriptions of the selected factors are illustrated below.

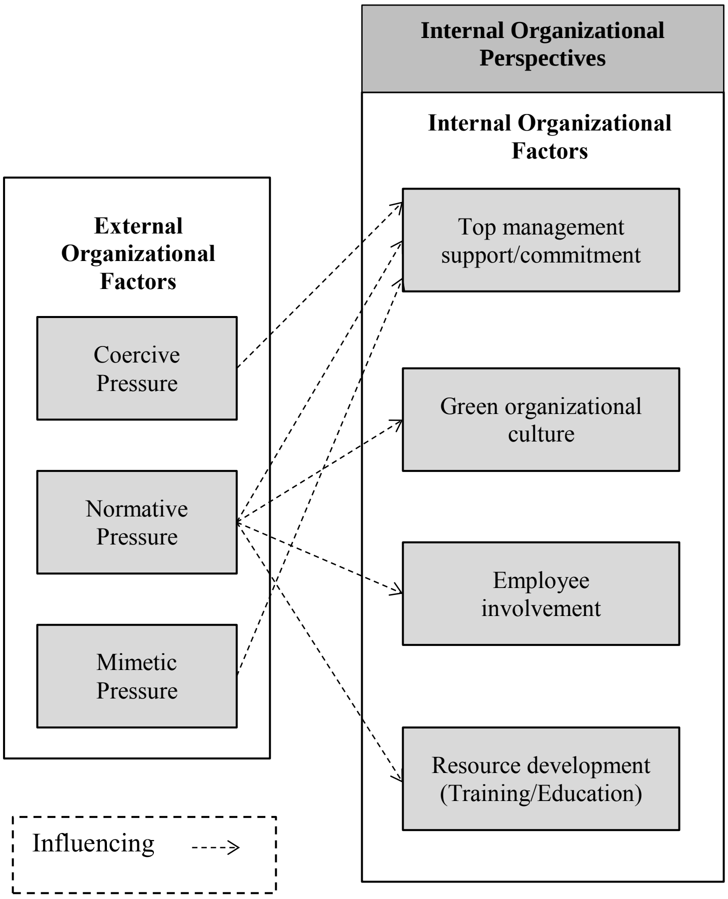

Figure 3.1: External Pressures Influencing Internal Organizational Factors Surrounding Green IT/IS Adoption and Implementation

3.4.1 Coercive Pressure

Coercive pressure comes from the law and regulations of institutions within the field specific to certain organizations (Scott, 2001). Organizations need to conform to regulations to avoid the punishment for non-compliance (Hoffman, 1999). Without the appropriate actions or behavior, an organization may encounter the sanctions by which organizations function (Scott, 2001), in this case within the aviation industry. It is a fundamental to drive environmental management (Kilbourne *et al.*, 2002). Daly and Butler (2009) claim that, clearly, the emphasis of regulative corporate influences is on coercion from agents such as governments and regulatory agencies that use legal sanctions to implement Green or environmentally responsible initiatives. Green IT/IS is subject to legal complications as governments have started creating policies and regulations to punish organizations that produce waste and reward those that diminish it, for example by lessening carbon emissions (Chen *et al.*, 2011). Government agencies are considered as a dominant institution that may coercively stimulate organizations to take action, i.e. fines and trade barriers (Rivera, 2004). Some international environmental regulations, e.g. the Kyoto Protocol, Restriction of Hazardous Substances (RoHS), and Waste Electrical and Electronic Equipment (WEEE) directive, are firmly established, which allow many large organizations to adopt Green standards for their manufacturing processes (Huang *et al.*, 2010). Developing countries, including China, have sanctioned progressively tough environmental regulations driving manufacturers to implement Green practices (Zhu and Sarkis, 2007). Increasing such pressures compel organizations to become more responsible and Greener.

As they must be consistent with the legal requirements of the countries where institutions are situated, regulations and laws related to the aviation industry are varied. Airports, such as Stockholm Arlanda, and Geneva, are progressively using charges and taxes as a mechanism to reduce noise and fuel emissions (Lynes and Dredge, 2006). The Federal Aviation Administration (FAA) and the European Aviation Safety Agency (EASA) have come up with laws prohibiting the use of aircraft in populated areas (Walala and Mutinda, 2013). Chen (2012) also highlights that environmental regulations within the Taiwan aviation industry are mostly focused on noise pollution, air pollution, and effluent produced by the aircraft manufacturing industry (e.g. the Air Pollution Control Act as well as the Waste Disposal Act); nevertheless, in some countries, some regulations may be different in practice (e.g. the Greenhouse Gas Reduction Act). Below is illustrated in details in what way coercive pressures affects each of the key internal organizational factors as seen in Figure 3.1.

- Coercive pressure may influence the decisions of top management and senior managers to support and participate in Green IT/IS to be in accordance with law and regulations; for example, top management needs to support and force the Green IT/IS investments because of government institutes' policy and regulation (see Figure 3.1). Gholami *et al.* (2013) claim that management attitudes or perspectives could be affected and changed to accept Green IT/IS initiatives and practices and then they act accordingly. In this case implementing Green IT/IS, to avoid costs or any expenses imposed that are related to sanctions or permissions. It is crucial for managers to obey laws and regulations concerning environmental management issues so as to protect the environment and drive changes within this industry.

3.4.2 Normative Pressure

Normative refers to the aspect of institutions that is involved with standard operating procedures (Hoffman, 1999). It deals with social groups and patterns such as formal education, professional associations, trade associations, and professional media (Scott, 2001). Institutions (organizations or people) may act in accordance with the values and norms where they work and behave in a certain way. Moreover, the actors within the organizational field may act or behave according to their own standards or responsibilities, without others forcing them to act in a certain way or influencing their decisions (DiMaggio and Powel, 1983; Scott, 2001). Compliance with normative pressures happens once organizations feel obliged by particular cultural anticipations from professional groups or greater society (Chen *et al.*, 2011). Normative pressures originate from the expectations of stakeholders including suppliers and customers, which influence the organization to adopt particular legitimate and appropriate behaviors (Lei and Ngai, 2012). Ijab *et al*. (2012) claim that the use of ISO 14001 certification or Environmental Management System (EMS) has become normative, encouraging companies to comply with environmental performance indicators to improve environmentally. Other examples of normative influences that shape organizations' Green IS include the formation of industry associations, for example, Climate Savers Computing Initiative (CSCI), the Global e-Sustainability Initiative (GeSI), and The Climate Group (CG), which also assists in promoting greater awareness among organizations (Butler, 2011a).

Within the aviation industry, ISO 14000 and Green Globe 21 are two accreditations through which airlines are striving to obtain recognition for their environmental efforts (Lynes and Dredge, 2006). Also, Lufthansa reduced specific CO2 emissions, implemented environmental management practices, and expanded various procedures to keep emissions down, as the company is fully aware of and shows responsibility for the climate and promoting better, cleaner skies (Mrazova, 2014). Chen (2012) illustrates that in the case of China Airlines, the organization is appreciated to compliance with environmental guidelines within the environmental philosophy of the organization. Below is discussed in details in what way normative pressures affects each of the key internal organizational factors as seen in Figure 3.1.

- Normative pressure affects the degree of top management support/commitment in the sense of professionalism because the experience or educational backgrounds of managers may also be the cause of changes in perception or differences regarding Green IT/IS investments within their professional networks (Kloviene, 2012). In the case of Singapore Airlines, it was the only airline to receive Green Globe 21 recognition for environmental efforts (Lynes and Dredge, 2006). Therefore, it can be seen that top management truly understands and supports the importance of environmental protection and is willing to act in support of protecting the environment in many ways.

- As normative pressure relates to people and shared norms, building strong relationships within employees' professional networks can implicitly increase the strength of norms in helping them to understand the benefits and implications of Green IT/IS investments within the same type of industry (Cai *et al*., 2008). Also, Smith and Grosbois (2011) claim that airlines try to increase employee involvement in CSR issues (as reported by ten airlines), this can be understood that participation from employees in environmental projects or events can build a relationship between aviation networks.

- Normative influence refers to social obligation as a foundation of environmental responsibility or Green behavior. Such influences are referred to by Scott (2001) as the values and expectations that develop in cultures and organizational fields. In other words, normative pressures could affect corporate culture in that everyone shares the same understanding, beliefs, and norms of Green behavior and develops Green organizational cultures. Curry *et al.* (2012) state that forming a sustainability mindset to understand, feel, and perceive in the same direction. Thus, it can also strengthen business efficiency, reduces consumption and waste, and enhances the organizations' brand and image by influencing corporate culture.

- Normative pressure affects organizations regarding the development of resources in delivering the suitable amount of education and training/learning related to Green IT/IS. For example, regarding the environmental education of Taiwanese airlines, the organization uses media such as the official company website, information guides, and e-mail to transmit and communicate environmental knowledge to their employees, with the hope that it becomes a part of workers' lives (Chen, 2012). If airlines/airports want to meet industry standards and satisfy with the norms of the groups/associations, resources development should be taken into account, e.g. employees need to learn and understand the importance of environmental practices.

3.4.3 Mimetic Pressure

Mimetic pressure is usually defined as a firm's response to uncertainty when the progress of action is uncertain (DiMaggio and Powel, 1983; Scott, 2001). It influences how people think and reduces uncertainty by imitating successful peers, competitors, or market leaders in their particular environment (Scott, 2001). Mimetic action can occur when other organizations have adopted Green technologies or practices, and they anticipate positive effects from the investments; also, firms tend to follow the leading firm who, being the first movers, gain benefits in the industry (Gholami *et al.*, 2013). Furthermore, Kauppi (2013) claims that organizations seek to imitate other successful firms or their competitors to increase the efficiency of their structures and practices once excessive environmental uncertainty is imminent. Capoccitti *et al.* (2010) claim that leading aviation organizations including Airbus, Boeing, and Virgin Atlantic agree on new strategic directions to protect the environment. This means, consequently, that those industry leaders can influence other airlines to follow the same practices in this competitive aviation environment. The details below is provided how mimetic pressures affects each of the key internal organizational factors as seen in Figure 3.1.

- Mimetic pressure results in organizations imitating other successful leaders/competitors/peers, which could affect top management support by causing a mindset shift among managers and inducing uncertainty to go Green (Chen *et al.*, 2011). For instance, management of the prominent airlines has designed and proposed policies, goals, and action plans for environmental management/protection, e.g. Cathay Pacific, one of the leading airlines, released an official announcement on environmental protection/preservation, setting out an array of environmental commitments and goals. Other airlines have followed by establishing internal EMS, responsible for planning, implementing, and auditing environmental management performance (Chen, 2012).

3.4.4 Summary

This section has described and developed the rationale for the left portion of Figure 3.3 (shown as Figure 3.1). The proposed model exploits the elements of institutional theory to underpin the model itself and help to explain in what way external pressures promote and influence Green IT/IS initiatives and practices and affect each of internal organizational factors, and also how institutions including organizations or people react in response to those pressures with regard to Green IT/IS investments.

3.5 Internal Organizational Factors

Equally important, the proposed model constructs a combination of factors, particularly the internal organizational factors identified from the normative literature, including: "*IS evaluation*", *and* "*Green IT/IS adoption/initiatives/practices.*" In the aviation context, none of Green IT/IS adoption/evaluation theoretical model has been developed. Also, for this context and in particular, the factors identified and applied in the aviation context are associated with "*Green/Sustainable/CSR of the aviation industry.*"

The key internal organizational factors are taken into consideration as shown in the normative literature (refer to Table 2.9, Section 2.8). The studies mentioned related to the Green IT/IS evaluation domain try to employ theoretical groundings such as TOE, INT, and NRBV in understanding either external or internal organizational factors that are influencing adoption. This is since both external and internal organizational factors are considered to be significant because they are suitable combinations that affect the business operations and strategic decisions, and also because of the magnitude of their influence (Mann *et al.*, 2009).

Furthermore, the main internal organizational factors (as shown in Figure 3.3) have already been chosen and prioritized based on their significance and repetition from the taxonomy of literature in (Table 2.9, Section 2.8). There are a number of factors surrounding Green IT/IS investments within the aviation industry, and some of them are not integrated in the proposed model. However, it posits and reflects on the key internal organizational factors which are deemed to be meaningful, especially within the aviation context. Besides, for this research, it depends on how well such particular internal organizational factors can assist in managing the indirect costs for Green IT/IS investment. Thus, by incorporating the relevant key factors into the proposed model, it contributes to increasing the effectiveness and efficiency of the decision-making process in evaluating Green IT/IS.

Previously, the proposed model discussed how external pressures influence the decision of institutions (organizations and people) to adopt and implement Green IT/IS. Subsequently, the proposed model is presented with a discussion of how the key internal organizational factors, such as *employee involvement*, *top management support/commitment*, *organization culture and resources development*, *e.g. education/training*, as well as their sub-factors, play crucial roles within Green IT/IS investments, affecting the management of these indirect costs associated with Green IT/IS investments within aviation industry. The following section discusses in detail the importance of each internal organizational factor associated with Green IT/IS investments within the aviation industry.

3.5.1 Top Management Support/Commitment

Top management support/commitment is significant for organizations in assembling themselves to new emerging technology, strategy, business processes, and overall project accomplishment (Lacity *et al.*, 2009; Dong *et al.*, 2009; Nedbal *et al.*, 2011). The implementation of Green IT requires dedicated support from the organization's top management so as to provide expertise and resources for innovation (Bose and Luo, 2011). Also, Molla (2008) emphasizes that the commitment of the CEO is a dominant factor in the story of every successful Green initiative. Adopting a new system needs top management support to help overcome resistance to new technologies and also in redesigning processes and acquiring new expertise (Bose and Luo, 2011). Managerially, in the sense of Green IT/IS implementation, without the full support of top management, IT organization is unlikely to drive sustainability by themselves priorities of other departments (Harmon *et al.*, 2010).

In the case of an EMS, to be adopted and implemented successfully, it requires top management to promote employee empowerment to effect changes, support organizational culture changes, institute systems to stimulate anticipated behavior such as rewards or incentive programmes, provide training, and increase communication throughout the organization (Gupta and Sharma, 1996). Also, top management can serve as the champion of change to aid the organization's transition occur more efficiently (Daily and Huang, 2001).

3.5.2 Employee Involvement

Employee involvement is considered as one of the crucial factors, as the people within an organization assist significantly in the formulation of business and IT strategy, such as the adoption and implementation of new IS (Keen, 1993; Irani *et al.*, 2000; Love *et al.*, 2004). Employees should be included, understood, and valued, whether they have positive or negative opinions of the current Green IT/IS practices (Jenkin *et al.*, 2011). Correspondingly, Dedrick (2010) supports the idea that the encouragement, motivation, and empowerment of employees to follow the Green path can significantly aid in adopting Green IT/IS practices. For instance, employees should be able to make changes to expand the environmental initiatives and practices deprived of unnecessary management involvement (Daily and Huang, 2001).

Within the aviation industry, organizations try to engage employees to understand environmental/Green initiatives and practices, such as creating opportunities for feedback, reward/bonus schemes for environmental participation programs, and providing a variety of work-time models to create environmental responsibility initiatives and practices (Lynes and Dredge, 2006). For example, more airlines try to increase employee involvement to resolve CSR/Green issues (Smith and Grosbois,

2011) such as employee resistance and nonconformity with new environmental initiatives (Jenkin *et al.*, 2011).

3.5.3 Green Organizational Culture

Organizational culture is one of the vital factors affecting IS evaluation (Love *et al.*, 2004; Irani *et al.*, 2006; Stockdale and Standing, 2006). Nanath and Pillai (2012a) claim that the process and value systems that perform environmental practices lead to what is termed in the literature as ‘Green organizational culture.’ It has an influential role in the incorporation of sustainability measures and confirming the continuity of Green IT initiatives (Nanath and Pillai, 2012a). In some cases when the management has overlooked the power of cultures, this has caused efforts in organizational change to fail (Harris and Ogbona, 1999). Esfahani *et al.* (2015) mention the importance of the values and beliefs of an organization’s culture in that they can also inspire individuals’ behaviors. Capoccitti *et al.* (2010) propose that the fundamental steps of Green practices are to enhance understanding and acceptance of such practices, and altering the public’s mindset is being organized within the aviation industry. The environmental objectives are more to become part of organizations’ normal practices, thus, the faster the world will tackle the rapid rate of natural resource depletion.

Newcomer *et al.* (2014) highlights that within the aviation industry, the working culture plays a significant role in manager–subordinate relationships as well as Chen (2012) states that airlines apply environmental management initiatives to reduce harm to the natural environment, which later assists in improving their overall company image as well, as it can reinforce relationships with stakeholders, including regulatory agencies, customers, suppliers, and the local community. Likewise, a Scandinavian company such as Scandinavian airline (SAS) is considered a prominent promoter of the environment because Scandinavian culture plays a strong role in shaping SAS’s reaction to the environmental challenges that it faces within the airline industry and assembles motivations for being both socially and environmentally responsible (Lynes and Andrachuk, 2008). A positive image can assist in develop relationships with stakeholders in the aviation industry which help to improve the environment as well as strengthen credibility with regulatory bodies (Lynes and Dredges, 2006). Moreover, most airlines emphasize employee wellbeing/health and safety to are strengthened their cultures. Chen (2012) claims that, in his study, he found that a safe work environment is vital for employee comfort, such as in the case of EVA Airways, which regards employee wellbeing as a significant environmental commitment within organization; this is regarded as an additional value in the advancement of environmental management initiatives, which can assist in boosting staff satisfaction and improving productivity. With regard to social responsibility, such practice is supported by Lynes and Andrachuk (2008). The SAS headquarters visited revealed that health and safety, safe working conditions, and equality are all strongly embedded in the organization and the culture of SAS. This suggests that the social wellbeing of employees of SAS is of significance as part of SAS's culture of social and environmental responsibility.

In the aviation industry, diversity in workforces has also been emphasized (Lynes and Andrachuk, 2008; Kivitis *et al.*, 2010; Smith and Grosbois, 2011; Kemp and Vinke, 2012) because it assists in building a positive image for organizations. As Smith and Grosbois state (2011), many airlines have increased diversity in their workforces, for example by increasing the number of women in management; employment of persons with disabilities (by far the most popular initiative, followed by activities to encourage more women into the workplace); and increasing the intercultural competence of the workforce, as reported by Lufthansa. Hence, through having diverse workforces, organizations can offer a wider range of resources, skills, ideas, and energy to the business and provide a competitive edge. Thus, one of the most vital steps to attempt to achieve sustainable solutions within organizations is to form an organizational culture that is grounded on environmental sustainability in all aspects (Harmon and Auseklis, 2009).

3.5.4 Resources Development (e.g. Training/Education)

As the aviation industry is promptly growing, education is necessary to meet the demands of an ever-changing industry continues to change (Newcomer *et al.*, 2014). Several business studies have noted a positive relationship between higher education and sustainability, personal growth, and national prosperity (Walsemann *et al.*, 2012). Training should be provided to employees of all levels so that they have the expertise and experience to achieve the aims and targets of environmental management practices

(Daily and Huang, 2001). Organizations can make notable changes easier to achieve by providing education and training for employees so that employees become more aware of the necessity for quality and environmental control, increase their adaptability to change, and develop a proactive attitude (Wong, 1998). Supporting education on Green issues tends to create Green awareness within the organization (Murugesan, 2008). In a case report by Smith and Grosbois (2011), employees of Singapore Airlines are provided with environmental education programs and sustainable development suggestion programs, and organizations also educate students about how changes to the climate can shift weather patterns and can impact upon the environment. Moreover, in the case of Taiwanese Airlines, the organization uses media such as the official company website, information guides, and e-mail to transmit and communicate environmental issues to its employees, with the hope that it becomes a part of workers' lives (Chen, 2012).The above discussion of the key internal organizational factors provides sufficient justification for considering how each of the factors affect and play a crucial role in Green IT/IS adoption and implementation within the aviation industry. Understanding such factors is significant in gaining a better understanding of factors influencing Green IT/IS investments, as well as how they assist in managing the associated indirect costs deriving from this investment afterward.

3.5.5 Summary

Section 3.5 has taken the middle portion of Figure 3.3 (repeated as Figure 3.1) to set out the logic behind the proposed prominent internal organizational factors. Each of these has been drawn from the literature that can be embedded in the model. The logic, in this case, is to highlight the importance of internal organizational factors, as it will be changed accordingly with the new system's adopting and implementing Green IT/IS as well as its effect later contributing to the management of associated indirect costs for Green IT/IS investments within aviation industry at the following stage.

3.6 IS Evaluation: Indirect Costs Factors

As illustrated, the last segment of the proposed model concentrates on indirect costs factors. Drawing on the IS evaluation literature, although many cost taxonomies have appeared (Table 2.1), including directly quantifiable costs associated with IT investments (i.e. Kusters and Renkema, 1996; David *et al.*, 2002), others fail to distinguish in depth the indirect costs, aside from Irani and Love (2001). Thus, the proposed model classifies the indirect costs factors into three broad categories to be considered (Table 2.2, 2.3 and 2.5). The first two are indirect human costs and indirect organizational costs (as put forward by Irani and Love, 2001; Mohammed and Irani, 2002; Ghoneim *et al.*, 2003). The third category, indirect environmental costs recognized by (EPA, 1995; Okafor *et al.*, 2013; Bai and Sakris, 2013), are introduced and added by the researcher in the proposed model, as those costs are unique to environmental aspects that can be applied to evaluate Green IT/IS investment. The fact is that organizations are enthusiastically aware of the strategic benefits derived from IT/IS adoption; however, many of them are reluctant to invest in the technology on account of the indirect costs associated with it (Mohamed and Irani, 2002; Ghoneim *et al.*, 2003). IT projects investment is affected by both human and organizational factors as users change their routines (Irani and Love, 2002; Närman *et al.*, 2009). This is likely to happen in the case of Green IT/IS investments evaluation as well (Bai and Sarkis, 2013). Without the identification of these indirect costs, the product/process and inappropriate allocation of environmental costs, inexact accounting for measurements and costs of wasted raw materials, and the real insufficiency of major environmental costs in the accounting system within an organization affect the outcome and mark it by way of less cost-effective (Okarfor *et al.*, 2013).

Most of the indirect costs cannot incorporate into traditional investment appraisal techniques as they are intangible, hidden or indirect in natures and they are being problematic for mangers to identify and manage them (Lefley and Sarkis, 1997; EPA, 1995; Okafor *et al.*, 2013; Bai and Sarkis, 2013). Possibly, Green practices might increase an organization’s profitability in the long run; however, they might also weaken cost-effectiveness due to the hidden costs resulting from the implementation and extension of environmental practices (Butler *et al.*, 2011). Adopting Green IT/IS practices undeniably brings benefits to both businesses and individuals (Murugesan, 2008); however, Green initiatives appear to incur additional costs associated with Green software or tools included to reduce energy consumption, to achieve EPEAT environmental ratings, to create awareness among stakeholders, and in re-engineering the business process to diminish the organization's carbon footprint (Murugesan, 2011). Therefore, figure 3.2 below provides a comprehensive list of indirect cost factors specifically for Green IT/IS investments that will affect its implementation. The explanation and rationale for Green IT/IS indirect costs and in what way each of the key internal organizational factors aids in managing and controlling the associated indirect costs factors is deliberated in detail in the following sub-sections below.

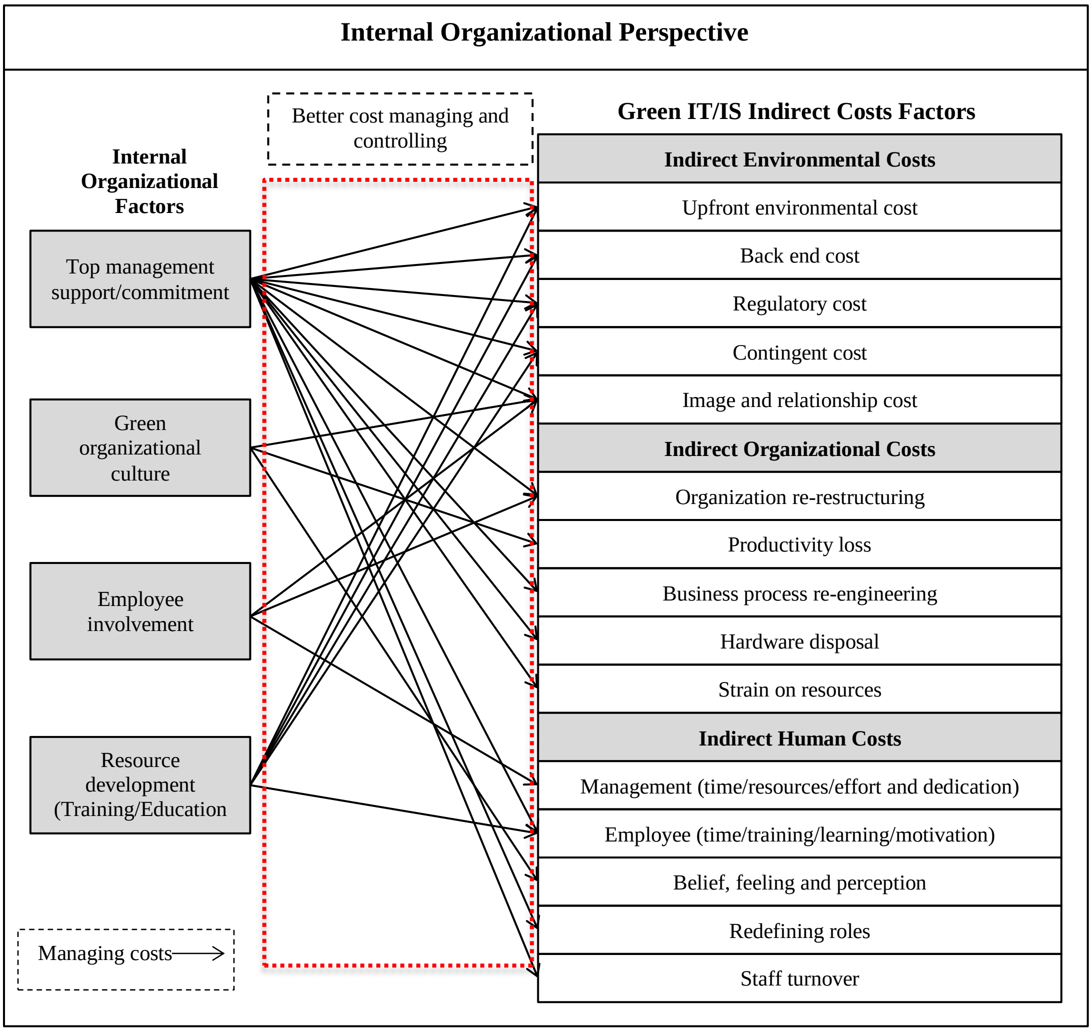

Figure 3.2: Internal Organizational Factors Affecting the Management of Green IT/IS Indirect Costs

3.6.1 Indirect Environmental Costs

- ***Up-front environmental costs***

These are environmental costs incurred before the operation or system. This includes costs related to site studies and preparation; design of environmentally desirable products, site preparation approving; installation; procurement; and evaluative criterion of suppliers (EPA, 1995; Okarfor *et al.*, 2013). It can also be classified as overheads, or research and development (R&D), and these costs can easily be disregarded, as managers usually focus on operational expenses (EPA, 1995). Various regulations are placed on IT manufacturers that direct the design, manufacture, and performance of computers and other IT products (Butler, 2011b). According to Murugesan (2008), large corporations, including Wal-Mart and Dell, persistently adopt and practice Green IT/IS and force their suppliers to pursue their environmentally safe practices and standards, especially in their merchandise and manufacturing procedures. If any of the suppliers does not meet its minimum standard, the company seeks to find others. Thus, these costs will be incurred once organizations decide to adopt and implement Green IT/IS initiatives and practices. The details below is provided how the key internal organizational factors assist in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Top management support/commitment may affect the management of upfront environmental costs in time spent planning and preparing Green procurement regarding the design, inspect of environmentally friendly products or processes and evaluating, at first glance, the performance of suppliers related to Green IT/IS investment in complying with laws or regulations. As referred to by Daily and Huang (2001), effective environmental management involves designing and preparing an arrangement or plan to provide available and qualifies resources which facilitate these initiatives/practices to follow with laws and regulations. Green IT/IS needs support and effort from top management to achieve successful results and become Greener in the long run, for example, selecting Green suppliers, and designing and selecting Green products and processes for Green IT/IS (Mithas *et al.*, 2010). Consequently, managers could manage these costs suitably so as to reduce its effect.

Resources development (training/education) may affect the management of upfront environmental costs in terms of a solid knowledge from education and training can help broaden employees' perspective and knowledge on Green IT/IS investments including installation and testing, in preparation and procurement of Green suppliers, and in evaluation of their compliance with aviation regulations, so they can be more aware of quality and environmental control (Wong, 1998). For example, SAS also supports and provides knowledge on product stewardship programs and will only deal with suppliers who have environmental policies and management systems (Lynes and Dredge, 2006). Educating organizational resources means that they have clear comprehension, and thus it assists in managing these costs appropriately so as to reduce their consequences.

- ***Back-end costs***

These are future environmental costs related to the closure, decommissioning, and clearance/disposal of inventory, which needs to obey with environmental regulations that are not yet in effect but have been declared (Okafor *et al.*, 2013). These costs are anticipated, meaning they will arise at some point in the future, for example, withdrawing a laboratory, terminating a landfill unit, or replacing storage used to hold toxic substances (EPA, 1995). After adopting and implementing Green initiatives and practices, it is expected these future costs will be encountered. The details below is provided how the key internal organizational factor assists in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Top management support/commitment and resources development (training/education) may affect the management of back-end costs as it requires top management to devote time to planning, preparing, and auditing environmental action plans as well as providing education/training related to Green necessities and requirements regarding this prospective future cost involved within this industry. IT/computer physical parts can be harmful to the environment as they contain toxic materials, which can leak out if care is not taken when disposing of equipment (Murugesan, 2008). Within the aviation industry, the airline has effects on biodiversity and resources, with waste production issues such as aircraft maintenance and onboard services. Also, airports require large land areas for the activities of airport operations, which are unfavorable to nature because they are either paved or built up (Smith and Grosbois, 2010). For example, there might be some problems such as hazardous waste from aircraft maintenance (e.g. petroleum products) and de-icing of aircraft (glycol) (Lynes and Dredge, 2006).

As a result, in cases where managers do not realize this and provide support, or staff do have enough fundamental knowledge about the implications of such costs and prepare contingency plans to handle them in the future, at worst organizations may have to confine or close down. Thus, by managing these costs carefully, managers could reduce the effect of back-end.

- ***Regulatory costs***

These are environmental costs related to planning, inspection, insurance, pollution control, taxes, and fees that organizations need to be concerned about and are incurred in the operating system (EPA, 1995; Okafor *et al.*, 2013). Traditionally, these costs have been viewed as overheads and may obtain undue attentions from managers when making decisions. For example, organizations may also incur additional government impositions if they neglect to address the environmental implications of their practices and the implementation of them (Murugesan, 2008). For example, WEEE regulations are strict and intended to reduce the amount of e-waste in landfill spots and to increase recycling rates (Murugesan, 2011), which organizations need to monitor. This cost is probable to incur once Green IT/IS is adopted and implemented. The details below is provided how the key internal organizational factors assist in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Top management support/commitment and resources development (training/education) may affect the management of regulatory costs as it requires top management to prepare business policies and procedures in accordance with laws and regulations as well as providing education/training related to Green requirements and environmental protection laws regarding aviation legislation and regulations in particular. As referred to by Lynes and Dredge (2006), some airports, especially in Europe, have begun to impose taxes, levies, and penalties to encourage airlines to meet standards and regulations to reduce waste, noise, and air emissions, and they will be checked to ensure they are doing this. Kivits *et al.* (2010) support that long-term factors such as emissions trading and Green taxes might change the position of the airline so that it drives change.

There needs to be understanding and proper management of these indirect costs, and staff should have a basic knowledge of the regulations to prepare for the implications of them. Then, this could reduce or avoid the consequences of such costs if the organization was punished by sanctions from the government in their country.

- ***Contingent costs***

These are environmental costs that may or may not be incurred at some point in the future (EPA, 1995), for instance, costs of curing and compensating for future accidental releases of pollutants into the environment (e.g. oil spills), fines and penalties, property damage, legal expenses, and harm to natural resources (Okafor *et al.*, 2013). These costs can also be named contingent liabilities, and usually the internal management accounting systems do not consider and include them (EPA, 1995). Adopting and implementing Green IT/IS or environmental sustainability might incur these costs, if undertaken without proper preparation. The details below is provided how the key internal organizational factors assist in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Top management support/commitment and resources development (training/education) may affect the management of contingent costs as it requires top management to prepare and plan safety regulations and schemes as well as providing education/training related to safety requirements in installing or setting up systems. Although safety and security are considered as top of the list in the aviation industry, accidents do occur and thereby impose these costs, including costs of mortality and injury, travel interruption, employer and employee costs, and property damage (Miller, 1997). As a result, managers need to be prepared and manage this cost in order to prevent accidents that might happen, such as planning a proper contingency scheme to put in place for future accidents that could harm people, the environment, and other things, and educating employees about safety and protection, which perhaps could assist in avoiding or reducing the effects of these cost.

- ***Image and relationship costs***

These are the environmental costs related to corporate image and relationships with customers, investors, insurers, suppliers, communities, regulators, and workers, as well as costs incurred for award and recognition programs (Okafor *et al.*, 2013). Concerning Green IT, industry standards such as IEEE and GeSI, whose supporters include Microsoft, Sun, Ericsson, Dell, HP, and many others, are considered to have substantial impacts in terms of image and recognition (Collet, 2008; Daly and Butler, 2009). Organizations are environmentally responsive (i.e. implementing Green IT/IS) to avoid negative and increase positive public attention or economic punishments (Chen *et al.*, 2008). Daly and Butler (2009) propose that business and IT executives introduce Green IT as part of environmentally effective programs for boosting their image and appealing to Green investors. In cases where organizations disregard Green initiatives and practices or environmental sustainability, there is concern that the public might react swiftly in a negative way. Consequently, it might harm organization's profitability. The details below is provided how the key internal organizational factors assist in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Top management support/commitment and employee involvement may affect the management of image and relationship costs due to how much top management support Green IT/IS investments and broadcast this to the public in planning and promoting environment projects for publicity, and whether employees are engaged in the events on a regular basis. Lynes and Dredge (2006) state that the introduction of new technologies, which are concerned with environmental protection, could benefit an airline's image. Some airlines, such as Singapore Airlines, Cathay Pacific, and Iberia, get support from top management and participation of employees for sponsorship of environmental projects/events. Thus, it can also improve their organizations' images and strengthen stakeholders' rapport.

Green organizational culture may affect the management of these costs in the sense that sharing and encouraging Green/environmental culture within the organization would enhance the organization's image, particularly when it involves Green or environmental sustainability for the benefit of the community and organizations as a whole. Newcomer *et al.* (2014) state that within the aviation industry, the supportive working culture plays a significant role in manager and subordinate relationships and can drive changes. Also, the organizational culture that is shared, understood, and educated in the same directions would support a better relationship among people in the organizationas it can stimulate people's behavior. Thus, these image and relationship costs could be managed in a positive way.

3.6.2 Indirect Organizational Costs

- ***Organization restructuring***

Organizational costs are triggered by the alteration of the organization's hierarchy, structure, and job redefinitions (Irani and Love, 2001; Ghoneim, 2007). This occurs when organizations are involved in adopting and implementing new systems; the structures of the organization will need to be altered more or less. Once it comes to implementation of the new systems (Green IT/IS), it is undeniable that organizations need to restructure and streamline themselves to accommodate such changes (e.g. new roles and positions), which results in this cost. The details below is provided how the key internal organizational factors assist in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Top management support/commitment and employee involvement may affect the management of organization restructuring in that top management spend time on planning and preparing the new organizational structure/hierarchy, and also employees participate in meetings about changes in the structure. With the entry of aviation into the EU emissions trading scheme, and consequently the requirements of regulations concerning the impact of climate change, the aviation structures/division needs to reorganize in order to respond to such changes (Randles and Bows, 2009). Jenkin *et al.* (2011) claim that for organizations to form and enact new Green practices, organizational structure needs to transform and align with IT and overall organizational goals, which are supported by top management. However, it might be difficult to do this without top management support and employee involvement in setting up the plans, allocating resources carefully, and enabling employees to understand that it is significant to reduce the effect of these costs.

- ***Productivity loss***

This organizational cost is related to the development of and adjustment to the new procedures and guidelines for a new system (e.g. Green IT/IS) within an organization. The burden of people performing lower than average would cost a lot and reduce productivity, such as the hours spent amending mistakes, unproductive performance, and the costs of having to recruit and train replacement staff (Ghoneim, 2007). Adoption of environmentally friendly technologies is evidently costly and may diminish productivity as well (Hottenrott *et al.*, 2014). Thus, this cost is prone to incur whenever organizations introduce new systems, especially when there are an absence of understanding and sharing of the same practices and goals within organizations. The details below is provided how the key internal organizational factors assist in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Top management support/commitment may affect the management of these costs in planning for the upcoming changes within organizations. Mangers can prepare and manage changes for their employees in terms of attitudes and behavior such as motivate, encourage, and train beforehand (Ghoneim, 2007). Thus, this could help in reducing the effect of this cost.

Green organizational culture may influence the management of these costs in the sense that people within organizations share the same understanding and sentiment towards Green or environmental sustainability initiatives and practices. However, organizations participating in environmental/Green initiatives can to some degree boost employee productivity through enriched corporate culture and employees' dignity (Lynes and Dredge, 2008). Those actions could then reinforce organizational culture and encourage employees to learn and be obliging. Thus, it is likely that people need to share a thoughtful attitude towards Green/environmental issues within organizations, which then can assist in reducing the consequences of such loss of productivity.

- ***Business process re-engineering***

These organizational costs are involved in the redesigning of the functions and processes of organizations when adopting or implementing Green IT/IS. For example, organizations have to re-design or re-process the business practices and scrutinize innovative ways to lessen their carbon footprints by reducing waste and improving efficiency (Murugesan, 2011). However, this process is time-consuming, costly, and it is difficult to get approval from the management (Ghoneim, 2007). By adopting and implementing Green IT/IS, an organization will unquestionably incur these costs, as there are liable to be more processes and functions within organizations. The details below is provided how the key internal organizational factor assists in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Top management support/commitment may influence the management of this cost in that top management to plan their business processes and functions in advance to respond to Green IT/IS investment. Airlines and airports need to redesign their business processes or functions so that they create a more sustainable aviation paradigm. Therefore, it is significant for top management to support these Green IT/IS initiatives and practices to reduce the effect of these costs.

- ***Hardware disposal***

The organizational costs include administrative and accounting, logistics, and processes for necessities such as inventory, hard drive deletion, and downtime, which tend to have negative consequences for the environment (Ghoneim, 2007). For example, unwanted computers and monitors need to be refurbished and reused or recycled in eco-friendly ways because they will end up in landfills triggering severe environmental troubles (Murugesan, 2008). Moreover, Piotrowicz and Cuthbertson (2009) suggest that when disposed of, IT equipment harms the nature; thus such costs should also be examined when evaluatiing IT/IS investments. Apparently, organizations are expected to incur these costs in every possible way. Thus, it needs careful preparation to avoid and minimize the consequence of such costs. The details below is provided how the key internal organizational factor assists in managing and controlling the impact of the aforesaid Green IT/IS indirect cost as seen in Figure 3.2.

Top management support/commitment may affect the management of hardware disposal cost in planning and prepare environmental action plans to deal with disposal issues, such as where and how to dispose of equipment in environmentally friendly ways. Organizations need to conduct audits and review equipment purchases and disposal policies and practices before disposing of products so as to avoid sanctions (Murugesan, 2011). As referred to by Pitt and Smith (2003), within the aviation industry, commercial activities in airports are expanding, resulting in an increase in the quantity of waste; therefore, charges could be declared on a gradual scale for waste disposal. In such a case, if managers plan, manage, and take serious action to tackle these indirect costs in a realistic way, organizations could diminish the negative consequences of such costs effectively.

- ***Strain on resources***

These organizational costs are related to maximizing the possilbe use of the new IT/IS (i.e. Green IT/IS) by integrating information streams and increasing information availability. To avoid these costs, for instance, when adopting or implementing a system, it is important to plan human resources needed earlier (Ghoneim, 2007). Organizations will incur these costs in some ways as if managers do not plan the availability of staffs required for implementing Green IT/IS in advance. The details below is provided how the key internal organizational factor assists in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Top management support/commitment may affect the management of these costs; for example, management needs to plan and prepare human resources that might need to implement the new system beforehand. Likewise, Shoeb (2015) supports that to implement any corporate environmental program successfully many divisions of an organization should collaborate to put forward a confident combined effort and among them, the most significant thing is the human resource management entity. Thus, the consequence of these costs can be reduced.

3.6.3 Indirect Human Costs

- ***Management Time/Resources/Effort and Dedication***

These costs are involved in leading, planning, and organizing the integration of new systems into current work practices, as well as the allocation and availability of human resources that are needed for the adoption process (Irani and Love, 2001). For example, a management team needs to devote time/effort to revise, approve, and develop a comprehensive business plan and strategy addressing broader aspects of Greening its IT system to render it comparable to that of other leading organizations (Murugesan, 2008). Shifting organizations for Green IT/IS investments will involve a great deal of these costs. The details below is provided how the key internal organizational factor assists in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Employee involvement may influence the management of these costs when employees can become engaged or empowered and share opinions during the decision-making process; management might be able to reduce the time and effort in making employees understand and accept the change quicker. As referred to by Longhurst *et al.* (1996), the airports that follow and adopt a concrete plan for sustainable development will be confronted by the complexity of management decision-making in a sustainable development world, such as becoming involved with many policies and plans. For instance, to increase Green efforts within an organization, it is vital to obtain employees' responses, address their worries, and urge them to engage in Green activities (Murugusen, 2008). Then, managers should be able to deal with and assign resources effectively and efficiently if the employee is involved/empowered, particularly at the operational level, to take part, and thus, they can reduce the effect of these costs.

- ***Employee time/training/learning/motivation***

These costs are inescapable when employees are exploring new systems and going through a learning curve while retaining the level of interest and motivation in the new system (Irani and Love, 2001). These costs are involved with implementing Green IT/IS, as employees are to spend time on things relating to the operation of new systems' accomplishment. The details below is provided how the key internal organizational factors assist in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Top management support/commitment may affect the management of these costs explicitly, in that managers should help and encourage Green IT/IS initiatives/practices within the organization in every possible way because employees have to go through many processes while these changes are happening. To be successful in implementing Green IT/IS, top management needs to support and motivate employees or staffs such as providing the benefits or various aspects of implementation and creating strategies for employees to participate in Green IT/IS or other areas related to energy saving and those that have positive effects on profits in the long run (Mithas *et al.,* 2010).

Resource development (Education/Training) is significant in allowing employees to understand Green IT/IS initiatives/practices and motivating them to learn about these. Initially, organizations want to triumph these Green efforts. Employees should be offered with a fundamental education and training on energy saving through changing their computer-using behavior. According to Smith and Grosbois (2011), Singapore Airlines educate students on how climate change and shifting weather patterns can impact the environment. Thus, it is believed that with education and training, the employee would be encouraged to understand more and react in a positive way about environmental responsibilities. Therefore, the support of top management and development of resources would assist in reducing the consequences of ignoring these costs.

- ***Beliefs, feelings and perceptions***

These costs involves when organizations adopt new systems but do not take the beliefs and perceptions of employees into consideration (Irani and Love, 2001). Esfahani *et al.* (2015) state that the organization’s moral behavior can shape individuals and groups’ behavior and attitude towards Green IT/IS initiatives and practices, and hence influence people’s desire to work towards achieving the same organizational goals. These costs are incurred during the transition period/process of Green IT/IS because certain people might not believe in or perceive the significance of Green IT/IS investments. The details below is provided how the key internal organizational factor assists in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Green organizational culture may affect the management of this cost concerning how people think and feel about or perceive Green IT/IS investments; however, a clear understanding of organizational culture (e.g. Green organizational culture) would result from the people who have been sufficiently informed and understood the importance of

Green IT/IS initiatives/practices and environmental protection within their organization. To achieve the desired outcome to have a Green organizational culture, organizations need to nurture a shared culture grounded on sustainability that results in employees become more conscious of environmental issues (Olson, 2008). For example, the management of Taiwanese airlines supports and involves employees in environmental awareness and protection as part of their daily routine. Thus, it encourages positive beliefs and feelings towards these schemes (Chen, 2012). Having a goal of ensuring that employees' beliefs, feelings, and perceptions are in the same direction as organizational strategy would reduce the effect of these costs.

- ***Redefining roles***

These costs, involved with changes in the organization's structure, may lead to further training, redundancy, and promotion when taking decision to adopt and implement Green IT/IS (Irani and Love, 2001). Unavoidably, these costs are incurred owing to the new positions/roles appearing concerning Green IT/IS implementation. The details below is provided how the key internal organizational factor assists in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Top management support/commitment may affect the management of this costs as they need to plan and allocate resources properly, e.g. redefine skill sets and match the right people with the right jobs. For example, there might be a new department, which relates to environment/Green tasks and responsibilities, and some managers might be transferred to new positions and roles, or some may be moved to a job with duties that they do not enjoy. Therefore, proper planning and allocation of resources can reduce the effect of indirect costs.

- ***Staff turnover***

These are organizational costs involved with the increase in interviewing and training costs because employees decide to leave organizations and join competitors; this usually occurs during the implementation process (Irani and Love, 2001; Ghoneim, 2007). For instance, it could happen when employees do not understand or accept the reasons why organizations need to adopt or implement new systems. Managers within organizations should ensure that an introduction to the Green IT/IS initiatives or practices is given and there is communication about this. Another important factor is support for employees' health and safety, good working conditions and equality should be firmly embedded in the organization, such as in the culture of the SAS airline, which could then reduce staff turnover as it enhances and improves job satisfaction (Lynes and Dredges, 2008). Organizations appear to struggle with these costs when employees leave for any reason; such costs are incurred in several ways. The details below is provided how the key internal organizational factor assists in managing and controlling the impact of the aforementioned Green IT/IS indirect cost as seen in Figure 3.2.

Top management support/commitment may influence the management of these costs in supporting Green IT/IS initiatives/practices as well as giving encouragement towards project accomplishment by, for example, setting up incentives/reward schemes for those who perform Green IT/IS actions. As referred to by Gupta and Sharma (1996), in instituting successful systems such as EMSs, top management can promote desired behaviors by using, for example, rewards or incentive programs; by providing training; and by increasing communication throughout the organization. In other words, if employees are willing to stay instead of joining competitors, the organization would reduce the effect of these costs.

3.6.4 Summary

Section 3.6 has taken the right portion of Figure 3.2 (repeated as Figure 3.3) to set out the logic of the proposed cost categories with details of the associated indirect costs. Each of these has been drawn from the literature (Section 2.3.1; 2.6.3) to create a comprehensive cost taxonomy that relates to Green IT/IS investments and can be embedded in the model. Identifying the full range of indirect costs can be problematic, but managers should not ignore this as it has tremendous effects on the overall Green IT/IS investments. Thus, the aforementioned indirect costs emerging from Green IT/IS investments that could be managed with the assistance of the key internal organizational factors and mechanisms to reduce the impacts. For example, coercive pressure may influence the decisions or mindset of top management and senior managers to support and participate in Green IT/IS to be in accordance with law and regulations Gholami *et* *al.* (2013) claim that management attitudes or perspectives could be affected and changed to accept Green IT/IS and then they act accordingly, in this case implementing Green IT/IS, in order to avoid costs imposed that are related to sanctions. Therefore, top management support/commitment may affect the management of upfront environmental costs in time spent planning and preparing Green procurement regarding the design of environmentally friendly products or processes and evaluating, at first glance, the performance of suppliers related to Green IT/IS investment in complying with laws or regulations. As referred to by Daily and Huang (2001), effective environmental management involves designing and preparing an arrangement or plan to provide available and qualifies resources which facilitate these initiatives/practices to comply with laws and regulations. Consequently, managers could manage these costs appropriately so as to reduce its impact. This briefly demonstrates how the proposed model works.

Therefore, the emergence of Green IT/IS indirect costs could be managed with the assistance of the key internal organizational factors, and mechanisms to reduce such costs will be suggested in more details afterwards by the empirical evidence (Chapter 5). This can then result in more effective costs management, in the sense that organizations will understand that these indirect costs will appear during the life cycle of the Green IT/IS adoption and implementation process, yet they can be managed and controlled.

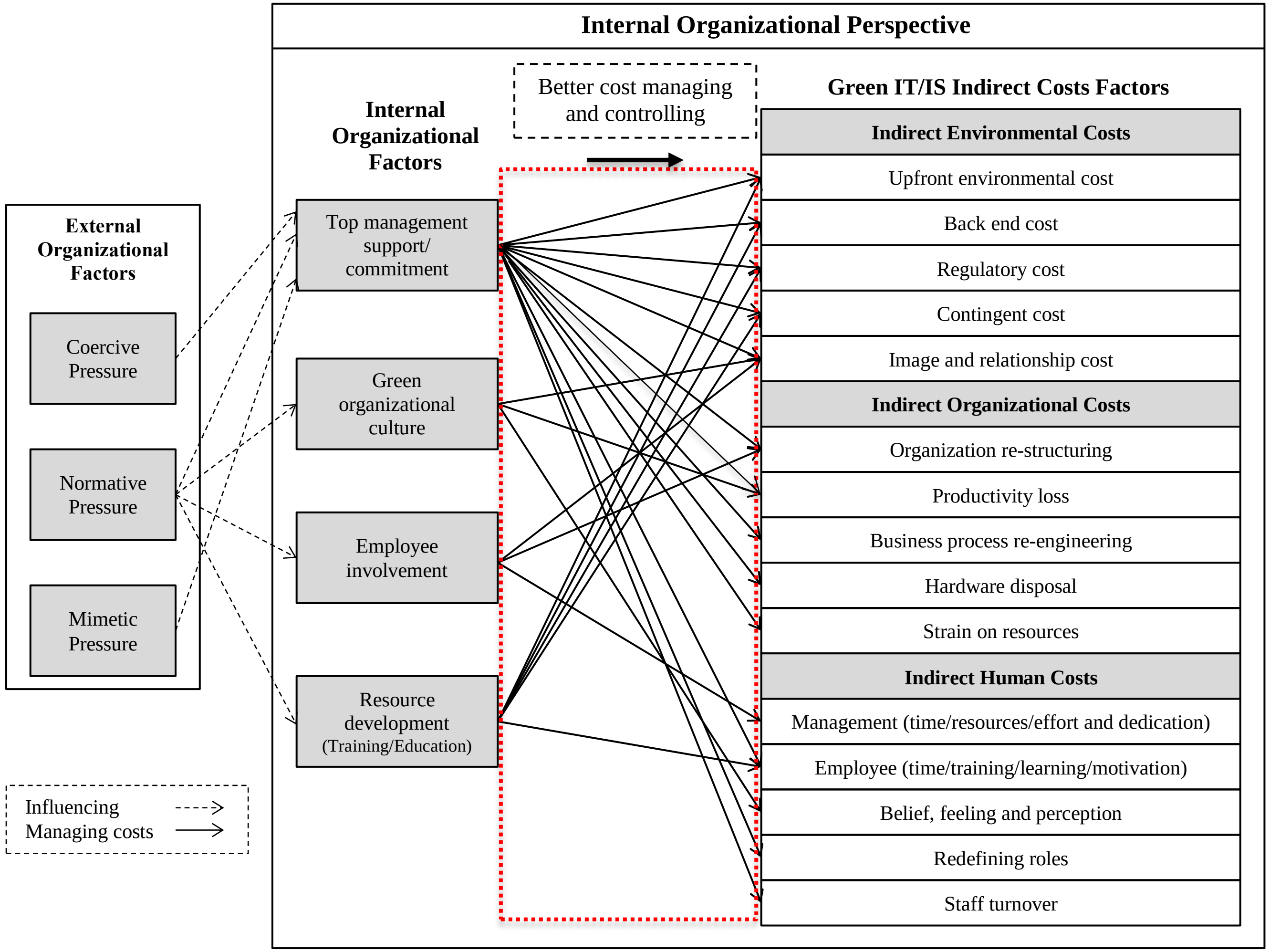

Figure 3.3: A Proposed Cost Management Model for Green IT/IS Investments Evaluation within an Aviation Industry

3.7 Contribution of the Conceptual Model

This section attempts to contribute to the area of Green IT/IS investments evaluation by proposing a novel model within aviation organizations, owing to the confines of Green IT/IS adoption/evaluation literature within the aviation industry. The proposed model (see Figure 3.3) highlights the importance of both external and internal organizational factors affecting Green IT/IS adoption and implementation, together with the identification of comprehensive lists of indirect costs that have a potential effect on the evaluation process of Green IT/IS investments within the aviation industry. It emphasizes the need for decision-makers to recognize the softer issues (i.e. human, organizational, and environmental) associated with developing Green IT/IS infrastructure and demonstrates the presence of such concerns with a comprehensive cost management model for more effective and efficient Green IT/IS investments evaluation. As there is a lack of studies and theoretical models for the Green IT/IS evaluation domain, particularly regarding indirect costs management surrounding Green IT/IS investments, this thesis is going to fill the aforementioned void (Section 2.10). However, the factors have yet to be evaluated in the practical arena. In doing so, the proposed factors may: (a) extend the current research in Green IT/IS within the aviation industry, (b) enhance the level of understanding for Green IT/IS investments evaluation, (c) provide comprehensive lists of indirect costs associated with Green IT/IS investments as a guidline for mangers, and (d) support decision-makers within aviation organizations accompanying cost managemnt strategies/mechanisms to reduce finiancal impacts when taking decisions to invest in Green IT/IS.

Establishment of this model is robust as there is no clear articulation of the relevant factors and indirect costs implications of Green IT/IS investments within the aviation industry present in the literature. Thus, the development of this conceptual model is significant as it can assist academics and organizations to make effective decisions and reduce financial impacts and consequences on Green IT/IS investments. The need for appropriate frameworks/models for investigating, identifying, and managing indirect cost implications of Green IT/IS investment is widely apparent in the existing literature, as is the need for a more theoretical development of the reasons for indirect/hidden costs concerning such investment.

As aforesaid, the proposed model (Figure 3.3) in this research makes a significant contribution at two levels. Initially, at the conceptual level, the model incorporates various factors recognized in prior studies and environmental related literature as influencing Green IT/IS investments and, which contributes to the emerging literature of IS evaluation, and Green IT/IS evluation within the aviation industry, by presenting a synthesis of factors from the normative literature as well as utilizing theoretical grounding (i.e. institutional theory (INT)) within this research area. INT was selected to enhance a better understanding of the complex phenomenon of such investments (see Section 2.7.5). Correspondingly, the internal organizational factors have been identified for the aviation industry in particular in different selected studies and literature resulting into a comprehensive taxonomy of internal organizational factors (refer to Table 2.9). This then results in the identification of key internal organizational factors, which can be used to assist in managing comprehensive lists of indirect costs (i.e. human, organizational, and environmental costs). The researcher develops these works and adapts them to the Green IT/IS investments evaluation area focusing on indirect costs through utilizing a theoretical lens and combining factors discussed in the normative literature. Thus, this results in the development of a comprehensive cost management model for Green IT/IS investments evaluation within aviation industry.

Moreover, the notions of this comprehensive model articulates the main factors and a detailed evaluation (with a focus on indirect costs) that perhaps need consideration when adopting and implementing Green IT/IS within the aviation industry. The goal is to produce a costs management model that is of particular relevance to aviation organizations and that seeks to provide decision-makers with an in-depth understanding of factors that may hinder or encourage Green IT/IS investments. In turn, it also serves as a tool to assist decision-making in the identification of the indirect costs at each of the IS life cycle stages, which then produce the proper management of such costs. Not only does this provide a decision-making tool but it also helps facilitate and formulate an organization’s strategies with concern for the environment. Additionally, it may assist aviation organizations in understanding the true costs associated with Green IT/IS investments and what significance this investment may offer them and all stakeholders.

Practitioners can use such a model during their evaluation process, as it gives a rich insight into the process of identifying and managing indirect costs surrounding Green IT/IS investments. Also, it provides them with a greater understanding of guidelines and essential factors that encourage or hinder Green IT/IS investments. Therefore, with such a comprehensive tool and with mechanisms to manage the indirect costs of Green IT/IS, this results in the success of projects because of the reduction of financial impacts, or improvements for organizations that are experiencing an under-optimized budget or cost overruns, increasing the likelihood of projects' success as well as organizations that want to perform post-implementation evaluation.

This proposed model is to be validated using the empirical data collected (Chapter 5). This evaluation both allowed the model to be refined and the development of a deeper understanding of how the various parts bond together. In turn, this revision was designed to assist those facing the practical challenge of adopting and implementing Green IT/IS in the aviation industry.

3.8 Summary

This chapter has taken the literature review in Chapter 2 to develop a conceptual model that integrates the elements of an IS evaluation (i.e. indirect costs) with a consideration of the various external and internal organizational factors surrounding Green IT/IS investments within the aviation industry. Figure 3.3 identifies the external organizational factors utilized from INT affecting key internal organizational factors, as well as how internal organizational factors assist in managing and controlling the associated indirect costs of such investment. INT has been utilized as a theoretical lens of organizational and IS disciplines to underpin this research, which supports organizations in assessing potential for undertaking Green IT/IS initiatives. Green IT/IS investments are considered as one of the most costly, multifaceted, time-consuming, and ambiguous costs and payoffs undertakings that an organization has to be aware of when taking decisions to commence. There is a great level of uncertainty surrounding such implementation, from which it can be implied that there should be a meaningful evaluation of this level of investment within an organization.

However, organizations have often ignored or had inadequate knowledge in understanding and taking into account relevant factors, including non-financial and intangible factors, that in fact play a critical role in this investment, particularly indirect costs. Therefore, organizations within the aviation industry are increasingly calling for a more proper cost evaluation tool to help in providing them with a more accurate view of indirect costs associated with Green IT/IS investments and reduce the financial impacts that would come along.

There is a demand to fill the gaps in this research area, especially the need for a suitable mechanism to identify the indirect/hidden costs of this investment and the range of implications associated with this tool within the aviation industry, thus supporting management and control of the cost. Therefore, the researcher has attempted to propose a costs management model, which tries to address this problem by presenting a conceptual model that enhances a better understanding of factors influencing Green IT/IS investments as well as the management and control of the associated indirect costs of this investment. In doing so, it will assist organizations in the process of evaluation to manage costs more efficiently through identifying a wider scope of project implications. Thus, with the clear understanding and proper management of the full cost implications, particularly indirect costs, organizations can reduce the financial impacts, e.g. budget/costs overrun and the likelihood of a project's failure, more effectively and efficiently.

In establishing the proposed model, a review of the literature has highlighted some gaps. Addressing these gaps informed the choice of research approach (Chapter 4). Therefore, a proposition has been made to link these gaps and, consequently, provide and broaden understanding of the phenomenon of Green IT/IS investments evaluation focusing on indirect costs. However, to validate the proposed model and satisfy the aim of this research, the theoretical proposition have been developed from a Green IT/IS perspective. The reason for this is so that the proposition can now be empirically validated against the employment of Green IT/IS. This is discussed in Chapter 4; however, in this case, observation of a real-world instance was a vital part of assembling the data required to refine the conceptual model. Doing so supported the development of a cost management model for Green IT/IS investments evaluation, which is presented in Chapter 6 of this thesis.

Chapter 4

Research Methodology -

A Qualitative Case Study Approach

This chapter specifies the research methodology and describes the way the current research propositions will be tested. It also examines the way the aims and objectives will be fulfilled, and establishes the context of common research methods employed in the IS research domain. The chapter distinguishes between research strategy and methodology for this research area. It describes the epistemological stances and justifies the use of an interpretivist stance by using qualitative research methods. The chapter explains the conditions that supported the researcher's decision to choose a case study research approach, in which a single case is examined. The framework for conducting the empirical work is presented as an empirical research methodology.

The case study protocol is presented as a variation of the empirical research methodology. This protocol works as an action plan for data collection, where data is drawn from the case study organisation such that the proposed proposition can be tested and the conceptual models validated.

4.1 Introduction

In Chapter 3, the proposed conceptual model, a cost management model for Green IT/IS investments evaluation was established and discussed. In this chapter, the researcher elaborates on how research problems concerned with testing the conceptual model will be undertaken and how the aim and objectives will be accomplished as well as allowing the modifications to be made to the conceptual model presented in Figure 3.3.

This research is concerned with accumulating a group of knowledge, in the boundaries of IS evaluation, Green IT/IS investments evaluation, and particularly in regard to indirect costs and various factors within the aviation industry. Therefore, a range of human, organizational, and environmental dimensions that help to broaden the evaluation process of Green IT/IS investments will be recognized. These factors will then be incorporated together into one specific model that could be used by decision-makers surrounding Green IT/IS investments within the aviation industry.

Nonetheless, it is vital to ground this conceptual model with the empirical data by gathering and analyzing data to test the propositions presented in Chapter 3. In doing so, a premise that updates will necessity to be adjusted to the model in Figure 3.3. As a result, a set of factors that affect the research process will now need to be addressed with account for their inclusion or exclusion within the proposed research methodology, establishing the basis of this chapter.

4.2 Selecting an Appropriate Research Approach

Choosing a suitable research approach is a fundamental undertaking of the research design process (Walsham, 1995). While IS is multi-disciplinary, thus the decision to choose a specific research strategy is a complicated one as there are multiple methodologies to choose from; therefore, selections must be made thoughtfully (Galliers, 1994). Moreover, there is an wide-ranging choice of philosophical assumptions drawn from IS practitioners, and thus the way in which they comprehend the subject being investigated differs significantly (Orlikowski and Baroudi, 1991).

As per Galliers (1985), choosing a research approach is not just a procedure of complementing advantages and disadvantages; rather, it is a more primary procedure of understanding the research phenomenon.

4.2.1 Epistemology: Philosophical Underpinnings

To begin with, to develop a research approach is to establish an extensive comprehension of various philosophical underpinnings that could be employed towards it. The philosophical assumptions underpinning the chosen approach are vital in aiding to understand them, as they facilitate in training and building a strong case for using either qualitative or quantitative research approaches in a certain study, in a specific setting. According to Guba and Lincoln (1994), within IS research, there are four distinctive paradigms for qualitative researches including: *positivism*, *post-positivism*, *critical theory and interpretivism*. These methods depend on various hypotheses concerning the type of knowledge and employ different methods in research. The primary research philosophy is the foundational assumptions that define in what way a research on a certain topic will be drawn and in which way data about phenomenon should be gathered, analyzed, and interpreted. The scientific method, and to an extent to, in this case interpretivism, is to change a doxology (what is believed to be true) to an epistemology (what is known to be true), it is the process of transforming things believed in into things known (e.g. through the testing of hypotheses) (Galliers, 1991).

IS literature advocates that the dominant method in IS research is positivism (Galliers, 1992; Miles and Huberman, 1994; Walsham, 1995; Yin, 2014). Orlikowski and Baroudi (1991) recommend that IS can be assigned as positivist, in cases there are certain quantifiable types of variables, formal propositions, hypothesis testing, and drawing of inferences related to a phenomenon from a prospective sample drawn from a specified population are presented. Galliers (1992) also reports that positivism assumes that observations of phenomena can be made objectively (by measurement). Galliers (1992) argues that there are other approaches that are also relevant to IS apart from positivism. Interpretivism assumes that the knowledge of reality is simply attained throughout social constructions such as consciousness, language, shared meanings, documents, tools and other artefacts (Galliers, 1992; Klein and Myers, 1999). In addition, IS research can be classified as critical in case the main task is seen as being one of social criticism (Hirschheim and Klein, 1994). Critical researchers assume that social reality is historically established that it is produced and reproduced by people (Myers, 1997). Although people can consciously perform to change their social and economic circumstances, critical researchers realize that their ability to do so are obliged by various forms of social, cultural, and political domination (Myers, 1997). However, in the literature, the post-positivist approach that is viewed as a variant of the former positivisms, but they are both objectivist and situated halfway between positivism and critical theory as it has emerged as a necessity to move beyond from positivism and to surpass its limitations (Lincoln and Guba, 2000). Lastly, post-modernists often uses conventional positivist and interpretivist methods rather than methodological differences (Gephart, 1999) It would contend that both the entity of an investigation and the interpretation process are created by going away from the notion of an abstract reality that can be revealed in the research process (Creswell, 2008).

4.2.1.1 Choosing a Positivist or an Interpretivist Approach

Galliers (1992) argues that the boundaries of IS both positivism and interpretivism are considered as applicable approaches. The selected methodology of this case study is drawn from an interpretive approach, meaning social constructions such as consciousness, language, documents, shared meanings, tools, and other artifacts can lead to knowledge and understanding of reality. In other words, the researcher approaches the study, through the research phenomenon, with a complete understanding of the appropriate literature, and the case study provides processes of gathering data as well as understanding the existing phenomenon. In this thesis, the development is to comprehend the nature, practices, and assumptions of IS by a situated hermeneutic approach. This method is thoroughly related to Walsham (1995), as a philosophical approach to human understanding; it offers the philosophical foundation for interpretivism, whereas, it advocates a way of understanding textual data. Interpretive studies are primarily conducted to help in understanding phenomena over the implications that people assign to them (Bryman and Bell, 2015).

Positivism offers a framework to observe reality as a solid, given entity which can be understood objectively. However, interpretivism is a philosophical system that emphases on reality as a human creation, which can only be understood subjectively (Kroeze, 2012). The positivist approach embraces the concept that an abstract reality occurs and that this can be presumed across a suitably rigorous inquiry. This typically depends on an extent of experimental control and undoubtedly the exclusion of unpredicted variables. Kaplan and Maxwell (1994) state that interpretivism research emphasizes the complication of human sense making as the circumstances emerge and it does not predefine dependent and independent variables. Walsham (1995) clarifies that the purpose of interpretive research is to enhance the understanding of the IS context and the process whereby the IS affected and is manipulated across the context. In interpretivism, researchers allow factors to appear though collecting data at fieldwork, rather than introducing pre-conceived assumptions into it (Glaser and Strauss, 1967; Miles and Huberman, 1994). While it is vital to access existing theory in a particular subject domain, it is similarly significant not to assume that it draws the final truth in that certain area (Walsham, 1995). In an empirical research strategy, both positivism and interpretivism have an impact on it, since the positivism requires that the researcher take the observer's role, whereas the interpretivism instructs the researcher to obtain knowledge by becoming involved in the subject of the empirical study (Irani *et al.*, 1999).

The researcher argues that for the purpose of this thesis, the interpretive research approach has been selected. The justification for this choice is the following:

- Chapter 2 and 3 show that within the boundaries of Green IT/IS investments evaluation, concerns regarding managerial, social, cultural, environmental and technical issues are to be taken into considerations. These factors associated with Green IT/IS investments evaluation particularly indirect costs appear to be various, complex, and interrelated characters. Hence, the factors reported in Chapter 3 that influence the Green IT/IS investments cannot be isolated from its organizational, environmental, technical, and cultural context. Therefore, there is a need for a research approach that will allow the researcher to understand the evaluation process of indirect costs associated with Green IT/IS investments and all relevant factors that influence such adoption rather than assigning specific quantifiable procedures to them. Interpretivism is considered by the researcher as more appropriate for the research reported in this thesis for the reasons previously described. The justification of this decision is based on the aim of this research as stated in Section 1.7.

- Positivism cannot be adopted in this research since there is no research hypothesis, measurable measures of variables, or formal propositions reported in the research. Green IT/IS evaluation could not be viewed as one where facts and values are independent. This means that positivism cannot be used in the context of this thesis since positivism assumes that knowledge consists of facts that are independent.

4.2.1.2 Justifying the Use of Qualitative Research

In exploring a phenomenon throughout events, there is the necessity to consider the collaboration of various variables such as people, times, and culture (Irani, 1998), which two settings are not identical. Thus, it is evident that quantitative research methods are not appropriate in this case, as they cannot take into account the differences between people, words and the objects of the natural sciences. The fact is that IS research is concerned with human beings and behaviors because people influence IS research as pointed out by Irani *et al.* (1999). Thus, any methodology that uses quantitative research methods must recognize the variability that is inherent in human behavior. The research presented in this thesis focuses on the factors that influence the decisions of people (e.g. decision-makers/managers) when adopting and evaluating Green IT/IS as well as identifying and managing indirect cost factors. As a result, the value of applying the foundation of scientific methods to the inquiry of people is doubtful, proposing the appropriateness of a more qualitative method.

According to Remenyi and Williams (1996) within IT/IS research, qualitative research methods should be adopted, in case, an area of discipline is linked with human and organizational characteristics. Bryman and Bell (2015) indicate that the qualitative method is usually based on words rather than quantification in the collection and analysis of data. The issues under investigation in this thesis are soft, confidential, and subjective, with much context to the data needed. Thus, this advocates that the chosen research methods must be able to take account of such factors and acknowledge that many management decisions are idiosyncratic and guided by circumstances pertaining to the organization. Within a qualitative approach, various techniques are to be considered including grounded theory, semiotic analysis, participant observation, discourse analysis or hermeneutics (Myers, 2009). Therefore, it is apparent that 'rich' empirical data is mandatory, stimulating the use of qualitative research methods.

As aforementioned in Chapter 1 of the research objectives, the subjects under investigation are confidential and subjective as they affect most of the data required. This emphasizes the need for the selected research methods to accommodate these factors. Moreover, the research method chosen must consider the nature of key stakeholders' decisions since that knowledge is contributed directly to organizations. Thus, for a comprehensive understanding of Green IT/IS evaluation, empirical data is needed. In this thesis, it is anticipated that the qualitative approach will support the understanding of people's perceptions, processes, and assumptions of evaluating Green IT/IS investments especially indirect cost implications within an aviation industry.

Within the boundaries of IS, positivism approach and quantitative methods are still dominated than other methods (Galliers and Huang, 2012), as well as Green IT/IS research domain, literature showed that most of the studies employ a quantitative method (Molla, 2008, 2009; Molla *et al.*, 2009; Corbett, 2010; Chen *et al.*, 2011; Bose and Luo, 2011;; Lei and Ngai, 2012; Zheng, 2014; Molla and Abareshi, 2012; Nanath and Pillai, 2012a; Cai *et al.*, 2013; Gholami *et al.*, 2013; Koo *et al.*, 2013; Mishara *et al.*, 2014; Opitz *et al.*, 2014). However, a few studies have chosen a qualitative research method including interview, case studies, documents collection and cross-sectional field study or a combination of both methods as their main research methods. Therefore, as this Green IT/IS research domain is still in a nascent stage; therefore, it needs more studies in the confines of understanding of people 's perception, behavior and process so as to broaden diverse comprehension of this area, which is qualitative research method.

Reasons that qualitative approach works to a great extent for this thesis are as follows:

- The research question 'how' is being asked, which is emphasized by qualitative rather than quantitative methods (Yin, 2014).

- Qualitative research is suitable for research settings that need some exploration (Creswell, 2008), or while the research agenda is still new and emerging.
- Research that observes one in-depth complexities and procedures case (Dyer and Wilkins, 1991).
- Research that involves in understanding the nature as well as the complexity of the process taking place (Marshall and Rossman, 1999).
- Research that is not able to experimentally carry out for practical or ethical reasons (Marshall and Rossman, 1999).
- Research on straightforward and unstructured connections and processes within organizations (Marshall and Rossman, 1999).
- Lastly, qualitative research constructs no assertion to objectivity and the research is recognized as being that of a participant observer, or observant participant (Myers, 2009).

However, there are some drawbacks associated with a qualitative research approach. Qualitative data has somewhat problematic characteristics, which are different from those of quantitative data (Miles and Huberman, 1994). Qualitative data is mainly documented, with a fullness that can be absent once summarization takes place. Due to the fact that data might not be properly structured as it involves with people's behavior and attempts to recognize their opinion of a given situation. Qualitative data collection may continue over an extended period. Also, it lacks controllability, deductibility, repeatability, and generalizability (Lee, 1991).

Despite the shortcomings of qualitative research, it has still been chosen as most relevant for this research because:

- Essentially, qualitative research is useful because qualitative data is obtained in its natural setting (e.g. Green IT/IS investments evaluation focusing on indirect costs within the aviation industry), and it has richness. Thus, assisting the understanding of the consequence of the environment to be taken into accounts, and it has richness (Miles and Huberman, 1994; Denzin and Lincoln, 1998).

- Qualitative research is multi-method, comprising an interpretive and naturalistic approach to the subject matter. That signifies that qualitative researchers study undertakings in natural settings, and they understand events (e.g. Green IT/IS evaluation) in the sense of the meanings that individuals bring to them. Furthermore, the researcher can plan what they ask the participants, thus resulting in more natural and realistic information being obtained, which is the favorable approach for this study.

- As previously mentioned, a number of research surrounding Green IT/IS evaluation particularly indirect costs within the aviation industry is limited. Therefore, qualitative research may assist the researcher in studying Green IT/IS in its natural setting and learning from practice within the aviation industry. This may also allow the researcher to understand the nature and the complexity of the Green IT/IS evaluation process within a chosen case organization as well as indirect costs implications associated with Green IT/IS investment within the aviation industry.

- As explained in Chapters 1, 2, and 3, Green IT/IS evaluation is considered as very limited research especially within the aviation industry. Thus, qualitative research may aid the researcher to study Green IT/IS in its natural setting and then, learn from practice within the aviation industry. This may also allow the researcher to understand the nature and the complexity of Green IT/IS evaluation process within the aviation industry.

- By using Walsham’s (1995b) comments, in that interpretive case studies provides four types of generalizations, in which data triangulation can help to overcome the bias that is considered as an uncertainty though using the qualitative research approach. Thus, generalization issue can be overcome.

Therefore, qualitative research is chosen for this study as the most appropriate approach to gain a greater understanding of the phenomena under investigation.

4.3 Selecting an Appropriate Research Strategy

Having justified the use of interpretivism as the research philosophy (see Section 4.1) and adopting a qualitative research approach (see Section 4.2.1.2), this section starts with an interpretation of some research strategies to choose from and justifies the suitable research strategy for this study. Galliers (1992) explains a research strategy as the processes by which research is literally conducted, including the technique and methods of data collection. The prevailing research strategies used are experiment, survey, case study, longitudinal studies, grounded theory, field study, ethnography, action research, and exploratory, descriptive, and explanatory studies (Saunders *et al.*, 2009). Yin (2014) considers that to choose or differentiate between researches strategies, there are main standards that need to be taken into consideration, as reviewed below:

- Outlining the kind of the research question to be emphasized;
- The degree to which the researcher can control the research setting; and
- The magnitude of research focus on contemporary as compared to historical events.

A case study approach was selected because it helps the accessibility of real life data (Creswell, 2008). However, these were other reasons to consider when determining the research strategy to use in this thesis. A range of additional factors was taken into consideration in light of these research characteristics within the aviation industry. Particularly, these factors need to empirically test the research questions; the complication of the anticipated solutions as participants would have various perceptions; the necessity to study the phenomenon in its natural setting; the need to cope with resource constraints such as time, budget, and accessibility to data; and most notably the need to capture ‘reality’ and ‘rich’ primary data. Therefore, all of the aforesaid should take into consideration, along with the reasons advocated by Yin (2014), a case study research strategy was adopted.

4.4 Justifying the Use of Case Studies

Within the IS research community, case study research is well accepted as a valid research strategy (Klein and Myers, 1999). A case study is a rigorous investigation of a phenomenon in its natural setting, engaging multiple techniques of data to gather information from one or more entities (e.g. people, groups) as noted by Yin (2014). Data is gathered through interviews, observation, questionnaires, and written material. According to Benbasat *et al.* (1987), below are the following characteristics that should be taken into account:

- Consideration of a phenomenon is extensively in its natural setting;
- The researcher can ask 'how' and 'why' questions to assist in understanding the complexity of the processes taking place;
- Data is collected by multiple means;
- The focus is on contemporary phenomenon;
- There is the ability to conduct research in an area where few, if any, previous studies have been undertaken;
- No experimental control or manipulation is involved;
- One or a few entities are examined;
- The researcher may not assign the group of variables before;
- Case studies support knowledge-building process via various kinds such as exploration, taxonomy, and hypothesis building. The investigators should have a open attitude towards exploration; and
- Changes in data gathering methods or the site chosen could take place through developing a new premise.

This is by applying multiple methods such as interview, observation, written materials, and data collection from different entities to obtain the required information (Walsham, 1995b; Irani *et al.*, 1999; Yin, 2014).

Yin (2014) notes that there are mainly three categories of case studies including exploratory, descriptive, and explanatory. Each category advocates differently as it depends on how they are used to respond what, how, and why research questions sequentially. Saunders *et al.* (2009) define exploratory studies as a means of exploring, discovering out any new insights; to pose enquiries and to evaluate phenomenon in a new knowledge. This is accomplished throughout a literature search, communicating and examining with specialists of certain subject, or leading focus group interviews. In contrast, Saunders *et al.* (2009) state that explanatory research deploys for causal relationship between variables and is used primarily in quantitative studies where the data is subjected to statistical tests such as correlation. It observes the data very intensely in order to clarify the phenomena in the data. Descriptive research assists in providing and describe an accurate explanation of the natural phenomenon, is carried out with surveys and histories, and used as an additional of a piece of explanatory research (Saunders *et al*., 2009).

Therefore, from this classification of case study types and taking Yin's (2014) suggestions into consideration, within this thesis, the case study can be interpreted as being exploratory. This is because the research focuses involve extensive and reviewing the literature to find new insights in this emerging research area, which is evaluation of Green IT/IS investments, particularly with regard to indirect costs factors, within the aviation industry. Also, it highlights on factors affecting Green IT/IS investments evaluation. It assists in exploring situations in which the intervention being assessed has no clear or single set of outcomes (Yin, 2014). Also, this research emphasizes on 'how' questions of the relevant factors surrounding Green IT/IS investments as well as indirect costs factors surrounding Green IT/IS investments within the aviation industry. Roethlisberger (1977) supports that the exploratory research offers a ways of carrying forward a future research agenda as a primary benefit of case study research with this emerging field of study.

However, within Green IT/IS evaluation research domain, it appears that there are a few studies (Daly and Butler, 2009; Sarkar and Young, 2009; Butler, 2011a) employ a case study research method as previously revealed that most of the studies in this domain apply questionnaires or large-scale survey. Thus, it is going to be beneficial for Green IT/IS research area domain as this research will be utilized and extend the case study method to test its theoretical concepts.

4.4.1 Case Study Objective Theory Testing

There are numerous reasons for selecting a case study strategy. According to Remenyi (1991), a case study research allows a researcher to closely examine the data within a certain context as well as it can be used to describe a phenomenon, test theoretical concepts and relationships, build theory, or it can be exploited for all of them. Case studies have a solid tradition of description and theory-building, and Remenyi (1991) supported their use for this objective because they offer an inductive explanation of the findings through moving from certain observations to wider generalizations and theories. However, for testing theoretical propositions, a case study can also be used as an appropriate strategy. Essentially, the use a deductive explanation can be considered in which the research proposition is examined by comparing the emerging data with existing research and hypothesized connections among the new identified factors and results. Benbasat *et al.* (1987) and Yin (2014) are intensely supported the deductive explanation for testing theory as an suitable use of a case study strategy. Thus, case study strategy chosen will be utilized with the purpose of testing those theoretical concepts or relationships illustrated in Chapter 3.

4.4.2 Single and Multiple Case Studies

Researchers can adopt either a single or multiple case design depending on the issue in question. It is important to select which should be applied for the research before collecting the data to tackle the research question and to comprehend the difference between what is being considered and the circumstance in which it is situated (Benbasat *et al.,* 1987). A complete picture and rich data of the organizational context could be achieved by conducting a single case study. Benbasat *et al.* (1987) noted that a single case study can be assigned into numerous dissimilar justifications as presented below:

- Critical case – a critical inquiry for a substantial theory
- Extreme or unique case – documenting the specific type of a phenomenon not well comprehended
- Representative or typical case – capturing the circumstances of a common situation

- Revelatory case – a situation previously inaccessible to scientific investigation
- Longitudinal case – involving data gathering repeatedly over a period of time, causal mechanisms, patterns of transition, etc.

Thus, a single case assists a researcher in exploring and getting closer to a phenomenon and studying it thoroughly. An identification of deep structures and rich explanation are established (Yin, 2014). A single case study allows the full and rich consideration of a phenomenon contributing towards knowledge, through developing theories and concepts. According to Yin (2014), a single case study is also suitable for theory testing in particularly at the beginning of theory testing a single case study appear to be more relevant through the confirmation, or rejection, of propositions, as they allow the researcher the possibility to settle the investigation and start to comprehend the situation, idiomatic language, and conflicts of the setting. Besides, a single case study can be adopted for this research, as there are no other cases accessible for replication (i.e. Revelatory case) as well as are regularly selected as originators to a program of multiple case approach, so it is not an issue of ultimately selecting one or the other.

It is argued by Herriott and Firestone (1983) that the results derived from multiple case studies are more compelling than those from single case studies. As there are evidences and data come from more case studies, thus it increases the degree of more robust and more reliable of the overall study. Conversely, multiple case studies will not provide the richness of data that a single case study can attain but will give the research a more robust investigation of cause and effect about the units of analysis. However, it allows the researcher to test and cross-checking research findings with each individual studies. However, the suitable number of cases in a multiple case study is doubtful, and it is usually determined intuitively. Gable (1994) advises a finale of ten case studies, while Eisenhardt (1989) recommends a possibility of four to ten.

Nevertheless, there are problems in examining more than one appropriate case, and some researchers contend that a single case study can offer the depth of knowledge, which offset for any absence of comparison across multiple cases (Gerring, 2007). Therefore, a single case study enables the researcher to use multiple sources of data and a variety of research methods to explore the research questions, which, in turn, foster the validation of data through triangulation (Yin, 2014). Concerns about this might include the anticipated results of the case studies and the information likely to be obtained, and a clear likelihood of classifying them all (Dyer and Wilkins, 1991). Yin (2014) claims that pattern-matching is a vital tool for the outcomes of a single case can be compared to the literature, and where the findings are correlated to the existing literature employing a conceptual model (Chapter 3).

4.4.3 Developing Insights from a Single Case Study versus Multiple Case Studies

Green IT/IS evaluation are considered as an emerging phenomenon, particularly within the aviation industry. There are still doubts regarding the indirect costs implications surrounding Green IT/IS investments as well as the value derived from it as highlighted in the literature review. In addition, access to the organizations that are adopting or implementing Green IT/IS within the aviation industry was very limited, thus this is a significant reason to adopt a single case study.

Yin (2014) argued that in this nascent disciplines (e.g. Green IT/IS area) a single case study could present a role in both building and testing theories. Herein, Yin’s (2014) pattern-matching is critical as it confirms the outcomes of a single case are compared to the existing literature using a conceptual model (as presented in Chapter 3). Also, he argues, together with Sammaddar and Kadiyala (2006) that a theoretical understanding can be formed to compare with the research findings in other existing studies one by one. This careful process of repetition can be established to enhance the better understanding of the underlying factors, whether or not they are mutual or diverse and strengthen its internal validity.

In contrast, Gable (1994) emphasizes that the use of a single case is limited to the process of comparing case study results, contrasting to multiple or several case studies. However, in a single case, it is occasionally probable to segment the findings by time or place. As Eisenhardt (1989) noted that there should be at least four case studies in a research project, because it is not considered challenging to provide research findings with broader explanatory power with fewer cases than this. Nonetheless, it might appear simplistic to follow Eisenhardt (1989) without analytical consideration. Undoubtedly a single case study can offer a real understanding into a research setting and may act as a an originators to a program of multiple case approach but attention should be applied as to the degree to which explanatory power should be devoted to one case study.

Hence, the consideration across the value of single or multiple cases is fairly inconclusive. Accordingly, a single study is chosen for this research because it will yield information that will enhance thorough understanding and possibly reflect the limited accessibility to prospective cases. As aforementioned, although a single study has limited capability to provide a generalising conclusion; however, this can be overcome by triangulating the study with other methods and generalize its findings by carrying on other reported studies in order to confirm the validity of the process. A second advantage is that the emphasis produces the richness of detail that describes suitable case study research, and it is proposed that findings from a single study can be more valuable and comprehensive than those attained by multiple studies (Dyer and Wilkins, 1991). Above all, a single case study prioritizes richness of data over the capability to compare multiple cases and broad explanatory power. As there is no absolute recommendation on how many case studies should be done, as it should be reliant on the research domain and its environment. Eisenhardt (1989) and Gable (1994) are rigid, to the point of their instructions appearing completely subjective. Therefore, this thesis pursued the work of Dyer and Wilkins (1991) in making the choice of the research approach and case study. Consequently, a single in-depth case study approach was selected.

This case study tackled a research questions and a range of issues that is not generally addressed in academic literature. As previously discussed, the Green IT/IS evaluation research domain, particularly within the aviation industry, is limited, and Green IT/IS investments research emphasizing indirect costs implications is lacking. The research model, supported by the empirical evidences, will significantly contribute and extend to the normative literature as well as assist academics and practitioners (i.e. decsionn-makers) to gain a deeper understanding of Green IT/IS investments evaluation from costs perspectives. This will aid invaluable future research directions within this area. Moreover, this research allow others to draw similarities and compare themselves against the lists of factors and indirect costs factors surrounding Green IT/IS investments through this single case.

Analytical generalization from the findings does not drawn inferences from data to population; however, it is to compare and contrast the results of a case study to a formerly theory or existing literature. Overall, reflecting the emerging Green IT/IS investments evaluation research domain, specifically on indirect costs implications within an aviation industry, a case study approach was chosen (e.g. Hakim, 1987; Galliers, 1992; and Yin, 2014). The fact is that this research attempted to identify factors influencing Green IT/IS investments as well as indirect costs related with such investments within aviation industry, which is still a nascent area. Thus, the model is developed, and it is apparent that a rich and exploratory method was necessary.

4.5 Empirical Research Methodology

Now that appropriate case study variants have been identified and justified; the researcher proposes to integrate these factors into an empirical research methodology. This methodology is detailed in Figure 4.1. Essentially, in qualitative research, there are three stages to be pursued including research design, case study data collection, and case study data analysis as recommended by Janesick (2000).

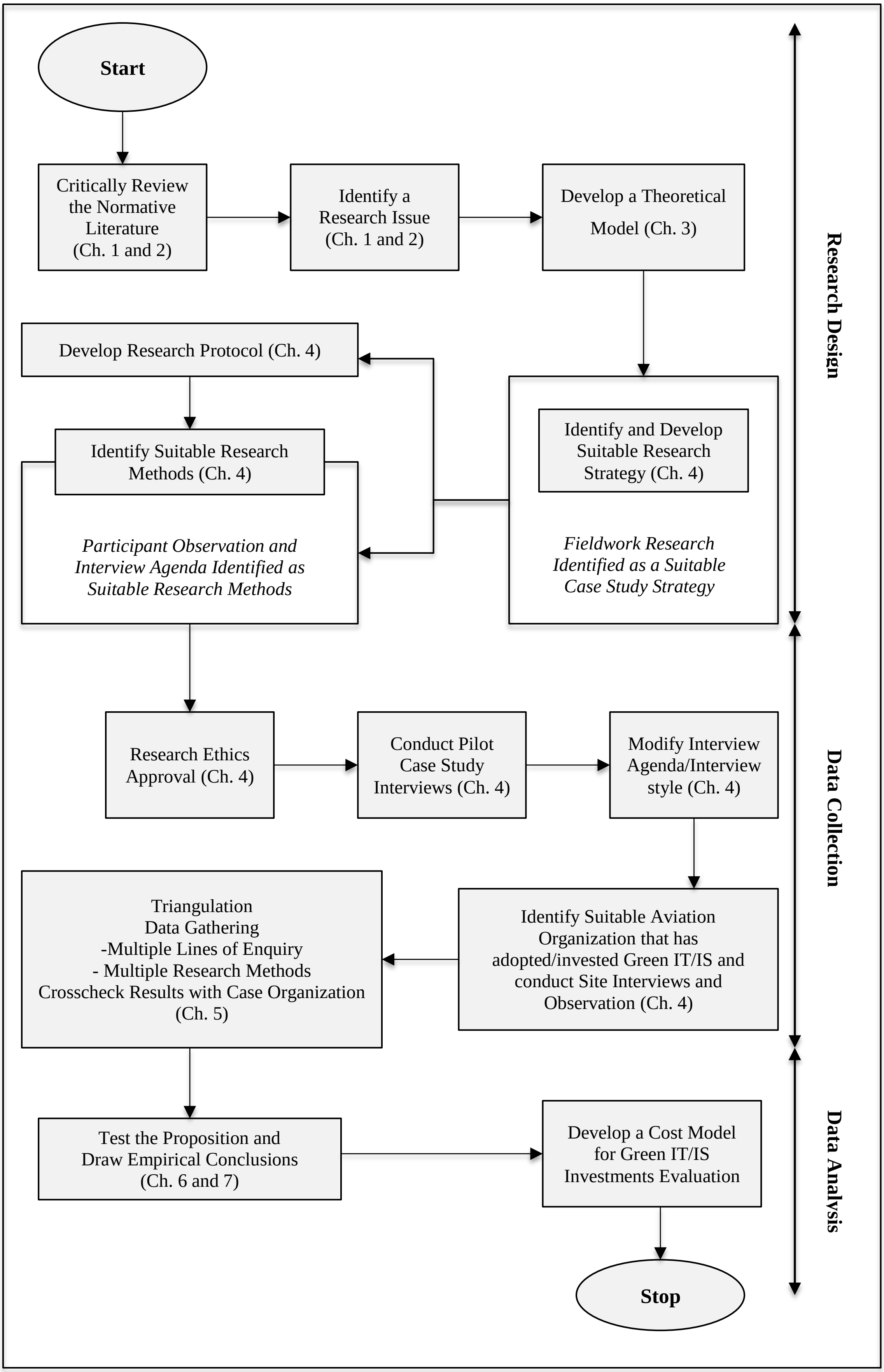

Figure 4.1: Empirical Research Methodology Process

4.5.1. Research Design

The initial phase of the empirical research methodology is the research design. The research design selected is grounded on an interpretivist framework. Fundamentally, it begins with attaining and developing background knowledge, understanding the research domain as well as underlying the study by reviewing the literature and identifying the research issues. This results in the identification of a certain focus and needs within the research area. Hereafter, a conceptual model is developed to represent the expected empirical research, and the features of the model are tested by empirical studies, and assist in interpreting the outcomes. Given the nature of this research (i.e. Green IT/IS investments evaluation in the context of aviation), an in-depth single case study was selected. Then, the research design was operationalized into a research protocol (Friedman, 1987) and adopted to carry out the fieldwork in order to achieve the aim of this thesis.

Consequently, a suitable qualitative research method, as well as a thorough interview agenda, was developed. Then, it was used during the formal interview process (Appendix B), which was a series of questions designed to guide the researcher during the semi-structured interviews. It was chosen as most suitable for exploratory research because it assists the researcher's understanding throughout the engagements of the interviews (Yin, 2014).

The choice of method was influenced specifically as there is a need to apprehend rich contextual information in order to respond the underlying research questions in an emerging domain. Together with the interviews, data was collected from numerous sources such as archival documents, minutes of meetings, the reports and websites of the organizations. The use of multiple data collection methods aids triangulation, which provides the theory more substance (Eisenhardt, 1989). Additionally, research related with the evaluation of new technology (i.e. Green IT/IS) emphasizes the necessity to consider numerous factors that involves with human, organizational and environmental dimensions. Thus, this stimulated the need to reflect the interviewees of aviation organizations and their staffs so as to exploit their knowledge and experiences on Green IT/IS evaluation. Given the type of the study (in a single authority) other data collection tools such as questionnaires were perceived to be of little useful. The justification for the interviews and the range of key personnel are illustrated below (Section 4.5.2).

4.5.2 Case Study Data Collection

The following part of the methodology is the data collection phase. This stage involves for determining the appropriateness of the interview agenda. As previously mentioned, the data concerning with the issues was soft, confidential, and subjective. Empirical data was originally collected by conducting in-depth semi-structured interviews with the largest airport operator in Thailand and participant observation (Atkinson and Hammersley, 1994; Myers *et al.,* 1997). Thus, their comprehensions into Green IT/IS evaluation and indirect costs implications in the context of aviation were also obtained. By conducting a pilot case study with a senior manager from another aviation organizations confirmed the reliability of the research methods. It then helps in improving the research's quality, as concerns such as vagueness and ambiguity indicated in the interview agenda, could be discussed. Also, the researcher was allowed the chance to enhance interviewing skills and verbal phrasing of questions. Moreover, the pilot study assisted in improving the interview agenda that was then used with the aviation organization, which had been chosen as the most suitable in order to aid the appearance of rich, relevant case study data. The interview process also allowed the interviewee to have sufficient freedom to discuss related issues.

The case organization used for this research was selected because it is one of the leading and largest organizations within the aviation industry in Thailand, well-performing and top 20 of the busiest airport in a world airports' ranking. More importantly, from the selection criteria, it is the only airport operators who is already adopted and implemented Green IT/IS for a certain period and value the environmental sustainability greatly by obtaining sustainability and carbon reduction awards in attempting to reduce environmental impacts within the aviation industry. Thus, it would be able to provide views associated with this research appropriately. Hence, the literature review and the model previously developed are significant tools to place the particular findings of this inquiry in a wider context. Supplementary data-gathering research methods and multiple lines of inquiry contained policy documents, a corporate strategy report, consultancy reports, and minutes from meetings. For instance, the extensive list of data sources used is presented in the following Table 4.1. The use of multiple methods within this research confirmed data triangulation, hence adding towards the reliability and validity of the findings. Therefore, as part of the triangulation process, the empirical findings were cross-checked with the case organization selected to further validate the outcomes.

Sources of Evidence	Media	Explanation
Meeting minutes	Electronic/paper	• Meetings of IT and environmental groups • Meeting documents related to Green initiatives projects
Interview transcripts	Electronic/paper	• Final interview with directors, senior and operational staffs of IT, environmental, financial and HR groups.
Documents	Electronic/paper	• Organizational/environmental policy • CSR and sustainability reports and plan • Possible future Green initiatives projects and plans • Documents that have been written on the same day based on field notes/observations • References material and websites • Reflections from participation in activities
E-mails	Electronic documents	• Meeting agendas • Time schedules and Green project plans • Comments on draft of reports and minutes
Archival records	Paper	• Organizational and some financial records

Table 4.1: Empirical Materials Used in the Case Study

In addition, this interview protocol followed the standard university process to gain ethical approval for data collection procedures and method of collection. The researcher paid attention to detail to keep the data from the collection process safe and was not contaminated by data bias. Within this research design, a method parallel to that employed by Molla *et al.* (2006) was used for data collection, analysis, and examination through conducting the preliminary exploratory research.

4.5.3 Interview Process

Denzin and Lincoln (1998) state that for the qualitative study, that interviews are the primary tool in the data collection process. Yin (2014) also supports that interviews as one of the most vital foundations of case study based research. Moreover, this research is followed the interpretative stance, interviews are regarded as the key and most applicable foundation from which data has been gathered.

In this research, interviews were conducted through a formal interview agenda (see Appendix B), and it mostly comprised of open-ended questions. For instance, the higher level of senior and experienced directors, supervisors and operational staffs who have been involved with Green/environmental and IT-related projects are selected. The job roles and responsibilities of the interview participants (to elicit data) were: Strategic IT Planning and Budgeting Director (ICTD), Information Technology and System Director (ITD), Systems and Network Supervisor (SITS), IT/IS Communication Supervisor (ITISS), Organizational Culture and Knowledge Management Director (OCD), Corporate Social Responsibility Director (CSRD), Environmental Management Director (END), Planning and Budgeting Director (PBD), Financial Director (FD), Business Development Director (BDD), Business Development Supervisor (BDS), Environment Officer (ENO) and IT Staff (ITS).

Moreover, the length of each of the interviews was about one hour and thirty minutes; every individual was conducted on a one-to-one basis to stimulate discussion and overcome any obstacles that may have arisen between the interviewer and interviewee. On top of this, 11 of the interviewees were at a strategic level, and the rest were operational staffs that have been working with the case organization at a certain period. The interview process took place in a meeting room, which was silent and no interruption. During the interview, the verbal and non-verbal reactions of the respondent were also taken into account as part of the feedback.

The following (Table 4.2) below is the list of interview participants from the case study (APTH). For confidentiality reasons, the case organization is referred to as "APTH" in this research.

Who	Where	How
Organization Culture and Knowledge Management Director (OCD)	APTH Human Resources Department	**Formal Interview** • Semi-structured interview agenda (refer to Appendix B) • About 90 minutes for each participant • One-to-one basis
Strategic IT Planning and Budgeting Director (ICTD)	APTH IT Department	
Information Technology and System Director (ITD)		
Systems and Network Supervisor (SITS)		
IT/IS Communication Supervisor (ITISS)		
IT Staff (ITS)		
Planning and Budgeting Director (PBD)	APTH Finance Department	
Financial Director (FD)		
Corporate Social Responsibility Director (CSRD)	APTH CSR and Corporate Governance Department	
Business Development Director (BDD)	APTH Business Development and Marketing Department	
Business Development Supervisor (BDS)		
Environmental Management Director (END)	APTH Environmental Department	
Environment Officer (ENO)		

Table 4.2: List of Interview Participants from the Case Study (APTH)

4.5.4 Case Study Validity

It is necessary to address internal validity by digitally recording and then, transcribing each interview as to assure the robustness of the findings including interviews, documentary sources, and observation. Then, these were sent back to the interview participants to check and determine any inconsistencies that may have emerged and to assist in removing interviewer bias to confirm the validity.

Moreover, the researcher was taken an extremely careful to ensure that data collection was based on facts instead of feeling, as there are several of evidences collected in this research. The procedures used in conducting the study were followed correctly, and that triangulation was used for data collection. During this study, the research methods pursued multiple lines of inquiry, as a diversity of opinions was sought. Thus, the researcher has full confidence in the reliability and accuracy of the research process and the findings.

4.5.5 Case Study Data Analysis

Data analysis is the final part of the empirical research methodology presented in Figure 4.1. Empirical data obtained from case studies held triangulated and then analyzed to pull empirical conclusions. Data analysis process conducted by following directed content analysis, as codes or keywords of this research are derived from (or started with) theory. They are defined before and during the analysis process. Generally, the goal of this analysis process is to validate or extend a theoretical framework or theory. In addition, a qualitative data analysis technique and tool using NVivo software (a qualitative analytical tool) was adopted to aid the development of the manual coding system employed for data analysis. NVivo software was technically used for storing and retrieving the interview transcripts for the each of the coding procedure. Data analysis process was involved observing the meaning of people's actions and words (e.g. Ramanath, 2009), and the research findings were determined from the empirical data. Additionally, the secondary data, such as documents related to organizational policy on Green practices, IT presentation documents, and sustainability reports, were also analyzed comprehensively to support some of the interview findings. As a result, it was used to support the empirical evidence reports that assisted in the development of a cost management model for Green IT/IS investments evaluation emphasizing on indirect costs within the aviation industry

4.6 Case Study Protocol: An Operational Action Plan

Both Eisenhardt (1989) and Yin (2014) suggested a useful tool for guiding while conducting case research, which is a case study protocol. It acts as an action plan, sets rules, regulations and guidelines, which can be used to assemble and direct a case research study (Miles and Huberman, 1994; Yin, 2014). Also, the protocol acts as a data collection tool, where data is derived from case studies. Such a protocol is essential to increase the consistency, reliability and focus of the data-gathering process (Remenyi, 1991). As such, it denotes an official document that accompanies a researcher in carrying on the data collection and conducing the case study in a thorough manner including scheduling data-gathering dates, identifying the means which it will be gathered, and describing the objectives and procedures of the analysis.

Apart from the significance described above, developing a protocol can also benefit the researcher by allowing for more effective data gathering and enhancing communication with participants (Miles and Huberman, 1994; Yin, 2014). The following segments suggested by Yin (2014) that a case study protocol should contain:

- Outline of the case study;
- Procedures of fieldwork research;
- Questions addressed by the research, and;
- The research output structure.

These sections assist in keeping the researcher concentrated on the topic, and the development of this protocol helps the researcher in predicting any difficulties beforehand (Yin, 2014). Per se this research adopted such outline recommended by Yin (1994), and it is now entirely explained.

4.6.1 Case Study Overview

This section of the protocol contains any background information about the research and details the fundamental concerns to be reviewed (Yin, 2014). As contended, this area (i.e. Green IT/IS evaluation) has seen a lack of research to date; thus the singular purpose of this study is to increase the available collection of data on the Green IT/IS evaluation particularly on indirect costs research domain. Therefore, the purpose of the research is to propose a deeper understanding of the phenomenon of Green IT/IS evaluation focusing on indirect costs within an aviation industry that can be used in the justification of evaluating indirect costs surrounding Green IT/IS investments and provide cost management mechanisms and an effective evaluation process.

In this section of the case study protocol, the issues under investigation are complete, to aid the researcher in concentrating on the key questions that need to be examined. For instance, the factors that the researcher needs to focus on so as to generate data that is required to investigate the evaluation of Green IT/IS. The consideration of these concerns is important, to maintain focus and collect required data during the interview process. The following are particular concerns of this research:

- To establish the justification process used by the case organizations, during their evaluation of Green IT/IS investments, e.g. whether or not traditional/non-traditional appraisal techniques are being used as part of their evaluation process;
- To identify whether or not any of the indirect costs (i.e. human, organizational, and environmental) considered during the investment evaluation process;
- To describe how are the identified costs are a cost to the organizations and when they appear during the IS development life-cycle stage;
- To identify and explain external and internal organizational factors surrounding Green IT/IS investments;
- To identify the suitability of these factors for inclusion in a cost management model for Green IT/IS investments evaluation within the aviation industry;
- To establish the strategy or mechanism when assessing the accomplishment of Green IT/IS projects on indirect costs implications objectives so as to reduce the impacts within the context of aviation.

4.6.2 Fieldwork Procedures

As the nature of case studies is associated with the investigation of a phenomenon in its natural, real-life setting, it is necessary to incorporate for real-world events in the requirements of the data-gathering plan (Yin, 2014). This indicates that researchers should be aware of and handle with real-world events, including respondents opting out and documents not being obtainable, and they should realize that forgetfulness and disruptions during the interview are anticipated, but that should not stop them from gathering required data. Thus, to cope with such situations, a fieldwork procedure must be carefully designed. These issues have significant implications during data-collecting, highlighting the importance of appropriately designed fieldwork procedures. These procedures include the following:

- ***Choosing the interviewees***. While this research focused on the evaluation process of Green IT/IS investments, almost all of the interviewees were selected from the management team including directors and supervisors at a strategic level from relevant departments (i.e. IT, environment, finance, business development, CSR, and HR). The reason for this is that they are a group of people who actually influence and involve within the evaluation process associated with Green IT/IS investments. Also, the interviewees have experienced and involved within the area of Green IT/IS. However, to diminish the effect of bias, and to facilitate the gathering of appropriate and reliable data, two operational members of staff from the IT and environment departments were also interviewed for new insights. The researcher triangulated the lines of enquiry using three methods: firstly, while not depending on data from one functional source, formal interviews were carried out in various functional areas within the organization; secondly, concerns surrounding Green IT/IS investments were discussed with employees at an operational level to see differences in perspectives; and thirdly, opinions were attained from employees on cultural characteristics of the organization. Furthermore, theoretical saturation for this research has reached, when the data is consistent in the same direction as well as there were no new findings, concepts or issues emerged in the data.

- ***Identifying suitable data-gathering research methods and establishing a line of inquiry***. An interview agenda (see Appendix B) was developed and used to collect rich primary data throughout the semi-structured interviews. The agenda supported the steering of the interview process. The interview process was recorded and transcribed. Apart from this, additional supporting evidence was sought from, policy documents, internal memos, archival documents, minutes from meetings and business case reports. These diverse methods of data collection and similar questions asked of different interviewees aided increase the triangulation of data and avoid bias in collecting data.

- ***Developing a timetable for data collection that takes into account contingencies*.** In case the interviewee cannot keep the appointment, thus predefined employees were identified as backup employees for interviewing. However, in reality, this proved difficult to operationalize.

- ***Developing an interview schedule in advance, with dates and times set to accommodate the interviewees' needs.*** Interviews were arranged a few week before to allow the researcher some level of flexibility if any unanticipated events which might result in the cancellation of an arranged interview meeting. All formal interviewees were informed that it would take approximately one hour and thirty minutes for the whole process.

- ***Addressing and ethical procedures.*** The interview protocol was based on the standard university process with respect on ethical approval of data collection methods. The research ethics form was approved by the University (see Appendix A) and this research was conducted in full accordance with the university's ethical procedures. Therefore, the researcher refers to the organization under investigation without using its name but by referring to it as "APTH".

From a case study research strategy viewpoint, a case study indicates a comprehensive and rigorous study of a subject (i.e. Green IT/IS). Conducting interviews involve the skill of differentiating between what is relevant and what interviewees add. Thus, thoroughness is fundamental. Perspectives and opinions must be established and then cautiously interpreted. Also, the interviewer should have the ability to enable interviewees to discuss controversial and confidential issues where necessary.

As per Yin (2014), it is also vital for the researcher to obtain approval from the subjects and the organization being studied and for them to agree explicitly to participate in the interviews, in which all information disclosed will be presented without indication as to the identity of the interviewees. Then, the interviewer may ask the interviewee to begin by stating general information, their function in the organization as this could help to make the interviewee feel comfortable and in the right mood for the interview. During the interview, there could be a chance of getting other documents and possibly of getting to know more about other interviewees. Therefore, the researcher should be attentive and moderately flexible, so that they can apply different types of interview methods (e.g. structured, semi-structured, and unstructured) if the need arises. Also, as aforesaid, data for this research was collected from multiple sources (i.e. interviews, participant observation, fieldwork, and official organizational documents). Again, it allowed for triangulation of data to increase the reliability and validity of qualitative research as greatly recommended by the researcher (Yin, 2014).

Finally, for research validity, it was crucial to give feedback by sending the transcriptions of the interviews and observations to the participants of the study to ensure the correctness of the raw data. Then, analyses were presented to the participants to retain their trust in the long run as feedback regarding the analysis of the outcomes also assists in confirming the study's validity (Runeson and Host, 2009).

4.6.3 Questions Addressed by the Research

At the midpoint of the protocol, a set of questions is developed illustrating the inquiry at a single case level. These questions are designed for the researcher, and not for the interviewees, and serve as a indication for the researcher, regarding the data collection. The main goal of these questions is to keep the interviewer's focus during the data collection process as well as the researcher had an chance to review key questions that should be addressed. Making a note of the expected sources of evidence alongside each question is significant, as proposed by Yin (2014). Additionally, cross-checking between the question types is advised by the researcher concerning the question types and the expected sources of evidence to aid in gathering data. For example, before the beginning of the interview process, the researcher can swiftly review the 'key questions' that should be taken into consideration. It is to be noticed that these questions from the structure of the inquiry and are not use as the set of questions that will be pointed at the interviewee. As a result, in this research four specific questions were established, to assist in retaining focus during the case inquiry. These questions are shown in (Table 4.3) below:

Question Number	Research Questions
1	What are the existing IT/IS evaluation techniques used by the case organization when justifying IT or Green IT/IS investments?
2	Identify what are the indirect costs and how these indirect human, organizational, and environmental costs factors are associated with Green IT/IS investments evaluation.
3	What are the external and internal organizational factors affecting Green IT/IS investments within an aviation context?
4	What are the management strategies and mechanisms used to reduce financial impacts associated with Green IT/IS indirect costs?

Table 4.3: Questions Addressed by the Empirical Research

4.6.4 Research Output Format

Throughout the development of the protocol, the format at which the output of the empirical inquiry should be clear and easy to understand. In this case, the research output was the result of the empirical data analysis in Chapter 5. The researcher addressed issues related to the large amounts of data probable to be created by arranging each individual question in the interview agenda with a proposed proposition. This approach then contributed to the output's quality, as it emphasized the construction of a useful interview agenda (see Appendix B). The researcher collected data in consistent with the research questions so as to avoid misinterpretation when classifying the large amount of data collected. A fundamental outline of the case study structure is shown in Figure 4.2 that assisted in data collection and increased the value of the research yield.

1.1 Background of the organization within the aviation industry
1.2 Overview of issues surrounding IS evaluation techniques, Green IT/IS adoption and implementation and indirect costs factors associated with the investment
1.3 External organizational factors affecting Green IT/IS adoption and implementation within the aviation industry
    1.3.1 Coercive pressure
    1.3.2 Normative pressure
    1.3.3 Mimetic pressure
1.4 Internal organizational factors affecting Green IT/IS adoption and implementation within the aviation industry
    1.4.1 Top management support/commitment
    1.4.2 Employee involvement
    1.4.3 Green organizational culture
    1.4.4 Resources development (Training/education)
1.5 IS evaluation: Indirect cost factors surrounding Green IT/IS investments evaluation within the aviation industry
    1.5.1 Indirect human cost
    1.5.2 Indirect organizational cost
    1.5.3 Indirect environmental cost
1.6 Cost management strategies, policies and mechanism for Green IT/IS investment within aviation industry

Figure 4.2: Case Study Structure for Analysis

Nevertheless, it is not necessary that researcher needs to follow all of the components to the presented protocol exactly. According to Yin (2014), it is significant to be relatively adaptable in the methodological approach employed because usually, case study plans can be changed due to an outcome of the initial data gathering.

4.7 Summary

In this chapter, a rationale is presented for the use of a proper research methodology. The chapter reviews the research methodology to be applied to this thesis, which offers to understand in the broadest possible terms as well as offering a well-developed framework for the research process. The epistemological stances and their appropriateness was primarily provided and discussed. Hence, the researcher has followed the use of an interpretive viewpoint employed in this thesis to meet its aim and objective and help in the development of a comprehensive model that will support the justification process of evaluating Green IT/IS investments focusing on indirect costs. Also, the researcher suggests that a qualitative research approach was seen to be more appropriate for this study. The reasons behind this includes that a) it allows a study to be in its natural setting, b) it allows for testing and building theory, c) it allows the researcher to explore concerns that aid understanding of the nature and complexity of the processes happening, and d) it provides a suitable way to research and learn from practice. Thus, the aim was to use the outcomes for model's refinement presented in Chapter 3. As aforesaid, indirect costs surrounding Green IT/IS investments evaluation are new, and there is still a dearth of this research, especially in the aviation industry.

As previously discussed, there is a range of options within the case study approach; however, a single case study approach was adopted. As noted, Green IT/IS research is still emerging in this industry that implies reasonably; it is not helpful that multiple case approaches could have been established that suited with the research goals and timeframe. Moreover, the conceptual model was already established, which allowed the explanation of the findings. This was crucial as the main goal was the model's refinement and building a comprehensive tool that would assist other organizations within the aviation industry in developing Green IT/IS investments plans.

In the case study, the key data collection tool was semi-structured interviews but complemented by retrieving to main internal documentation. Also, Chapter 5 presents the outcomes of this study, which allowed a degree of triangulation between multiple data sources and offered access to a considerable amount of information on the design and implementation of the adopted by APTH. Moreover, the research methodology has been adopted to test and enhance a cost management model for Green IT/IS investments evaluation previously presented. This design is interpretive and relies on a single in-depth case study in one aviation organization. Data collecting was extent over a period, and this enabled observation of both the design and implementation of the adopted approach in the case organization.

Hence, the empirical findings were compared to the model developed from the existing literature and used to refine that model accordingly. The protocol can be used as a substantial tool that serves as an operationalized action plan with guidelines for the empirical inquiry. Based on this protocol, the researcher will use case study viewpoints to allow others to relate their experiences to the outcome of this research. Therefore, the work will offer a deeper understanding of the phenomenon of Green IT/IS investments evaluation, particularly on indirect costs perspectives.

Chapter 5

Case Empirical Data Analysis and Discussion

In Chapter 4, the research methodology was elaborated and a justification for the chosen methods for conducting this research was presented. The objective of this chapter is to analyse the data collected while observing the phenomena in the organisational settings. The data collected is applied to the proposed cost management model detailed in Chapter 3 for Green IT/IS investments evaluation within the aviation industry. The empirical data analysed and presented in this chapter has been collected from an in-depth aviation organisation in Thailand. The data sheds light on human perception and organisational behaviour throughout the Green IT/IS investments, and demonstrates the evaluation processes on Green/Environmental-related project investment (particularly on cost issues). The interview structure for all questions was intended to verify that each of the factors constructed into the proposed model was explored through the fieldwork and observation. This method helps improve the degree of the findings of this study in some follow-up case studies into Green IT/IS evaluation area within the aviation industry. Thus, the outcomes from the case study have validated the proposed model in chapter 3. Finally, the empirical conclusions are presented at the end of the chapter.

5.1 Introduction

Airports around the world are universally supporting the call to go greener or risk inevitable climatic and financial consequences in both developed and developing countries. This research focuses on the developing countries such as Thailand. It is argued by Gunasekaran *et al.* (2014) that there should be more research focusing on Green growth or sustainable development in developing countries, as the number of studies in the research domain is still limited.

There is also concern that when fostering economic growth and sustainable development, attention should be paid to developing countries as well. This is because the majority of developing country governments lack solid knowledge on the matter and look at different components to sustain the environment, and Green growth is rarely addressed in mainstream economic, budget and fiscal policy (Love, 2012). Air traffic volumes in Thailand, which have seen continued growth, are expected to return to normal as the domestic political situation settles down. Further economic growth should also be considered as some of the government's large investment projects take hold. This allows the case organization to better serve the constantly growing air transport industry, which is a key driving force of the nation's overall economic growth, social and sustainable development. Thus, it is crucial to enhance the understanding of this research domain in developing countries such as Thailand.

In the previous chapter, the researcher justified and analysed the research methodology employed in this thesis. This chapter applies the research methodology to test the proposed conceptual model (Figure 3.3) for Green IT/IS investments evaluation within the aviation industry. In doing so, the research presents and analyse an in-depth empirical data collected from a single case organization that aided the researcher in justifying the research presented in this thesis in order to present the preliminary research findings obtained while observing phenomena in the organizational setting.

The data collected are used to test: (a) the proposed external and internal organizational factors (Figure 3.3), (b) the comprehensive lists of indirect costs associated with Green IT/IS investment (Figure 3.2), (c) the management strategies and mechanisms to reduce financial impacts from indirect costs (Table 5.11). Hence, this chapter offers an empirical analysis of an in-depth case study perspectives that describes human and organizational behavior and perceptions during Green IT/IS evaluation within the aviation industry.

5.2 Background to Case Organization (APTH)

As previously mentioned, due to confidentiality reasons, the case organization in this study is referred to as "APTH." The case study is a state-owned organization under the Ministry of Transport and with Ministry of Finance as a major shareholder. It is a public limited company listed on the Stock Exchange of Thailand, was established officially in 1979 and is one of the largest operators of the airport business in Thailand, the core tasks of which are airport management and development of the country's international airports. APTH is responsible for managing the airport infrastructure at its six international airports, all of which serve both domestic and international flights. The development of these infrastructures is a high priority to support air traffic volumes as they increase.

APTH won the Outstanding Sustainability Report Award 2015 and 2014 held by the Securities and Exchange Commission, Thai Listed Companies Association, CSR Club and Thaipat institution in Thailand respectively. Moreover, Green Airport, Green Community: The campaign is based on the "Happy community, happy airport" concept. The program focuses on environmental development in communities to reflect the company's responsibility towards the environment and society as well as create good relations with communities living near the airports, thus upholding APTH's strong image. Accordingly, APTH is the first Thai and first international airport operator from Southeast Asia to become a member of the Dow Jones Sustainability Indices (DJSI), which is an international sustainable index within the Transportation and Transportation Infrastructure (TRA) category. In addition, APTH participated in airport carbon accreditation, established by the Airports Council International Europe (ACI EUROPE) that encourage airports around the world to measure carbon emission and introduce an effective energy management system, so as to reduce the overall carbon emission towards the environment. This reflects APTH's intention and commitment to strive towards Green and environmental initiatives, which makes the organization a unique and outstanding case study for this research.

As of 30 September 2015, APTH employed a total number of 6,043 personnel and approximately 10,225 outsourced workers. It transports 3 million tons of freight a year and operates 76 flights per hour. The profit for year 2015 after income tax expense is approximately £400 million. ATPH plans to increase its capability of all airports to support flights' growth through runway and taxiway expansion in year 2020. Table 5.1 below illustrates the position of the chosen case organization comparing with other similar organizations within Thailand.

Air Transport Traffic in Thailand			
Year 2015		Aircraft/Movements (Total)	Passengers (Total)
Company	Number of Airport Owned		
APTH	**6 Airports**	**707,362**	**106,789,914**
Airports under Government	25 Airports	140,493	15,482,934
Private-owned Airport	3 Airports	24,260	205,189
		3,037	80,981
		1,468	57,026

Table 5.1: Air Transport Traffic in Thailand (DCA, 2015)

As highlighted by the air traffic statistic above (Table 5.1) APTH is very prominent and leads other organizations in this competitive business among other airport operators in Thailand. For instance, one of the six airports under APTH alone had a total of 310,870 aircraft movements and 52,384,217 total passengers in the year 2015. Despite the fact that APTH might not be one of the top 10 airports in the world according to the customer-nominated 2016 World Airport Award for overall customer satisfaction, it currently stands at 36 out of 100 having jumped over ten places since last year. However, according to the Airports Council International (ACI) in early 2016, the airport is in the top 20 busiest airports in the world in terms of total passengers. Therefore, it has shown that the organization is in a prominent position to be a strong case.

APTH aims to enhance the airports' capabilities in coping with demand and boost competition in Asian region as well as prepare for the integration of ASEAN Economic Community (AEC). APTH's aim is to be Asia's leading airport, and its mission is to operate airport business of a superior standard, be service-minded, and to provide advanced technology, value creation and responsibility for the society and community. APTH wants to achieve excellence in its operations by emphasizing the development of service quality, personnel capabilities and information technology systems that respond to the dynamic and sustainable aviation industry.

In addition, APTH also places great importance on Corporate Social Responsibility (CSR) and sustainable development in line with international standards and strives to accomplish Green Airports in Asia. This will serve as a guideline for sustainable development, enhancing the confidence and satisfaction of airport customers under the slogan "*Safety and Service are our priorities*".

The organization has developed strategies, which emphasize:

- Corporate governance
- Environmental, social and community excellence
- Security excellence
- Information and communication technology excellence
- Human resource development excellence

There are ten main strategic directorates in APTH, which are Information and Communications Technology, Airport and Aviation Standards, Legal and Corporate Secretary, Legal Group, Corporate Secretary Group, Corporate Strategy, Human Resources and Administration, Business Development and Marketing, Accounting and Finance, and Engineering and Construction. However, there are four relevant departments selected to participate in the interview processes for this study, and they are a group of related stakeholders revealed in the normative literature in Chapter 1.

- **The Information and Communications Technology (ICT) Group** consists of four IT departments: Information and Communications Technology Strategy Department, Information System Department, Computer and Network System

Department, and Communications and Electronics Department. All of them report to the Chief Information Officer (CIO). The key functions are to facilitate corporate IT and overall strategy and policy, and to provide comprehensive ICT amenities to support all business functions of APTH.

- **The Environmental Department** is under Engineering and Construction Group, and its main function is to aid the strategic direction to become a Green Airport by ensuring that all relevant departments adhere to the environmental preparation and protection. Corporate Social Responsibilities and the Corporate Governance Department are under Corporate Secretary Group, the main job of which is to ensure that APTH maintains its positive image and relationship with all stakeholders and practices good corporate governance as one of the role model organizations within aviation industry. All of them report to the Chief Operation Officer (COO).

- **The Human Resource Management Department** is under Human Resources and Administration, and its main function is to facilitate and develop human resources development (e.g. training, education and skills development) as well as ensuring that employee welfare, safety, security are all maintained. All of them report to the Chief Executive Officer (CEO).

- **The Budgeting Department and Financial Department** is under Accounting and Financial Group, and it reports to the Chief Financial Officer (CFO). Its main jobs are to handle APTH's financial and accounting matters, forecast budgets, and work together with the Business Development and Marketing Department and Supplies and Procurement Department to assist in future project investments.

5.3 Green Initiatives and Projects of APTH

All of the senior manager's team and operational staffs reported that Green IT/IS initiatives and practices have adopted and implemented within APTH in the past few years, from individual to organizational level. Those Green initiatives and practices under various departments' responsibilities are adopted and implemented to be in line with the strategic directions of APTH in order to become Green Airport. A number of Green IT/IS or environmental projects are presented in following (Table 5.2) that are being undertaken by APTH:

Green Initiatives/Practices and Projects	Responsible Department	Purposes
Green IT/IS data center upgrading	IT	• Have a new storage place of IT, computer server system, and storage system and network system of APTH that have appropriate spaces, energy efficiency use and monitor, and all tools and peripherals are environmentally friendly.
Green IT infrastructure consolidation	IT	• Replace hardware that becomes obsolete, different versions that run on different platforms, which is time-consuming and more effective towards the environment. • Emphasize IT/IS expansion on virtualization, which is more flexible while working with other IT/IS resources, especially during peak periods; it reduces space and energy usage.
Desktop to laptop projects	IT	• Replaces desktops with laptops starting at the operational level, as this level heavily uses desktops at present. • Switch off unused monitors.
LED and automated light bulbs	Engineering and IT	• Replace the existing light bulbs with LEDs, which consume less energy and are more energy efficient. • Automated light bulbs to reduce its usages.
Paperless projects	IT, Human Resources and Environment	• APTH use much paper in meetings, memos, newsletters and so on, as the old practices involve keeping hard copies as evidence. Some meetings have more than 100 pages of documents given to each management with at least two copies each, and there are many meetings going on each week. • Replace paper with tablets, e.g. iPads for a meeting; use recycled paper; print on both sides of the paper.
Trees planting within airports' terminal	CSR and Environment	• In keeping with the campaign for a Green Airport, start to utilize unused areas of the airports to plant trees.
Airport Carbon Accreditation program	Environment	• Some of APTH's airports have been certified as Airport Carbon Accreditation level 1 and 2 and also certified ISO 14064-1 and 14064-2, which mean that they have passed some environments' protection and development standards.
Water recycling and reuse	Engineering	• Recycle used water and reuse again for tree watering and toilet purposes.
Incentives programs for airlines that can reduce pollution and	Business Development	• Launch incentive program for airlines that can reduce pollution within airports.

charges		• Introduce charges or fees to the airlines that create more pollution than the standard level.
Stakeholders' collaboration	Every department	• Meetings and workshops for brainstorming and discussing mechanisms to reduce pollution.
Green knowledge development and training	Human Resources	• E-learning and KM • More skilled HR or outsourcing to transfer Green knowledge.
Environment and Green manual	Environment and CSR	• Manual/handbook about environment practices for stakeholders.
Green funds	Finance	• Green fund for local people who are affected by the pollution from airports.
Satisfaction and performance survey regarding environment movement	Corporate Strategy	• Let stakeholders evaluate the performance of APTH in relation to the environment and provide suggestions for future improvement.
Changing attitudes to be 'Green' campaign	CSR and Human Resource	• Stimulate Green attitude and awareness within organizations.

Table 5.2: Current Green Initiatives/Practices and Green Projects of APTH

Table 5.2 above shows that the current Green/Environmental initiatives and practices within APTH are performing and some are ongoing and to be done in the future. This is parallel with some of the examples given in the literature (Section 2.5, Table 2.6). APTH's current Green initiatives/practices and Green projects adhere to the next trend of IT management attempting to reduce environmental impact at individual and management level (Unhelkar, 2011). The lists of Green initiatives and practices of APTH above have reflected some of the potentials of Green IT/IS commitment to a great extent as reported in the literature (Watson *et al.*, 2008) that eventually take place as a solid system in protecting the environment in the future. Therefore, over the next few years and beyond, Green IT/IS and other environmental/Green initiatives and practices at APTH can penetrate across all organizational processes and methods if they put in the effort and continue to do what they are doing.

5.4 APTH's Organizational Culture

This section examines organizational culture and the role of Green IT/IS investments within APTH. Before going through the specific questions in the interviews' agenda, the researcher could discuss the overview of APTH's organizational culture with an Organization Culture and Knowledge Management Director (OCD), who has about 30 years of experiences with this organization in the role of Human Resources (HR) management. Having spent such a long time within APTH, the OCD could provide the bigger picture with various viewpoints of the existing organizational culture and the likelihood of transforming the existing organizational culture within the case organization into what we call a Green organizational culture.

- The interviews with the OCD provided an overview of the general interpretation of the case organization's culture below:

"Apparently, our organization has lots of structures with procedures as you can easily notice. For example, employees have to wear ฟ proper uniform and the sign attached represents how senior you are. Though, I believe we share the same values and practices. We respect and compromise with each other and are careful; and while we are open to new ideas, we need to follow guidelines. Sometimes, we have ideas, but we have to wait, report and get approval from the seniors or top management...."(OCD).

This statement from the OCD emphasizes the fact that the case organization is a formal and structured with lots of processes to adhere to before things can get done. Thus, it could delay the decision-making process for projects' investment. APTH values seniority at the workplace a lot, as was quite noticeable during the time that the interview at APTH. For example, when compared with private companies in Thailand nowadays, APTH is a traditional or government organization and values seniority. Nevertheless, APTH is also exposing towards new changes including a changing and opening up a new attitude (i.e. Green) for letting employees develop and embrace new things.

In the supporting APTH's documents, the CEO of APTH refers to organizational culture as follows:

"Considering rapid changes and development in the aviation industry plus more intense competition in service, standards, facilities, technologies and innovations, an organization has to have a strong corporate culture in order to maintain competitive advantages. This is important because unlike other factors, corporate culture cannot be copied but is unique to one organization, especially when the organizational culture is

commitment to excellence…"(CEO).

The above expression underlines that due to intense competition, if APTH were able to maintain a strong culture internally, they would together win over competitors as a solid organizational culture is very important to drive, to collaborate and to achieve outcomes quickly. The CEO values a collective organizational culture to a great extent. That reinforces what Hofstede (1997) stated about culture influencing people's behavior and beliefs and the fact that it is vital to understand culture as it strengthens groups of people in the long run.

According to Cameron and Quinn (2006), the four types of organizational culture comprise of '*clan*' (family-like, focusing on mentoring and doing things together), '*advocacy*' (dynamic and entrepreneurial, risk-taking), '*hierarchy*' (structured and controlled, focusing on efficiency and stability), and '*market*' (competition, achievement and getting the job done), and it is apparent from what the OCD elaborated on regarding APTH's organizational culture that APTH is likely to be dominated by one cultural type, '*hierarchy*'. The characteristics of this culture type are clearly as follows: APTH is considered to have an organized, formalized and multiple hierarchical structure as obviously noticed when the researcher observed aspects in the workplace such as gestures, actions and uniforms. The main reason was perhaps that APTH used to be administered by and belonged to Air Force prior to the alteration to the state-owned enterprise, which meant stricter rules and regulations. Moreover, APTH also emphasizes rule reinforcement, stability of standard operating procedures to follow and it has multiple levels of managers to whom employees report to before things get done. The managers of this type of organizational culture tend to be effective at organizing, controlling, monitoring, administering, coordinating, and maintaining efficiency, as advocated by Cameron and Quinn (2006).

However, the interviewer also observed that although it was quite clear that APTH is considered as a '*hierarchy*' organizational culture type, there is possible evidence that APTH tends to become more of a '*clan*' organizational culture type. The fact is that APTH tries to change by emphasizing more on employee participation, nurturing and mentoring through teamwork, people sharing ideas and knowledge, and mentoring subordinates to achieve positive changes, and this is supported by Cameron and Quinn

(2006) as being in line with the ‘clan’ organizational culture type. For example, ICTD reported that junior employees are encouraged to accept changes easily and be ready to try new ways of performing their job roles in order to improve the overall business’s functions for the sake of the organization, but they need someone who can lead/inspire them first, along with more empowerment and communication regarding their needs.

- When asked to elaborate on *Green organizational culture and the role of IT/IS within APTH,* the OCD and ICTD responded that:

“We are on our way to sustainable growth. I mean, to become environmentally friendly or a Green organizational culture is not easy, it takes time to transform, but what I believe in is our organization sharing the same understanding of existing culture, value and belief and for this initiative, we will be doing the same but we might need a set of outlines, procedures or training and I strongly believe that we will attain it sooner or later…” (OCD).

“Although, IT/IS is not our core business, it is the main supporting part that we need to be concerned and sustain them, otherwise our organization would not be able to operate in a sustainable way. Green IT/IS and all the things including activities, games, seminars and more that we have done for better environments are somehow eventually going to embed and shape our organizational culture…” (ICTD).

The statements from both individuals indicate that APTH is trying to achieve their goal of becoming a Green or sustainable organization. Both directors believed that transforming organizational culture to be green or sustainable can be conceivable by ways of encouragement and efforts from top management and the senior as well as proper guidelines, procedures, training and activities to create awareness and active behaviors stimulating this initiatives to stick and establish Green culture. These in line with Olson (2008) supported that in order to create a Green culture organization need to have an suitable tools and training in response with such changes. The directors state that even though it takes time and needs collaboration, in the end they believe that it would be embedded in everyone’s belief, perception and actions successfully, as both of them claimed that they have been doing many green activities to support sustainable growth within APTH.

- The interviewees were also asked to identify and express their views on *the importance of the role of Green IT/IS towards the APTH's growth and success.*

The interviewees asserted that Green IT/IS plays a significant role in shaping the case organization. The IT/IS Communication Supervisor (ITISS) specified that:

"With the instability of the climate and environment nowadays, many sectors are striving to reduce the impacts and negative consequences by introducing ways to save our environment. For the IT aspect at APTH, I certainly believe that we are on the right way, Green IT/IS initiatives and practices that we have started are going to satisfy our stakeholders, as obviously we commit to social responsibilities continuously and there are more Green IT/IS projects that APTH intend to undertake…"(ITISS).

The ITISS highlighted that Green IT/IS has placed a great deal of focus on the growth and success of organizations. Stakeholders are grateful for what APTH has done in responding to reduce carbon footprints within aviation industry and the world's emissions. This was not only a campaign or policy but also a huge investment made by APTH that show great efforts.

5.4.1 Motivation for Green IT/IS Adoption and Implementation

When the interviewees were asked about the organization's motivation to adopt and implement Green IT/IS initiatives and practices, they gave the reasons outlined in the following (Table 5.3):

Positions	Motivation for Green IT/IS adoption and implementation
Organization Culture and Knowledge Management Director (OCD)	• Moral obligation • Subconscious to help environment
Corporate Social Responsibility Director (CSRD)	• Social responsibility • Positive image
Strategic IT Planning and Budgeting Director (ICTD)	• Support the Green Airport campaign • Save the environment • Improve overall IT system performances
Business Development Director (BDD)	• Be competitive • Provide better, faster, and more reliable services in terms of IT performance • Improve business processes
Environment Management Director (END)	• Social responsibility • Moral obligation • Strategic direction with Green Airport
Planning and Budgeting Director (PBD)	• Global warming issues e.g. save environment • Competitive advantages
Financial Director (FD)	• Subconscious to help environment • Reduce pollution
Information Technology and System Director (ITD)	• Help environment • Competitors are doing it • Save costs in the long run
Systems and Network Supervisor (SITS)	• Save the world's environment • Better data management
Business Development Supervisor (BDS)	• The tendency of an industry to go Green • Enhance organization's image • Be an environmentally friendly organization
IT/IS Communication Supervisor (ITISS)	• Social responsibility • Improve IT/IS system support
Environment Officer (ENO)	• Social responsibility, as we are a part of the cause of the negative effects to our world's environment, so we need to give back
IT Staff (ITS)	• Trends of Green Airports • Social responsibility

Table 5.3: Motivation to Adopt and Implement Green IT/IS with the Aviation Industry

According to (Table 5.3), it can be understood that there were varying reasons for APTH to adopt and implement Green IT/IS various reasons to adopt and implement; however, the most prominent concerns about the motivation to adopt and implement Green IT/IS within APTH are: *the intention to save the environment, moral obligation/social responsibility,* and *being competitive*. Other motivations to adopt and implement Green IT/IS are included: positive image, trends of the industry, strategic direction, cost savings and improved IT/IS and business processes within the organization.

Hence, the Strategic IT planning and Budgeting Director (ICTD) reported on the following:

"There are lots of reasons to adopt and implement them but from an IT point of view, not only does they support the Green Airport campaign but the IT department is willing to do it as we want to save our environment. Also, as you know nowadays, IT trends, products of IT have a shorter lifespan; there are more technologies out there that are more environmentally friendly and care for the environment. I think it is the right time for us to change for the better…" (ICTD).

The statement clearly indicated that the ICTD felt that environment protection is something under their responsibility and that they must do it for a better environment. Also, they are intensely aware of technological changes and select superior technology for improvements in terms of systems' efficiency and more environmentally friendly products and services to improve overall IT system performance, as aviation depends heavily on IT and moving forward towards sustainable IT organizations. Obviously, it is a good move for the ICTD to look for greener and energy-efficiency IT systems to replace the existing one; however, what is more important is to be concerned and planned carefully the ways to get rid of the existing one.

As indicated by Molla (2009), Green IT adoption is different from other IT adoption due to the significance of moral and eco-sustainability concerns in the decision-making process. On the contrary, IT adoption is usually motivated by the possible financial benefits of exploiting a technology; however, Green IT practices might be motivated for the sake of the world's environment even if the economic benefits might not be noticeable in the short term (Molla, 2009). Conversely, the purpose of IT/IS investment is mainly to improve the efficiency of an organization's operation in order to reduce costs and improve profit levels (Gunasekaran *et al*., 2001). For instance, social responsibility and environmental concerns are among of the main motivational factors to adopt Green IT/IS according to Bansal and Roth (2000), Melville (2010) and Hasan *et al.* (2012). Generally, organizations that are aware of environmental issues tending to consider Green IT as a fundamental responsibility that need to adopt and implement (Schmidt *et al*., 2010). Thus, the findings suggested that there was a distinction in intentions to adopt between IT/IS and Green IT/IS investment, which also supported the literature by Corbett (2010).

5.4.2 The Need for Green IT/IS Adoption and Implementation

When asked about the need to implement Green IT/IS had predominantly risen within APTH, SITS reported that as the demand for air travel continues to increase gradually, as APTH is one of the leading airport operators, they need to be enthusiastic in improving innovative and energy-efficient technologies like many other airport operators have been doing. There are many leading airport operators particularly in all region of the world progressively integrating innovative technology and system into their daily operations to reduce the impacts to the environments.

Consistent with the movement for Green Airport being prevailed and the world's environment is uncertainties, APTH has followed global airport environmental best practices by focusing on four core Green IT/IS components including resources management (e.g. recycling/reuse), energy/power management (e.g. minimizing energy use or alternative energy use), pollution control/management (e.g. pollution management and environmental quality control) and community engagement. However, the evidence from APTH's documents has shown that some of the components, especially resource management and pollution control/management, have a large room for improvement. END also mentioned that there have been pressures from various stakeholders to reduce the negative impacts from aviation activities, and they requested for collaboration from all departments to contribute to Green initiatives and practices within APTH.

5.4.3 IS Evaluation Techniques and the Justification Process within APTH

The literature stresses the importance of IS evaluation for new projects' implementation (Remenyi *et al.*, 1995; Irani and Love, 2001; Brown, 2005; Song and Letch, 2012). Besides, IT/IS investments are considered to be a high-cost, high-risk, long-term return with uncertain benefits as human and organizational aspects are involved (Irani *et al.*, 2006; Ghoneim, 2007). Similarly, Green IT operations are to be costly and challenging processes for IT managers in determining and measuring the value the intangible aspects (e.g. benefits/costs) as claimed by (Olson, 2008; Webber and Wallace, 2009) as well as when it involves with environmental aspects (Okarfor et al., 2013). Hence, it is of significance to understand how APTH justifies their IT/IS and Green IT/IS investments.

When asked in what ways APTH evaluates Green IT/IS investments project before its implementation, most of the interviewees responded that:

The findings highlights that APTH has followed the traditional evaluation techniques to evaluate IT/IS and Green IT/IS projects prior to the implementation, such as CBA, ROI and other techniques that have been proposed by the ICTD and BDD/BDS, such as Project Feasibility, NPV, IRR and Total Ownership Cost (TCO), respectively. They did evaluate the project prior to its implementation specifically for almost all of the large-scale project investments. The opinions of all the interviewees who advocated that it is a requirement process that need to be done before adopting and implementing a new project within an organization. Nevertheless, it is interesting to know that the a formal IS evaluation is conducted not because they understand the significance of investments evaluation but because they are required to do so as part of procedures within organizations, otherwise the projects are not going to get approved as mentioned by BDD and ITD. This implies that the interviewees do not truly realize the value and importance of the evaluation process. They just had to do it to get projects' approval, which somehow supports what Primose (1991) emphasized that some IT managers do not consider IS justification process as an important process to decide investment's value, but a difficulty that needs to be overcome due to some political reasons within organizations.

Generally, stakeholders who are involved in the project evaluation process for Green IT/IS projects are: IT, Finance, and Business Development departments. Apparently, there are many departments involved because it is a large organization and these projects are considered a huge investment of approximately >£5 million; however, some normal IT projects would involve only IT and Finance or IT and Business Development, as it depends on the nature and size of projects too. Certain projects' evaluation varies according to the type of project as well as which department that project belonged to.

Thus, the decision-making process of APTH is time-consuming as it usually involves many departments that need to reach an agreement. There are also too many units to report to, and sometimes the decision-making process needs to be performed more than twice. The final decision for Green IT/IS investments, to approve or reject lies in the hands of the CIO and CFO.

- Nonetheless, when we discussed it further, the BDD informed us of other techniques or aspects and whether or not they are considered other things within the IS evaluation process:

"Our department is working together with various departments to evaluate projects for our organization; we usually use the project feasibility study to evaluate large investment projects such as Green IT/IS data center and IT consolidation projects. Other factors we do not consider in the evaluation process, even if there might be. The fact is that it is time-consuming, we don't know what elements we should include to make more sense of doing or not doing, and our top management would just want to see financial numbers, but to my knowledge, in the past, there were one or two large projects that we needed to get approval for from the Ministry (government); we need to include some non-financial factors but it was a long time ago…" (BDD).

The statement above indicates that although APTH use traditional techniques to evaluate projects; however, it implies that APTH might be aware that there should be some other factors to include within the evaluation process. However, they think that including other factors is time-consuming as well as there is a lack of knowledge and guideline to follow, and top management do not actually care so much and support if the projects are not proposed to the government. This also resonates with the literature (Jenkin *et al.*, 2011; Esfahani *et al.*, 2015) concerning the inability of mangers to use other evaluation methods. Nevertheless, the only reason that in the past they included such factors is to make the organization look better in the eyes of government. In other words, they want to show that APTH has carefully done a great deal of project analysis and is therefore worth of investment.

Another interesting to note that ICTD highlighted that some projects are approved as it is being seen as a successful project according to the financial numbers of NPV, IRR and project feasibilities; however, those projects are discontinued or hold during the implementation process. This implies that perhaps, such projects are incurred higher costs and experienced budget overrun, therefore, the projects are eventually failed. In describing this, the use of traditional appraisal techniques alone is considered inadequate for the appraisal of IT/IS or Green IT/IS investment that repeatedly has many qualitative and non-financial project implications specifically for environmental or social aspects (Irani and Love, 2002; 2008; Stockdale and Standing, 2006; Piotrowicz and Cuthbertson, 2009; Yusof *et al*., 2008b; Lagsten and Goldkuhl, 2012; Song and Letch, 2012; Bernorider *et al*., 2013; Okarfor *et al.*, 2013; Bai and Sarkis, 2013).

Thus, it would be more comprehensive and effective evaluation if APTH has had a comprehensive tool or guideline that contains various intangible and non-financial factors associated with Green IT/IS investments to ensure a better understanding so that APTH could exploit, reduce financial impacts as well as increase the possibility of projects' success and make better use of them for future Green IT/IS or environmental projects investment.

5.4.4 The Importance of Costs Evaluation within APTH

Before moving on to the costs section, the interviewees were asked to discuss whether they thought that costs evaluation (Irani and Love, 2001) was a significance criterion to be considered when implementing Green IT/IS investment projects within an organization. Below are the responses:

"Costs of any investment within an organization are significant for us; honestly, at the end of the year it accounts for our bonus too! Every investment needs to have detail of costs involved, whether it is worth doing now or later, and it needs proper guidelines and careful consideration…" (FD).

"Yes, it is and it needs to take into account all the costs before implementation because IT/IS is a huge investment, and don't even mention Green or IT for environment, it can double the price of any additional costs too, I assume…" (ICTD).

"I think costs evaluation is important, and sometimes I believe that it is more important than other things. For example, some projects were stopped even though there were lots of reasons to do it, but we could not handle much higher costs, it is not worth investment or we have to do some other projects that bring somehow the same kind of benefits at least cost. We cannot just do this and do that; some projects have to wait to do it for the next few years, as if we try to do them now, it might hurt our financial position…" (PBD).

The above statements highlighted by the FD, ICTD and PBD show that costs are a significant factor to be considered for every project, and Green IT/IS project costs in particular could hurt financial stability. More importantly, it implies that there were some projects experiencing costs overrun, thus the projects failed to implement. It is claimed by the interviewees that costs should be properly taken into account, justified and managed for all costs' components, before implementation, as it marks a project's failure. Those statements support what was stated by numerous researchers (Molla *et al*., 2009; Sarkar and Young, 2009; Chen *et al*., 2011; Bai and Sarkis, 2013) which is that the costs of Green IT solutions are one of the most crucial impediments that prevent organizations from adopting them. The findings resonated with most of APTHs management team. Therefore, it is vital for the decision makers at APTH to be able to identify the lists of associated indirect costs and to later manage and control them to reduce the possible financial impacts, particularly strengthening of the organizations' financial position.

5.5 Identification of Costs' Components Related with Green IT/IS Initiatives and Practices

The literature referred to in Chapter 2 indicated that the indirect costs (human, organizational and environmental) are significant for influencing the decision-making process surrounding Green IT/IS investment. As Irani and Love (2008) point out, the indirect costs surrounding IT investments are more substantial than the direct costs as the nature of these costs are intangible that makes their identification and control problematic. Drawing on the literature in Chapter 2, the indirect cost factors are classified into three main categories to be considered when investigating Green IT/IS investments evaluation, including indirect environmental costs (EPA, 1995; Okafor *et al*., 2013; Bai and Sakris, 2013), indirect human costs and indirect organizational costs (Irani and Love, 2001; Mohamed and Irani, 2002; Ghoneim *et al*., 2003). As Okarfor *et al.* (2013) state, the accounting systems do not fully reveal environmental cost management as the environmental costs are grouped under the general overhead accounts. For instance, such environmental costs are incorrectly allocated to cost centers, and are simply overlooked as their intangible, hidden or indirect in natures (EPA, 1995). As a result, most of them cannot incorporate into traditional investment appraisal techniques as it is being problematic for mangers (Lefley and Sarkis, 1997; Bai and Sarkis, 2013). This implies the similarity of indirect human, organizational, and environmental costs.

Consequently, it is crucial that organizations are able to identify the indirect costs mentioned for organizations pertaining to Green initiatives and practices for more effectively and efficiently justifying the outcomes of the overall projects during the decision-making process. Since, it is not possible to know which IT/IS costs would occur in the context of Green IT/IS.

- Some of the interviewees have expressed their awareness and perception regarding the term "indirect costs" as follows:

"I think, I know some of the indirect costs but not sure the exact meanings. It may be costs that have not been obviously shown in the financial statement I guess, sounds complicated…" (END).

"There might be the costs that happened from the use of resources in producing goods or providing services that we cannot calculate the value of that costs directly, but it can hurt our financial…" (PBD).

"It should be something quite similar as overhead I suppose…" (FD).

"I am not sure about it or maybe heard of it but in a different term, but I believed that some other departments who are responsible for evaluating big projects may know…" (ITISS).

The interviewees articulated the varying level of understanding and the awareness of indirect cost terms. Some of the interviewees partially understood but some did not.

Thus, the interviewer explained in more detail, and the interviewee understood more about the indirect costs and reacted that those associated indirect costs happen when new projects' investments are adopted and implemented and it somehow makes things more complicated and costly, with factors such as process changes, training, time, integration and more. To some extent, they just did not know those terms are being called indirect costs or considered as costs to them as well as to what extent it effects the overall budget. Thus, the findings confirmed the literature (Irani and Love, 2001; Ghoneim *et al.,* 2003; Daly and Butler, 2009; Nidumolu *et al*., 2009; Dedrick, 2010; Butler *et al*., 2011; Bai and Sakris, 2013) that those associated indirect costs should be included in the evaluation process for Green IT/IS projects, as they affect the project's profitability and success due to the hidden/indirect costs from implementation and continuation of environmental practices.

As a result, it is clear that interviewees have a clear understanding of the indirect costs and interestingly they want to know how significance such costs could impact the overall investment of IT/IS and Green IT/IS projects. The interviewees accepted the fact that the nature of the indirect costs is quite challenging and hard to identify and manage, so they try to overlook them, and honestly they do not even know how to cope with those indirect costs and do not want to raise the issues. Those statements were supported by Ghoneim (2007) regarding the problem of understanding, identifying, managing and controlling the indirect costs, but they cannot be avoided or ignored. Noticeably, it reinforced the literature by suggesting that it is essential for APTH to understand and particularly to be able to identify, manage and control the associated indirect costs as well as include them within the Green IT/IS evaluation process, as Green IT/IS projects involve intangible and non-financial components, such as environmental, organizational and social aspects, that are hard to quantify, but without taking them into consideration, it would cause cost/budget overrun or projects' failure (Murugesan, 2008; Butler *et al*., 2011; Okarfor *et al.,* 2013; Bai and Sarkis, 2013). In (Table 5.4) that follows, each of the interviewees was asked to confirm whether or not the presented list of indirect costs relating to Green IT/IS investments were incurred within APTH.

Green IT/IS Indirect Costs Factors	ICTD	OCD	CSRD	BDD	END	PBD	FD	ITD	ITISS	SITS	BDS	ENO	ITS
Indirect Environmental Costs													
• Upfront Environmental Costs	√	√	√	√	√	√	√	√	√	√	√	√	√
• Back-end Costs	√	√	√	√	√	√	√	√	√	√	√	√	√
• Regulatory Costs	√	√	√	√	√	√	√	√	√	√	√	√	√
• Contingent (Compensation) Costs	√	X	√	X	√	X	X	X	X	X	√	√	√
• Image and Relationship Costs	√	√	√	√	√	√	√	√	√	√	√	√	√
Indirect Organizational Costs													
• Organization Re-Structuring	√	√	√	√	√	√	√	√	√	√	√	√	√
• Productivity Loss	√	√	X	√	X	√	√	√	√	√	√	X	X
• Business Process Re-engineering	√	√	√	X	√	√	√	√	√	√	√	X	√
• Hardware Disposal	√	√	√	√	√	√	√	√	√	√	√	√	√
• Strain on Resources	√	√	√	√	√	√	√	√	√	√	√	√	√
• *Downtime*	√	X	X	√	√	√	√	√	√	√	√	X	√
• *Integration*	√	√	√	√	√	√	√	√	√	√	√	X	√
Indirect Human Costs													
• Management (Time/Resources/Effort and Dedication)	√	√	√	√	√	√	√	√	√	√	√	√	√
• Employees (Time/Training/Learning/Motivation)	√	√	√	√	√	√	√	√	√	√	√	√	√
• Belief, Feeling and Perception	√	√	√	√	√	X	√	√	√	√	√	√	√
• Redefining Roles	√	√	X	√	√	√	√	X	√	√	√	X	√
• Staffs Turnover	X	X	X	X	X	X	X	X	X	X	X	X	X
• *Conflict of Interest*	√	√	√	√	√	√	√	√	√	√	√	√	√
• *Problems Induced by Users*	√	√	√	√	√	√	√	√	√	√	√	√	√
• *Insufficiencies of Communication*	√	√	√	√	√	√	√	√	√	√	√	√	√

Table 5.4: Identification of the Associated Indirect Costs for Green IT/IS Investments within the Aviation Industry

The findings from the empirical data as shown in (Table 5.4) indicated that almost all of the presented indirect costs identified from the literature were incurred during the Green IT/IS investment projects within APTH, of which there are five more indirect costs raised by interviewees comprising:

- *Downtime*
- *Integration*
- *Conflict of interest*
- *Problems induced by users*
- *Insufficiency of communication*

Those associated indirect costs are incurred in the Green IT/IS investments evaluation within APTH, except for '*staffs turnover'*, which all of the interviewees agreed does not happen at all for Green IT/IS investments within APTH. Also, '*contingent costs'* is less likely to occur within Green IT/IS investments. Interestingly, a research synthesis of the findings present a clear gap of the importance and occurrence of each of the indirect cost surrounding Green IT/IS investments within APTH and will be discussed more in chapter 6.

5.5.1.1 Indirect Environmental Costs

- One of the important indirect environmental costs of Green IT/IS investments within APTH that the interviewees highlighted was ***image and relationship cost.***

The Corporate Social Responsibility Director (CSRD) and Business Development Supervisor (BDS) asserted that this was an extremely significant factor and stated:

"Maintaining a positive image is something that we have been doing for a long time, especially in this competitive industry. We have to focus on doing good things for our society as a whole; we have to pay back to them even if it costs us in some way, as we accepted that we are one of the organizations creating negative effects on the environment. Being good from the inside to the outside of our organization, which results in a better relationship with all stakeholders…" (CSRD).

"*We are a large company; everyone is watching and following us, especially within this industry. We are dealing with many customers' groups and partners both locally and internationally, it is a must to maintain good relationships and images among them…I can say that they are expecting us to do something or investing for the environment…"* (BDS).

The statements indicate that the case organization is focused heavily on the organization's positive image and maintains relationships with their relevant stakeholders. The aviation industry is one of the most competitive industries, particularly as it is an industry that creates negative effects towards the environment, thus organizations try to minimize the effects of pollution e.g. air, noise and waste on society. The statements also reflect that investing in Green IT/IS would increase their image and relationship in a positive way, although it is also considered as indirect costs to them. If APTH chooses not to adopt and implement Green IT/IS, surely it will negatively impact upon their image and affect the relationship with their stakeholders. Thus, the opinion of the CSRD and BDS confirmed the literature mentioned in numerous studies (Lynes and Dredge, 2006; 2008; Collet, 2008; Daly and Butler, 2009; Kivits *et al*., 2010; Chen, 2012) that within this industry, organizational image and relationship are crucial for Green IT/IS investments.

- ***Upfront environmental cost*** is considered a significant factor when considering Green IT/IS investments within APTH and the interviewees commented that:

"Before choosing any companies or suppliers for any projects' investments related to environmental or Green practices, I have to spend more time assessing suppliers' qualifications such as whether or not they comply with and conduct environmentally friendly products/processes, but it is essential as we have to pay the costs twice …" (END).

The Environmental Management Director (END) claimed that in order to implement any Green or environment projects, in comparison with normal projects, they need more time and efforts to select the shortlisted suppliers who truly practice and focus on environmental products, services, and processes. For example, the environmental, procurement and IT team need to review all documents, survey the sites or companies, products and services, and process all environment certification. Those processes are time-consuming and do not guarantee that all shortlisted suppliers will pass and qualify for the Green process, but it is necessary as any environmental-related projects have high investment costs. The comment from the END supports the literature in that the UK public sector organizations use strict procurement standards on IT suppliers, including Energy Star and Electronic Product Environmental Assessment Tool (EPEAT), down to the materials of metals used in the motherboards and parts they produce (Butler, 2011b).

Within the aviation industry, many airlines nowadays would choose to deal with any suppliers or partners who have an environmental policy or environment management systems (Lynes and Dredge, 2006). The Strategic IT Planning and Budgeting Directors (ICTD) from the APTH concurred with this opinion and also added that this process can be pricey, time-consuming and considered as indirect costs to APTH, but it is still a very significant procedure that cannot be ignored.

- The viewpoint of Environmental and CSR Directors (END, CSRD) responded towards the ***contingent costs*** by reporting that:

"By implementing Green IT/IS within an organization, I think, this cost is less expected to happen within the confines of the IT/IS aspect as it is something more to do with the operation of airports in general or environments…" (SITS).

That statement made by the System and Network Supervisor (SITS) suggests that Green IT/IS investment so far has nothing to do with the contingent costs. It was also considered as a less significant factor when considering to invest in Green or environmental initiatives and practices projects. They claimed that this cost is typical to them especially within APTH and they used the term '*Compensation costs'*. They explained that this cost had been incurred by APTH, in the form of noise contamination, legal expenses and personal injury through fines and penalties usually resulting from the aircraft's operations. APTH needs to pay compensation to the local people who are living near the airports. Then, APTH has to work more than it is supposed to in terms of observing, solving and reporting to relevant government's department and setting up a noise control station to detect the level of noise around the airport's surrounding areas, in which the villagers/local people nearby can check the level of the noise online. This takes APTH time and effort.

However, IT teams consider this cost to be less significant as this cost is less expected and anticipated during IT/IS operations; however, it may be considered important for other environments' projects within APTH regarding the activities of the airport's operations itself.

- When asked about ***back-end costs***, the senior management team highlights this cost was considered significant to the projects that relate to Green IT/IS and IT/IS implementation especially for the IT disposal and e-waste.

Although, the nature of this cost is more into the confines of environmental related projects as reported by the interviewees. For example, the environment teams have been aware of this and have observed this cost from time to time; therefore, it supports the literature given by Okarfor *et al.* (2013) on the occurrence of this cost in environmental related projects. Nevertheless, the IT directors highlight that obviously, the aviation operations as a whole affect the surrounding areas in terms of issues such as biodiversity, waste production and aircraft maintenance, and later, when something has happened, how it impacts upon the working routine of APTH to find ways to solve the issues. Thus, this cost is also involved with Green IT/IS investments to some extent, in case APTH disposes of IT/IS infrastructures and peripherals in an unpleasant way, it then eventually ends up in a landfill and becomes e-waste. As a result, it causes a negative consequence to the overall environment.

- Apart from this, ***regulatory costs*** are also considered significant when deciding to invest in Green IT/IS. Remarkably, it has been reported by the PBD that:

"Any costs that are involved with regulations, basically, it is rules and regulations from the government or relevant agencies that you have to conform to, you have to keep an eye on them…otherwise, you would end up paying for the things that you have overlooked or unnecessary stuffs…"(PBD).

The statement above made by the Planning and Budgeting Director (PBD) suggests that when it comes to the costs relating to specific rules and regulations for Green IT/IS, APTH would be more enthusiastic in its preparations in order to avoid fines or any penalties that may have been incurred. This is supported by the literature (Murugesan, 2008; 2011), which states that organizations may incur additional fines or penalties if they disregard the implications towards environmental practices and implementation such as e-waste or dispose of old inventory. It seems that APTH is very active regarding anything related to government policy, rules and regulations, especially the facial expressions made by directors.

Hence, Green IT/IS investments within the aviation industry have in fact been involved directly with image and relationship costs, whereby upfront environmental and regulatory are also considered fundamental, as the organization needs to be aware of suppliers who are required to meet Green standards as well as the rules and regulations relating to environmental initiatives and practices. Also, back-end cost is reasonably involved with the issues of e-waste surrounding IT/IS and Green IT/IS investments. On the other hand, contingency cost is far more accompanied by environmental projects rather than IT/IS aspects.

5.5.1.2 Indirect Organizational Costs

- With regards to indirect organizational costs, ***hardware disposal*** was considered to be significant factor when evaluating Green IT/IS. The ITISS asserted that this was a significant factor for Green IT/IS investments and reported that:

"As you know, apparently, IT may not be our core business; frankly, we do not have general rules to dispose of them. Some of the hardware had been donated or sold to the market at a very low price; the rest was left in the large room without being touched again until they were broken and became waste…" (ITISS).

Surprisingly, most of the interviewees articulated that hardware disposal was significant; but in fact, the above statement made by the ITISS together with the field work observed by interviewer gave another insight of the practices within IT department regarding hardware disposal at APTH and what other interviewees had reported. As a matter of fact, APTH obviously overlooked how to manage and dispose of bulk hardware properly and all the hardware that had been broken and unwanted were clearly considered as costs to them but they still cannot manage these well enough. The ITISS implied from the statement above that it was apparent that APTH had ignored this issue, and this was deemed to be a huge cost to them. According to the literature, hardware disposal is also one of the most significant issues and it is supposed to be taken care of; in fact, most organizations would follow proper policies and practices before disposing of them (Piotrowicz and Cuthbertson, 2009; Murugesan, 2011).

Also, the SITS asserted that the IT department now focuses more on aviation projects' development and IT infrastructure improvement and are completely unaware of these other overwhelming problems. Thus, they do disregard the concrete and fundamental ways of being more environmentally friendly, especially in dealing with disposal or e-waste prior to implement Green IT/IS as they proposed to us in the first instance, which implies that APTH has incurred a high level of these costs. For example, the problem of e-waste seems to be overwhelming for them and many other organizations, which frequently resonated in the literature as well (Harmon and Auseklis, 2009; Nanath and Pillai, 2012a; Tushi *et al*., 2014).

- All of the interviewees also felt that ***organization re-structuring*** was another highly significant consideration when evaluating Green IT/IS, as it could potentially have an impact on the investment, which supports the literature.

Adopting and implementing Green IT/IS might affect partial or entire departments requiring them to re-structure. The stimulating statement from the point of view of Organizational Culture and Knowledge Management Director (OCD) was as follows:

"Of course, the organization re-structuring is very significant for APTH, and everyone would agree with that when introducing new IT/IS. For example, positions/roles need to be adjusted… However, as mentioned earlier, we are a state-owned enterprise organization, with lots of political intervention, and our country is usually faced with the instability of political conditions, even now, which means we have lots of organizational re-structuring within APTH, at least once a year or twice a year or more we did re-structuring. So, personally, I think, all of us feel familiar with this, but undeniably some employees within certain divisions or departments would not like it so much…" (OCD).

The statement above was made by the OCD who has long been with APTH and offers another interesting viewpoint not directly revealed by the literature, which is that although organizations accept the fact that restructuring is quite common, this cost would occur in a predictable manner due to the instability of politics of the country, thus APTH kept restructuring once or twice a year with a new management team. Clearly, the interviewee reported that it has slowed down business operations and processes in general and there is obviously a lack of consistency in terms of policy and goals within APTH.

Also, what usually comes with restructuring is resistance to change towards the new systems that are introduced. APTH is not expected much resistance in implementing Green IT/IS; however, there may be a very small group of old employees who might not understand properly in the first place and might be a slow adopter. To avoid such problems when adopting or implementing a new system, all parties should accept and understand the role and objectives of Green Computing/IT, be acquainted with ongoing developments, and embrace them as appropriate (Murugesan, 2011). The organization should incur this cost, as not everyone has agreed or is willing to accept the changes (e.g. new roles and positions), even though it might prove that it is a better way.

- Accordingly, ***business process re-engineering*** was another significant factor for Green IT/IS investments evaluation.

The ICTD stated that that once APTH chose to go Green, there would be more efforts , more procedures and structure associated with Green/environmental requirements or verification along the processes. Some divisions would be expanded such as the strategic Green ICT division at APTH that is responsible for Green IT/IS related projects in the future. However, all of these consume time and efforts of employees, particularly IT teams, when doing their routine jobs. This was resonated with the literature (Ghoneim, 2007) surrounding IT/IS investments.

- Another important cost that APTH incurs when evaluating Green IT/IS is ***productivity loss.***

The Information Technology and System Director (ITD) accepted the fact that implementing Green IT/IS would involve employees needing to go for training. Learning and more coaching are to be prepared as he reported:

"Most employees attended the training programs during working hours, as they refused to train after working hours as they have to do their own things and we are not actually paying for training after working hours…" (ITD).

The statement above supports the literature that the time spent when employees go through the learning curve for Green IT/IS considering as indirect organizational costs that could not be avoided, which leads to a decline in the throughput (Ghoneim, 2007). In response to what the ITD mentioned, obviously, APTH's overall productivity and efficiency would decline, as those employees are not undertaking their routine jobs as they are supposed to. In contrast, the operational staffs such as the Environmental and IT Officers (ENO, ITS) expressed their feelings differently, as they think that this cost is not actually incurred for the reason that the training and learning of new systems are compulsory as it is considered as a part of learning process as well as an important part of doing their jobs, so it must be done for the sake of APTH itself. It is probable that APTH would confront the loss of productivity from inexperienced and unskilled staff, if the staffs do not receive a proper training program.

- Furthermore, any new projects' investment would come with the issue of staff availability; ***strain on resources*** was one of the significant factors when evaluating Green IT/IS as mentioned by the ITISS.

"We cannot deny that implementing Green IT/IS would require too many personnel to utilize and make the best out of it. They have to do too many things at the same time…" (ITISS)

The statement above illustrates that APTH has to plan for the availability of resources and knowledgeable staffs when implementing a new system especially for training new equipment and system. For example, broadening their awareness and knowledge of Green IT/IS and environmental issues. It is certainly going to consume time and take more efforts and commitment from all the people involved to assist, and perhaps APTH might need to recruit more staffs. Thus, implementing Green IT/IS comes with this cost.

- Another indirect organizational cost mentioned by interviewees was ***downtime,*** as it considered significant for Green IT/IS investments evaluation.

The interviewees expressed that this cost could happen at any time. Sometimes it happened without expectation and could be costly to the organization, especially in reduced productivity, as if everything is going to halt for a while, the IT department has to work on ways to reduce as much of the consequences from this as possible. The aviation industry is heavily run by IT/IS, thus downtime of the system is crucial for all stakeholder groups and must be prepared.

- Another ongoing problem for the IT department was ***integration***, and it has a significant effect on Green IT/IS investments evaluation.

The fact is that the existing IT/IS hardware, infrastructures and peripherals of APTH have various versions and models. Some of them are difficult to incorporate together suitably, and some cannot be integrated into the existing systems. APTH bought many different types of hardware from the past and some are old and some are new to use together any longer. Moreover, in terms of Green IT/IS integration at APTH, not only should IT/IS hardware and software be integrated together but also new systems should be integrated and people should take some time to get used to it.

Consequently, it can be seen that within the boundaries of indirect organizational costs, hardware disposal should be taken into account quickly, if organizations actually want to adopt and implement Green IT/IS successfully, they need to be considered and managed. Organization re-structuring and business process re-engineering were considered also as a significant indirect cost that also comes with resistance and need to be prepared, as well as APTH needs to incorporate new Green IT/IS with the existing ways properly e.g. new functions, processes and reporting respectively. There are various viewpoints on productivity loss with Green IT/IS investments, thus APTH should communicate and pursue the consensus between top and operational level. Downtime and integration are emerging indirect costs proposed by senior managers that also affect Green IT/IS investments within APTH.

5.5.1.3 Indirect Human Costs

- One of the key indirect human costs of Green IT/IS investments evaluation within the aviation industry that the interviewees highlighted was ***management (time/resources/efforts and dedication).***

The ICTD asserted that this was an extremely significant factor and stated:

"Implementing Green IT/IS would cause us to plan and check many existing and new processes, and we have to look at all aspects such as departments, divisions, people, and strategies that affected and are going to be affected by this new system. Frankly, many things need to be done, and it is overwhelming, but finally, we are going to make it through…" (ICTD)

The statement above highlights the fact that Green IT/IS adoption and implementation at APTH would create more duties and responsibilities for senior management to undertake, as they need to spend time planning, checking, revising, and allocating resources through this investment. As mentioned in the literature, management would have to deal with the complexity of the decision-making and the efforts to adopt an environmental plan and practices (Longhurst *et al.*, 1996). For instance, employees at APTH tend to be affected by the new system's implementation in both positive and negative ways, as it is management's job to make everything run as smoothly as possible at the end. However, this cost would definitely occur and become an immense part of this Green IT/IS project's implementation, as management need to carefully plan and prepare in advance.

- Another highly significant indirect cost for Green IT/IS investments evaluation was ***employees (time/training/learning/motivation).***

Unquestionably, implementing Green IT/IS can cause discomfort to employees at APTH. This is an inevitable indirect cost that could not be ignored and needs to be managed carefully. The ITD reported that employees at APTH were willing to spend additional time on training, learning and especially trying to understand the new systems. However, some employees may not feel motivated to learn, particularly the senior employees who are not familiar with technology and skills relating to IT/IS, even if employees implicitly knew that Green IT/IS is the decent thing to do for the organization and society as a whole. Conversely, there were some comments by IT operational staff like this:

"I agree that our organization is doing something for the environment, but to be honest, I feel like lots of IT projects now are overwhelming, and I feel so exhausted and unmotivated to be trained and to learn; I even feel that our boss should do something to increase our motivation…" (ITS).

The statement above implies that although the IT staff may agree to train and learn the new systems, top management should, however, be aware of this fact, which is considered fundamental to a project's success in the long run. This echoed what (Dedrick, 2010) on the idea that encouragement, motivation and empowerment of employees assist in the adoption of Green IT/IS. Unmotivated employees would result in decreasing overall productivity anyhow. Having some additional incentives and rewards for employees might increase the level of employee satisfaction at work as mentioned by the management literature, which states that incentives such as rewards and recognition programs could assist in reinforcing an organization's values, promote outstanding performance and provide continuous learning (Milne, 2007; Olson, 2008).

Thus, it can be seen that there were two dissimilar views from the senior manager and operational staff about how each of them perceive Green IT/IS implementation differently. The senior IT management think that employees were willing to spend the additional time on training and learning and ready to learn, as Green IT/IS investment is a new project assisting social responsibility, but on the other hand, employees felt unmotivated and exhausted due to the workload from many existing projects being implemented and somehow, management might need to consider about incentives and rewards to at least increase the level of their motivations.

- Correspondingly, ***beliefs, feelings and perceptions*** is another significant factor for Green IT/IS investments evaluation as shown by the OCD's response:

"By trying to implement Green IT/IS within our organization, as a non-IT perspective, I think, belief, feeling and perception towards Green or environmental issues receive attention from the people here, more or less. Also, I believe that in the early stages, there may be some reluctance and diverse beliefs, feelings and perceptions regarding this issue. Moreover, I assume that if it was a just IT/IS investment, it is less likely to do with beliefs and feelings of people but it is a Green IT/IS investment; understandably, it has involved moral goods and responsibility as it might take time to change, and that is why I think this cost factor is significant…" (OCD).

The OCD implied that people have different beliefs, feelings and perceptions at first when they encounter new things, in this case Green IT/IS initiatives and practices. He distinguishes that there are some differences in beliefs, feelings and perceptions for both IT/IS and Green IT/IS investment, as the latter involves social and environmental responsibility. Also, he stated that it is essential to create awareness, beliefs and introduce a new perception on Green or Environmental in order to broaden employees' perspectives and make this solid. It confirms what the literature states, which is that organizations would incur this cost when they adopt new systems, if only the employees do not take their beliefs and perceptions into considerations (Ghoneim, 2007). Somehow, it might affect the adoption and implementation process through indifference and disbelief, and as a result the Green IT/IS might not be as successful as it is supposed to be.

- One of the factors considered important for Green IT/IS investments evaluation was ***redefining roles,*** as it would have an effect on the indirect human costs.

APTH has a new strategic Green ICT division which involves promotion and new job functions for some managers. These might create a greater workload and more processes and reporting for Green or environment projects within the IT department. Some of the existing positions would have a lesser workload but some would have to obligate more, which could lead to a dispute within a department or organization such as it could result in the occurrence of another cost, which is a *conflict of interest.* This cost could happen because some senior managers who might previously have more authority and power for some types of projects might lose the power because of the introduction of a new division.

- Another indirect human cost that is considered as an important for Green IT/IS investments evaluation that originated from the interviewees was ***conflict of interest.***

Some top management might choose to do different projects prior to another one or some senior managers may have opposing thoughts or opinions, which delay the project. For example, some positions may deal with a third party where some suppliers' representatives of Green IT/IS; they might receive expensive gifts before the suppliers' selection process takes place to implicitly bribe the officers. Also, some projects may have some benefits for a certain group of people involving a third party or self-related issues that could lead to this cost.

- Moreover, the ITD proposed another indirect human cost that is considered a significant, which is ***problems induced by users*** associated with Green IT/IS investments evaluation.

Along with the new system's implementation, less acquainted users would accidentally delete critical files from the system, crash it or change the settings, accept unknown files by unintentionally installing a virus or cause other IT-related problems. Some of the new features that users have not been trained on yet or have less expertise in but are curious to try on their own would lead to this indirect cost which consumes time and leads to extra job duties for IT teams.

- One of the significant indirect human costs that were raised by many interviewees was ***insufficiency of communication***. One of the operational staff members claimed that:

"I didn't know when or how to access the knowledge base for Green knowledge…frankly, I didn't even know that it had existed for a while already…" (ENO).

The statement made by IT staff highlights the fact that there is a lack of communication from top to bottom level; managers might acknowledge that they have already sent the messages but it has never reached the bottom line. It can happened that communication might get lost somewhere or it is not conveyed properly, or those who are supposed to communicate it to all operational staff fail to do so. Failure to communicate effectively frequently results in conflict, which can slowdown the business operation as can easily noticed from (Table 5.7) that the operational staffs are considered this cost as highly significant to them. This can induce the successful of Green IT/IS investments within APTH, effective and efficient communication is fundamental. This resonates with the view of Fuchs (2008) who mentions that communication can foster environmental sustainability and increase awareness concerning environmental problems. However, internal communication should flow both from the top and bottom level so that all employees have the most up-to-date information regarding matters of environmental impact and cooperatively react to changes (Daily and Huang, 2001).

- Surprisingly, ***staffs turnover*** has not happened for Green IT/IS investments evaluation within APTH. All of the interviewees agreed that this cost is not incurred at all for Green IT/IS investments as discussed below:

"Although implementing Green IT/IS investment would cost double, it is a good thing to do for the sake of our organization and environment. Obviously, no one would leave the company if their bonus decreased by such investment…" (ICTD).

The statements by the ICTD emphasized that APTH acknowledge that Green IT/IS investment cost is very high compared to other projects but they still choose to do it and it is agreed by all stakeholders. Actually, staff turnover is considered one of the indirect costs suggested by Ghoneim (2007) as a result of IT/IS investment. However, when applied to Green IT/IS investment within the aviation industry, this indirect cost was not incurred at all, according to all interviewees. The reason behind this would be that Green IT/IS is a project involving social responsibility and doing something ethical for environment. Correspondingly, they all know it would cost more, but ultimately they understand the reasons behind it, the introduction of Green IT/IS would not also affect any reduction in staff within APTH. In addition, based on the interviewer's observation, staffs at APTH are in a good working conditions, good salary and interpersonal relationships. As a result, this cost is not incurred for Green IT/IS investments within APTH, contradicting traditional IT/IS investment literature.

Therefore, within the indirect human costs category, management(time/resources/efforts and dedication) and employees(time/training/learning/motivation) are considered the most significant indirect cost factors affecting Green IT/IS investments. Moreover, beliefs, feelings and perceptions need to go along together with Green IT/IS implementation for the project's success. Surprisingly, staff turnover reported, as it did not occur at all. However, the introduction of Green IT/IS would lead to redefined roles within APTH and resulting in conflict of interest, which is the indirect costs initiated by interviewees as well as problems induced by users and insufficiency of communication that need to be aware of for implementing Green IT/IS. Those indirect costs mentioned play a critical role towards Green IT/IS investments within APTH.

The above demonstration explains the significance level of each of the indirect costs associated with Green IT/IS investments, some of which are resonated or differed with the literature and some add on to the new dimensions of knowledge within this research phenomenon.

5.6 The Significance of External Pressures Associated with Green IT/IS

There are various reasons to drive changes within APTH to behave and act in certain ways. This research applies components within the institutional theory (INT) as a theoretical grounding for understanding various external pressures – namely coercive, normative and mimetic (DiMaggio and Powell, 1983; Scott, 2001) – as it can be used to comprehend how organizations tackle Green issues because of external pressures (Jennings and Zandbergen, 1995). INT provides a useful theoretical lens to examine organizational responses to environmental issues, in particular how significant institutional forces are beyond market forces, and whether this has substantially influenced organizations to respond (Scott, 2001). Within the boundaries of the Green IT/IS domain, scholars exploit institutional theory within their research (Chen *et al.*, 2008; Daly and Butler, 2009; Sarkar and Young, 2009; Chen *et al.*, 2011; Butler, 2011a; Lei and Ngai, 2012). It also demonstrates solid evidences for understanding in what way organizations may embrace Green or sustainability issues though this theoretical lens.

As the literature in Chapter 2 and 3 indicates, predefined external pressures within the aviation industry influence organizations to adopt and implement Green IT/IS.

- As mentioned, ***coercive pressure*** was mainly regarded as a significant factor by APTH in terms of influencing Green IT/IS investments within the aviation industry, and this was resonated with the literature fact, as reported by the ITD as followed:

"I believe that laws, rules, and regulations are significant in pushing and forcing any company to go Green as they must be conformed, which help the environment by means such as reducing pollution (water, noise, and air), waste management, and green schemes. In our country, I can say right now we have no specific regulations and laws that govern these issues or force us to adopt or implement Green IT/IS within aviation industry. However, our organizations are followed and conformed mainly international rules and regulations to avoid any possible sanctions or fines that may be bound to us…" (ITD)

The statement above demonstrates a similar view from the literature (Walala and Mutinda, 2013) that laws, rules and regulations could push Green IT/IS investments within organizations. Presently, there are no strict laws within the aviation industry in Thailand, which force organizations to adopt and implement Green IT/IS in order to protect and sustain the environment in general. Implicitly, APTH has chosen to obey the general rules and regulations in line with the international groups and agencies within the aviation industry, as they must conform to the international rules and regulations so as to survive and avoid impositions in the future. Thus, it confirms what is stated in the literature (Lynes and Dredge, 2006) that in certain airports of some countries, particularly in Scandinavia that laws and regulations are very strict and they can be a powerful force for those who ignore and reject to conform environmental protection through the use of charges, fees and taxes.

- Nevertheless, ***normative pressure*** was regarded as a highly significant factor for Green IT/IS investments within the aviation industry, which is supported in the literature. The CSRD reported:

"Frankly, to operate any business favorably in the competitive industry, you must follow the industry's norm and standard! The aviation industry around the world is considered to be one of the industries that is aware and takes serious actions regarding environmental prevention and reducing pollution in many ways and many

countries. Our company is among those accepting, believing, following and working out ways to be in accordance with our world's standards…" (CSRD).

The statement made by CSRD agreed with the literature that the normative pressure was considered a highly significant factor (Lynes and Dredge, 2006) and APTH is willing to follow the norm of its industry standards, as they want to be accepted and be a sustainable competitive advantage in this market and its group. The aviation industry consists of many public and private associations such as the Federal Aviation Administration (FAA), IATA and ICAO. Those groups are very active in preserving and reducing the pollution to the environment. There are representatives from different groups such as airlines and airports around the world to discuss and work out this problem and keep watching on members of the groups. For example, APTH has complied with ICAO by participating many environmental programs and accreditations (i.e. ISO 14000, Green Globe 21, Carbon accreditation program and sister airport agreement) that can be appraised by those associations, collaborating with other airports for knowledge sharing and submitting a report of environmental monitoring results to the Office of National Resources and Environmental Policy and Planning every six months in order to them to acknowledge of APTH environment's responsibilities. This resonates with literature fact regarding the importance of normative pressure (Lei and Ngai, 2012, Ijab *et al.*, 2012, Lynes and Dredge, 2006).

Moreover, the ICTD added that the IT department was delighted when Green IT/IS projects were approved by top management for implementation, as it was a huge investment and the IT team could not wait to see the successful outcomes for organization, particularly in saving the environment in general as well as accepting among the aviation groups and associations.

- Another factor that also was regarded as significant for Green IT/IS investments by APTH's interviewees was ***mimetic pressure***, as highlighted by the ITD:

"We want to adopt and implement Green IT/IS as our competitors did! They are ahead of us in doing Green things within the airports, especially the leading airports nearby us…" (ITD)

The statement highlighted that another reason APTH wanted to adopt and implement Green IT/IS was that of what market leaders and competitors surrounding them have been doing intensely. For example, leading airports in Asia (e.g. Singapore, Hong Kong, Korea) have prolonged doing Green initiatives and practices in various aspects quite a while ago, and they have never stopped. For example, Changi Airport in Singapore achieved a great number of positive words of mouth from all the Green initiatives and practices as well as receiving environmental recognition awards showing that they are vigorous (Lynes and Dredge, 2006; 2008). Thus, this supports the literature about how mimetic are crucial to influencing APTH to do the same activities as the market leaders.

Accordingly, there are also other factors that APTH's interviewees mentioned that are influencing Green IT/IS adoption and implementation within the aviation industry.

- The ICTD and the ITISS highlighted that ***trends of technology development*** is also significant regarding assisting in a decision-making process to invest in Green IT/IS within APTH.

"Whenever you have a chance to see what the developed world has been doing, visiting their sites, I mean, development of new technologies are out there to assist in reducing pollution, use energy efficiency, something to help the environment indirectly…you would pause and look at yourself and your company and think that it is time you must step forwards too…" (ICTD).

The statement highlighted that the trends of technology development around the world is considered a significant factor for Green IT/IS investments within APTH. It can be seen that this factor was introduced by the ICTD and the ITISS perhaps because the ICTD has full responsibility for Green IT/IS development projects. Some of the IT management team (ITD and ITISS) have been sent to attend many workshops and seminars abroad where they can see lots of examples of innovative and energy efficiency of new technology that is beneficial for the environment and to make a better world. IT teams emphasize particularly how the developed world is adopting Green technologies and changing behaviors to help save the environment. The trends of technology development could stimulate APTH to some extent in starting to be aware and shared their knowledge surrounding environmental preservation in various ways, so this would implicitly benefit the organization as it would result in the emergence of more Green IT/IS and environmental projects that contribute to the environment.

- Another significant factor for Green IT/IS investments emphasized by the Business Development Director (BDD) is ***government policy***.

Apparently, this factor has been raised by the BDD as this department work on many projects with government agencies as part of their job roles and responsibilities, so they understand how vibrant government policy is in that it could affect the new development of projects within APTH. It can be easily noticed that the BDD, PBD, FD, and BDS considered this factor as highly significant because the nature of their work is such that those departments are involved closely with government agencies and ministries. Below is the statement reported by BDD regarding government policy shown that:

"As our company is a state-owned company, this means any huge investment we want to do, is involved with government policy or your company must carry out any projects in accordance with the government policy. Some projects had been stopped even if they were to be completed due to the government policy changing or new government regime stepping in as our country has an unstable political situation. Also, whenever, there was a change in government, the whole board of directors (BOD) or top management of APTH tends to change too. Thus, it could affect the progression of projects as well as an investment as a whole…" (BDD).

The statement implicitly implied that government policy is a significant factor and a matter of concern for Green IT/IS investments if there were some changes within government and the political regime. This could affect the organization in that some good projects may be put on hold or stopped and lots of capital would be lost. Also, top management, who were responsible for the development of certain projects at that time, such as Green IT/IS, might be replaced by others with different opinions on the existing projects, which would affect the investment in general. APTH is aware of and keeps updated about government policy in order to reduce the impact of this uncontrollable factor. Therefore, government policy is one of the important external factor that needs to be taken into consideration when making a decision to invest in any large projects (i.e. Green IT/IS) for the aviation industry in Thailand.

The empirical findings in (Table 5.7) highlight that among external pressures influencing Green IT/IS investments within the aviation industry, normative pressure is considered one of the most influential factors among others. APTH follows the norm of the industry group and that of those associated with aviation industry in order to survive in the long run. Government policy and trends of technology development were raised by interviewees as they are affecting Green IT/IS investments within APTH.

5.7 External Pressures Affecting Internal Organizational Factors Related to Green IT/IS investments

Three predefined external pressures derived from Chapter 3, namely coercive, normative, and mimetic pressures (DiMaggio and Powell, 1983; Scott, 2001), are considered as significant factors, together with two emerging factors proposed by interviewees, which are government policy and trends of technology development, and which affect APTH in Green IT/IS investments within the aviation industry. The mapping (Table 5.8) illustrates how each of the external pressures influences the internal organizational factors to act and respond accordingly in altering the ways they adopt and implement Green IT/IS.

External Pressures / Internal Organizational Factors	**Coercive Pressure (e.g. Law and Regulations)**	**Normative Pressure (e.g. Norm, Group/ Association)**	**Mimetic Pressure (e.g. Market Leader/ Competitor)**	***Government policy***	***Trends of Technology development***
Top management support/ commitment	√	√	√	√	
Employee involvement		√			
Green organizational culture		√			
Resource development (Training/ Education)		√	√		
• *Positive image*		√			√
• *Leadership skills*			√		

Table 5.8: External Pressures Influencing Internal Organizational Factors to Adopt and Implement Green IT/IS within the Aviation Industry

According to (Table 5.8) above, the empirical data behind the mapping results is identified by almost all of the interviewees within APTH (Appendix C).

- The interviewees responded that ***coercive pressure*** such as laws and regulations was an influence in terms of pushing or affecting the way in which top management to support and commit to go for Green initiatives and practices so as to comply with international rules and regulations.

As reported by the interviewees that within the aviation industry in Thailand, there are no specific laws and regulations placing organizations to adopt or implement Green IT/IS; however, they might be simply the standardized environmental rules and regulations within aviation industry that need to be conformed such as noise and emission control. Accordingly, the operation of APTH is currently reacting and obeying to international aviation standards; thus, the organization has conformed to all the laws, rules, and regulations in order to survive in this industry.

Therefore, it implies that top management at APTH are agreed to change their attitudes and behavior to adopt and implement Green IT/IS, if there are such forces both inside and outside its country in order to avoid impositions or being excluded from tax exemption or incentives for implementing Green IT/IS in the future. One of the interviewee's reaction was that even if there are no strict laws to force them to take action at this moment, they would eventually be obligated to do so in the future. Therefore, there is no time in postponing till that day came. The findings confirmed what Gholami *et al*. (2013) mention in that coercive pressure could affect the decisions of top management to adopt and implement Green IT/IS so that they conform to laws and regulations in order to avoid sanctions being imposed.

- Another factor that was considered as having a crucial role in influencing Green IT/IS investments within the aviation industry was ***normative pressure***, in affecting and changing almost all of the key internal organizational factors react and respond to industry standards.

As highlighted by the interviewees that the industry group or norms or associations pertinent to an organization's situation may not only influence management decisions or perceptions to be in accordance with the group norm but also affect the organizational culture in changing their ways, belief and behaviors to become Greener or care for the environment. For instance, airport carbon accreditation was established by ACI EUROPE, which encourages airports to measure carbon emission and introduce an effective energy management system in order to reduce carbon emission. The initiative is a way to express the airport's responsibility towards the impact on the environment and society that may be caused by airport operations as there is raising global awareness of global warming. APTH was first introduced to the program by fully supported from top management and was highly successful as it was recognized by ACI for the first and second level of "Mapping" practice in year 2015, meaning the emission has been reduced. Participation in the ACI program would yield many benefits, and effective emission and energy consumption reduction has a direct effect on both cost reduction and a positive corporate image related to environmental and social responsibility, which are crucial aspects of good corporate governance practice. This is the way in which APTH responded to the industry norm.

Moreover, there is an airport agreement cooperation named Sister Airport Agreement (SAA), whereby the organization could reinforce its rapport with other airport operators by exchanging know-how and knowledge, e.g. training programs, learning, and sharing/exchanging information and best practice sharing in all aspects. For instance, when employees such as a key person or senior employees are involved with the programs and are sent abroad, they usually acquire new innovative ideas and knowledge of how the developed world is doing something for the global environment willingly and sincerely. The knowledge and learning that they derive from others they could then share and help in developing and shaping the attitude of people to be Greener and enhance positive images and all stakeholders are pleased, so the need for environmental protection would be well accepted at all levels of APTH as an industry norm. The aforementioned confirmed the views in the literature (Lynes and Dredge, 2006; Smith and Grosbois, 2011; Chen, 2012) that normative pressures influence almost all of the major internal organizational factors, which is supported by the statement highlighted below:

"…because we have corresponded with the international standards in terms of Green initiatives, practices and programs, that bring along other benefits such as positive image, brand recognition and more customers!…" (ITD).

The statement implied that normative pressures affected APTH to act and follow with industry standards; however, it also paid back something beyond they expected that more customers, increase in brand recognition and positive image. This could imply that it may result in higher profitability of APTH afterwards. Thus, it confirmed the literature fact that the industry norm has influenced APTH internally very much in terms of top management support, employees' involvement, Green organizational culture, resource development, and positive image.

- ***Mimetic pressure*** would also influence top management support, the development of resources and leadership skills towards Green IT/IS within the aviation industry.

Neighboring countries are strongly implementing Green initiatives and practices, e.g. Changi Airport, one of the top airports in the world, has promoted the Green Airport by setting up gardens with trees, flowers, and efficient energy use within all terminals, and it has received environmental recognition awards and more. Passengers feel positive about the airport; they can even change their transit flights to spend more time there rather than in Thailand. The END expressed her thoughts regarding this issue:

"The Green garden or wall of green of our next-door airport has now become enormous, and there is a positive atmosphere, compare to us…we are far behind them; we could lose the transit passengers over that delightful Green ambient…" (END).

The above statement highlighted that the END feels that APTH might have to take some serious action and get support from top management if they want to gain sustainable competitive advantages and take a real step towards Green initiatives and practices in the aviation industry in Asia. The statement implied that the END's attitude and perception towards Green issues were such that she was determined to do something with APTH, which supported the literature (Chen, 2012) that those competitors or industry leaders could influence others (i.e. APTH) to make changes and follow the same practices.

Correspondingly, mimetic pressure could also influence resources development (training/education) at APTH so as to achieve sustainable competitive advantage in adopting and implementing Green initiatives and practices. As reported by BDD that it is fundamental for employees are required to be trained and educated about the importance of practicing environmental protection and Green knowledge in all aspects, in order to be competitive. One of them reports that:

"Some of the leading airports, especially our competitors, are greatly developing their Green path and knowledge mainly sustainable competitive advantages as part of their becoming world-class airports such as setting up its own academies with famous universities or schools within their countries. Those ideas can be followed for improving employees' knowledge based on forms of meetings, seminars and workshops…" (BDD).

Thus, APTH is moving forward in developing its own human resources to get further perspectives by hiring professors, consultants, or gurus with knowledge in all areas, in particular, environmental protection, in the long run, to prepare for these Green initiatives and practices. Thus, in the statement made by the BDD, new knowledge emerged that mimetic pressure could also influence resources development as well.

Moreover, mimetic pressure could also influence leadership skills at APTH to move towards Green IT/IS investments. As reported by CSRD, when other leading airports in Asia especially Singapore, Hong Kong and Korea have moved forward on to adopt and implement something new, a true leader see the best practices of other the leaders or competitors, he/she will act and drive changes quickly by leading, guiding, inspiring and delegating the employees the efficient way to strive towards the changes together within APTH. She believed that leadership influence in achieving sustainable competitive advantage especially for implementing Green IT/IS and environmental initiatives.

Following the statement made by one of APTH's operational staff that:

"…what we need is somebody who will lead, guide, and dedicatedly motivate us and can be trusted and will show us by their actions in steering the organization towards the new perspective of Green, being competitive in the aviation industry, just like other leading airports in the world…" (BSS).

This implies that employees want to achieve competitive advantages on environmental and Green initiatives and APTH might in need of a true leader. Moreover, what is more important for APTH is not only top management support but a leader who can inspire them to achieve the goal in the long run, which agrees with what Capoccitti *et al.* (2010)

and Lynes and Dredges (2006) say about how leaders are crucial in driving change. Therefore, the above statements highlighted by the BSS.

- Another factor that has been brought up by the interviewees is ***government policy***, which was considered as a significant factor for top management when moving towards Green IT/IS investment projects within the aviation industry.

Government policy in Thailand plays a large part in huge investment within the aviation industry, particularly for airport operators in Thailand. As Thailand's politics are unstable, the government has changed from time to time, and this has affected APTH's policy in investing in the development of new projects. Thus, it is important for top management at APTH to be aware and supported all of this, so that they are careful in selecting and revising any large projects that they are considering adopting and implementing to ensure that they are in accordance with government policy. For example, if the government changes and a new political group comes in, if that group does not support investing in Green or environment initiatives and practices, APTH projects have to be put on hold or even stopped. Thus, this has opened up a new aspect as to how government policy affects top management's decision and the ways top management support and act for the development of such projects.

- Regarding to the ***trends of technology development***, it has been mentioned by the ICTD and ITISS that the IT department's managers have been following the IT industry's trends and advancement of technology development, and particularly technology for the environment, for example, from well-known companies such as Gartner or Cisco.

APTH follows and looks out for the development and advancement of new IT/IS that reduces the effects on the environment, from small to large-scale investment projects, with a view to replacing the existing IT/IS. This awareness supports the assertion in the literature that technological advancement is playing a crucial role in the level of carbon emitted from hardware as technology advancement implies that emissions are likely to reduce (Fenando and Okuda, 2009). In the case of APTH, they are in a period of preparing to change the light bulbs for LED ones and automated for a healthier environment, the projects that replace desktops by laptops; paperless projects, air flows management within airport terminals or even Green solar farms in the near future as this visibly creates fewer negative effects towards the environment. This has delighted stakeholders and the public, thus increasing the positive image of APTH as a whole. Therefore, it has added new knowledge about how the trends of technology development are promoting a positive image for the organization when they make changes to a better environment in general.

Nevertheless, some interviewees decided to opt out from this question. For example, the PBD did so because he believed that this question was not that relevant to Green IT/IS evaluation. Operational staffs including the ITS and ENO also declined to answer as they felt uncertain as to what to say because the questions were quite complicated for them. Obviously, Green IT/IS evaluation process regarding this investment is also mainly involved in the financial department, whereby the PBD would report and assist the CFO, who makes a final decision about it. Thus, it can be concluded that the PBD is supposed to be involved in the whole evolutionary process, but he chose to opt out. Hence, it showed that he was not concerned about other factors that would somehow weaken the understanding of a more effective evaluation process of APTH, and therefore, which might affect the prediction regarding budgeting.

5.8 Internal Organizational Factors Influencing Green IT/IS Investments

Equally important, the internal organizational factors identified from the normative literature include "*IS evaluation*" (Irani *et al.*, 2000; Love and Irani, 2001; Love *et al.*, 2004; Irani *et al.*, 2006; Stockdale and Standing, 2006; Yusof *et al.*, 2008b) and "*Green IT/IS adoption/initiatives/practices*" (Molla, 2008; Sayeed and Gill, 2008; Sarkar and Young, 2009; Watson *et al.*, 2010b; Butler, 2011b; Jenkin *et al.*, 2011; Nedbal *et al.*, 2011; Lei and Ngai, 2013b). Likewise, in the context of the aviation industry, there is a lack of a theoretical model for Green IT/IS adoption/evaluation. Also, for this context and, in particular, the factors identified and which apply in the aviation context are associated with "*Green/Sustainable/CSR within the aviation industry*" (Amaeshi and Crane, 2006; Lynes and Dredge, 2006; Lynes and Andrachuk, 2008; Capoccitti *et al.*, 2010; Kivits *et al.*, 2010; Smith and Grosbois, 2011; Kemp and Vinke, 2012; Chen, 2012; Walada and Muinda, 2013) to be used in this case. Thus, some of the key factors associated with internal organizational factors are taken into consideration as shown in the normative literature.

Despite the importance of other internal organizational factors, some have already been prioritized and chosen, based on their significance and repetition from the comprehensive taxonomy classification (Chapter 2, Table 2.7), which are considered to be meaningful, especially within the aviation industry. Besides, it depends on how well such particular internal organizational factors can assist in managing the indirect costs implications for Green IT/IS investments within the aviation industry. For instance, the internal organizational factors influenced by certain factors will help to manage and control the associated indirect costs during the decision-making process of evaluating Green IT/IS investments more effectively and efficiency. Correspondingly, the model as presented in Figure 3.3 provides a comprehensive list of indirect cost factors specifically for Green IT/IS investments evaluation within the aviation industry that will affect its implementation.

The findings from the empirical data as depicted in the (Table 2.7) highlight that the key internal organizational factors such as employee involvement, top management support, Green organizational culture, and resources development (training/education). In addition, there are some of other sub-factors embedded within the main factors and new factors introduced by interviewees, had assisted to manage and control the effect of Green IT/IS indirect costs within the aviation industry.

5.8.1 Employee Involvement

According to (Table 5.9), the ICTD, END, BDD, FD, ITD, ITISS, and ITS highlight that ***employee involvement*** is a highly significant factor in terms of influencing Green IT/IS investments within the aviation industry. This confirmed what Jenkin *et al*. (2011) say about how employee involvement is considered a crucial factor, and senior management at APTH are determined to encourage more involvement within this organization, as shown by the following statement:

"At the moment, I think, employees are more involved than in the past as we create more communication channels for them to share ideas and comments. Organizations are trying to encourage employee involvement by planning more on activities relates to environmental or Green initiatives…" (ITISS).

The statement above highlighted interviewees' perceptions regarding employee involvement in Green IT/IS initiatives and practices within APTH: that there is more employee involvement than before as they wanted to encourage Green and environmental initiatives and practices through many channels. Also, the BDS, ITS, SITS, FD, and ENO suggested that there should be more events and activities such as Green exhibitions, competitions, games to teach and test employees about Green ideas, and newsletters sent to raise employees' awareness and encourage them to discover more about the subject. At the first stage, APTH has organized a way for employees to share their thoughts through communication channels including social networking, e.g. Facebook, group chat, box of ideas, and the intranet, where employees can express anything, including their existing and new ideas, opinions, or anything relates to safety, well-being, or welfare. In doing so, APTH would eventually get more quality feedback, less conflict as well as develop greater effectiveness in retaining employees and boosting better performance. This finding concurs with (Dedrick, 2010; Jenkin *et al.*, 2011)'s viewpoint regarding the importance of employee involvement surround Green IT/IS investments.

On the contrary, an IT operational staff who had been working at APTH for about 15 years expressed openly that sometimes he came up with good ideas regarding new projects – what to propose in that would be of more benefit to the organization as a whole – but they were not involved in the decision-making process. Truthfully, they do not want to communicate through social media for the reasons that they are dealing with IT operations daily and know the real problems, and should be involved to some extent.

Nevertheless, the ICTD reported that it is quite hard to let everyone or operational staff is involved in the decision-making process concerning new investment projects because it already had too many senior managers involved and consumed more time for projects to start. He claimed that the operational staffs do not know the whole evaluation process well enough, including how problematic it is to complete. However, the ICTD revealed that for future projects they will try to include some IT people who will be involved hands-on regarding new IT/IS investment. It is understandable that employees feel more involved and committed when their opinions are being heard, and a broader range of ideas and viewpoints might be shared that would otherwise go unnoticed. This is supported the viewpoint of (Jenkin *et al.*, 2011; Smith and Grosbois, 2011) that involving employee into the adoption and implementation can resolved Green or CSR issues.

Hence, it can be seen that there was some disagreement between what the ITISS was discussing with the interviewer, what the IT operational staff expressed regarding his inner feelings about employee involvement, and some comments made by the ICTD about how complex evaluation procedures were and that he thought that operational staff would not understand them, which would result in more time being wasted. The point here could be that APTH might need a key person to communicate the whole process to different levels of positions to enhance a better understanding of it. In other words, APTH might need a champion for Green IT; Bose and Luo (2011) refer to a member of staff at the managerial level who would deliver resources and support throughout the development of Green IT investments. Again, the following statements are some views that were expressed by the END regarding employee involvement within an organization:

"I'm trying hard to think and plan events, activities that encourage employee involvement in Green-related projects. I still think that there is a lack of employee participation even if people think there is…it is better if you can share ideas and collaborate together as a team. So, the project will be successful quickly, and it will be a robust one…" (END).

It can be seen that the END supported IT operational staff and understood the importance of employee involvement and would prefer to include them, even if it is going to consume a bit more time, for a more robust decision-making process. When collaboration is involved, things are more easily understood and problem simply solved, and it takes less time in the end as all parties agree upon relevant matters. As a result, the finding corresponds with what the literature (Smith and Grosbois, 2011) highlighted about the importance of employee involvement in influencing Green IT/IS investments within aviation industry, and the management should be prepared to make changes for the better regarding this issue.

5.8.2 Top Management Support/Commitment

Not surprisingly, interviewees considered ***top management support/commitment*** is highly significant in driving Green IT/IS initiatives and practices within APTH. As referred to by Bose and Luo (2011), the implementation of Green IT initiatives and practices requires support from the organization's top management so that they lead with authority and provide resources for innovation (Bose and Luo, 2011). Also, top management support are considered as a powerful tool to aid the evaluation of sustainably of airport operators (Carlini, 2013). The ITD elaborated on top management support for Green IT/IS investment within APTH as follows:

"Our new ideas or projects that are benefits to our company have been pretty much supported by top management. However, as we have many projects from many departments, we have to prioritize them consistent with the benefit and costs that each of them can generate first. We need top management to understand and work together as some projects incur high costs, such as Green and environment-related projects, but it is necessary to be implemented first, we must do first...." (ITD).

Interviewees including the BDD, FD, and BDS highlighted that there was management support for new ideas and activities, especially for helping, collaborating Green IT/IS projects and preventing environmental damage, as they are attempting to campaign to be a Green Airport. Top management has been supporting many Green initiatives and practices, such as trying to use more innovative technology for the airports' operational activities; growing more trees; energy-saving projects, e.g. changing to more efficient light bulbs; transforming data center infrastructure; training on Green IT/IS; and many more so that they become part of Green IT/IS projects at APTH. From what the ITD concurred, top management gave thoughtful attention to Green IT/IS projects as they are considered as environment-related projects; however, he highlighted that some high-cost projects could put on hold and carried out later due to the complexity of the projects and the possibilities of that particular projects to be successful. Thus, it implies that top management support and chooses to undertake environmental or Green IT/IS projects first as they think it would benefit all stakeholders of APTH; however, costs are also crucial factors to be considered to carry on.

On the other hand, the CSRD has given a somewhat varied opinion in terms of top management support for Green IT/IS or environment-related projects:

"Frankly, I think, in terms of CSR, Green, Environment initiatives in our company, all these types of activities need more commitment and true understanding from top management in pushing these types of activities. Top management accepted the fact that we must do Green initiatives and practices, but it is going to be much better if top management commit, drive, and lead continuously and wisely…"(CSRD).

The statement implied that it is true fact that top management has been supporting environment-related projects in the sense that they acknowledged the fact that this kind of project must be done for the sake of a positive image for publicity in general. However, what employees need is more than that. They also need a leader who will drive continuously throughout the projects to overcome any challenges within the organization as Green and environment initiatives would take time to implement.

5.8.3 Green Organizational Culture

Green organizational culture is considered as a significant factor to emphasize when there are changes emerging within APTH surrounding Green IT/IS investments. Within APTH, Green organizational culture is a new and interesting term, and it has been stated by Nanath and Pillai (2012a) that the process and value systems behind the performance of environmental practices within an organization would lead to what is termed in the literature as '*Green organizational culture'*.

As referred to by the CSRD, APTH fundamentally have a good organizational culture embedded, which means people share the same understanding of values, beliefs, attitudes, and behaviors and are striving to achieve the goal in providing the best service, and prioritizing the safety and happiness of to all stakeholders within the aviation industry. However, things have gradually changed; APTH is more interested and concerned about the environment as there have been many climate-related tragedies. For example, at the individual level, top management and employees at APTH try to reduce waste by using less paper, put the computers on sleep mode, and set them up to switch off automatically during non-working hours. Such actions would take some time to stick and become embedded within the beliefs and perceptions of everyone at APTH. The finding concurs with the view of Esfahani *et al.* (2015) that the significance of the values and beliefs of an organization's culture can stimulate individuals' behavior. Resulting in the interest in environmental initiatives and practices starts from Green awareness, acceptance, norms, and values and in the end, these results in a Green organizational culture at APTH. However, this would take quite a long time to become a solid established; the form of culture cannot be just changed overnight.

Accordingly, the OCD gave clearer pictures of these emerging Green initiatives and practices within the organization as reported below:

"Regarding Green organizational culture, frankly it is a new term, isn't it? However, I understand what you mean as we are also trying to achieve sustainable practices. We are trying to emphasize on them to be in accordance with the strategic campaign for Green Airport's goals too…basically about our core values. The ways we

are going to transform our organization to become a Green organizational culture. We are working our way through, it is a very early stage, and it will not change suddenly I suppose…" (OCD).

The statements from the OCD show that APTH is working their way towards achieving the objectives to become a Green Airport as well as to build a Green organizational culture, as they know that it is going to take time. Noticeably, the five core values shown in some APTH's documents*: safety and security, service, teamwork, continuous learning, and good corporate governance,* do not include or emphasize any environmental or Green term. Thus, it can be determined that if they are seriously working their way towards the environmental or Green goal, they should somehow emphasize more on this; otherwise, it will be difficult for employees to understand and act in the same way and become a strong Green organizational culture. Managers and staffs were also asked to describe the stages and understanding regarding Green organizational culture:

"Honestly, I feel that we are doing some environmental initiatives and practices, but I don't have the feeling that this would embed solidly as organizational culture atmosphere anytime soon"…" (SITS).

"Not appearance or easily detect this Green culture yet as it is still beginning stage…" (ENO).

The statement above implies that the environmental or Green initiatives and practices at APTH do not seem to be apparent at the moment and a senior IT member of staff accepted that it is going to take time to create, embed, and transform this type of organizational culture. Although there is evidence of such environment initiatives and practices going on at APTH as already mentioned, there would have to be much more effort put into this if they want to establish a Green organizational culture, and it would not be that easy.

In addition, the BDD confirmed what is in the literature surrounding the importance of providing staff with safe workplaces and promoting their wellbeing within the aviation industry (Lynes and Andrachuk, 2008; Chen, 2012). APTH emphasize their employees' safety and wellbeing, as the slogan is *'safety is our standard and service is in mind'*. For example, an employee submitting a complaint in good faith according to the procedures set out will be protected, and the complaint will not cause discharged on the part of the criticize. APTH ensures fair treatment, safe working environment, and reasonable remuneration for every employee, such as the establishment of the provident fund, medical expense reimbursement, and the establishment of the savings plan and credit cooperative limited. There is standardization for safety, occupational health, and environment in the workplace for employees; APTH head office has received the Outstanding Organization in Safety, Occupational Health and Working Environment Award from Ministry of Labour, and Department of Labour Protection and Welfare for eight consecutive years. The finding also concurs the view of Lynes and Andrachuk (2008) that employee' wellbeing can be of prominence as part of organizational culture of social and environmental responsibility in the long run. In addition, APTH has not shown much of an emphasis on the diversity of workforces as the OCD implies that most of the employees are men and 100% are Thai people in order to protect confidentiality according to the organization.

Though, some of the senior managers, such as the OCD and CSRD, thought that Green organizational culture is significant for Green IT/IS investments to be a success. Also, they emphasized what they were trying to accomplish in creating and embedding Green organizational culture at APTH, which confirmed what the literature stated, that Green organizational culture has an influential role in integrating environmental sustainability processes and ensuring the continuity of Green IT initiatives (Nanath and Pillai, 2012a). However, the conflicting perspectives shown by the SITS and ENO together with some APTH's documents have indicated that APTH perhaps needs more time and real effort to create an understanding of Green practices together with strong and lasting positive beliefs and attitudes among staff towards such practices because employees at APTH do not perceive this as happening yet. This reflected that the perception of top management and the feeling of employees were rather varying; thus, there is room for improvement within APTH if it wants to build a Green organizational culture.

5.8.4 Resource Development (Training/Education)

According to (Table 5.9), the interviewees highlight that ***Resources development (Training/Education)*** is a highly significant factor in terms of influencing Green IT/IS investments within the aviation industry. This resonates with the literature fact (Walsemann *et al.*, 2012; Newcommer *et al.*, 2014) that within the aviation industry, training and education is a solid foundation for every organizations taking decision to adopt and implement sustainability/Green initiatives and practices. Coherent with APTH's supporting document, APTH reorganized its structure over the last two years. Under this new organizational structure, soon the Airport Academy will take the lead in human resource development. The objectives are to enhance employees' knowledge, skills, and competency and to ensure that airport management and operations are in line with air transport standards set by domestic and international organizations, such as the Department of Civil Aviation in Thailand, ICAO and FAA. There is a training roadmap for each level of employees such as functional training, leadership, financial, airport managements courses and more. Human resource development is also a crucial factor in APTH's employees attaining a high level of competence and the ability to drive the organization to achieve its vision within the operational framework and strategy, and then enabling APTH to finally achieve sustainable growth.

The interviewees denoted that resources development in terms of training, learning, knowledge, and skill is highly significant in connection with Green IT/IS investments within APTH. Those are the underpinning of everything if an organization wants to be successful. This confirmed the views in the literature: as the aviation industry is growing, provision of education continues to alter to meet the demands of an ever-changing industry (Newcomer *et al*., 2014). Several business studies have noted a positive relationship between higher education and sustainability, personal growth, and national prosperity (Walsemann *et al.*, 2012). When discussing the existing training and learning programs of employees within APTH, some of the senior management team highlighted that:

"We have lots of training courses and provide education relates with aviation knowledge according to the level of jobs. We sometimes send our employees to train abroad with our partner's agreement program…" (BDD).

"Our training rate per employee is increasing each year as we emphasize on building up knowledge. Each employee will learn and train on its own specialize area first, and later they have to join training programs in general. We also provide e-learning and knowledge management (KM) database for employees who have less time to join training programs in class…" (OCD).

Generally, as referred to in the statements above, this showed that APTH were concerned about resource development and is continuing to provide more training programs for all employees with both internal and external education programs. Moreover, there are more education channels for employees to select from such as e-learning and the KM database for future learning whenever they want to. Interestingly, what the interviewer extracted from APTH's documents was that only a few people attended the online or web-based learning and some employees do not actually know how to open it because of lack of communication and basic training in how to use e-learning or the KM database properly. Besides, it did not look interesting and there were no incentives such as rewards or games to persuade employees to take part. Therefore, this year, the senior management teams plan to promote these learning channels. The OCD has set up a KPI for 500 people to join in, next year for 600 people to do so, and for this to increase 10% year by year. They plan to start this year. However, it seemed that the training and learning programs provided were still limited to just general aviation knowledge courses. For example, within IT/IS courses, there should be more specific courses for the relevant people to learn based on their jobs roles and responsibilities, so they can use the knowledge to improve and carry out their work more effectively and efficiently. Without the appropriate knowledge or training to complete the projects, it could delay the project and risk to fail.

When asked about resources development (training and education) surrounding Green IT/IS within APTH, an interviewee responded as follows:

"I strongly believe in this! Although, we started to set up the training programs related with CSR last year as we invited scholars from university to do a kind of workshop, provide knowledge that are relevant employees who have a direct responsible to CSR in general at the first glance for four times a year (about 70 people

each time). However, it is still not covering everyone. We believe that for example, innovation is not only come from new technology's enhancement but educated and knowledge people; then with the new knowledge and ideas, they will create innovation at the end. This is what we want to do!..." (CSRD).

The statement implied that there were only CSR courses available to a small group of employees compared to the number of overall employees at APTH. However, the CSRD believed that education and training should be compulsory for employees as she was convinced that it enhances knowledge and new ideas and innovation. However, APTH needs to have more specific courses and programs that include all groups of employees where possible. Obviously, Green IT/IS knowledge and training are still lacking especially the courses for low-mid level, and this should be instructed before or during the implementation, otherwise it would result in a more complicated process as expressed by IT staff.

On the other hand, some senior management (ITISS and ITD) stated that there should be more education to support employees at all levels for developing specific knowledge and skills to prepare for the changes. For example, there should be courses about IT and the environment or Green IT/IS knowledge and education programs for the better understanding of all employees within APTH. The ICTD claimed that:

> *"We increase training budget every year but maybe still not covering everything we may need, but for Green IT/IS or Green initiatives we promise we will do more. We also put some documents in e-learning and in our KM database to share…"* (ITISS).

ITISS highlighted that they increase the budget for training programs each year, but it was not enough to cover for the employees that need to be trained and some other IT projects may use up training budgets as well. Although there are other education channels that cost less, it is useless if employees do not know how to access and use them, as expressed by operational staff at APTH. In contrast, the OCD argued that currently there was a lack of HR availability to assist with this job as people were being required to help out with other jobs too. However, if everyone wanted it to run efficiently, KM and e-learning functions were in need of more assistance.

Apparently, the interviewees responded regarding Green IT/IS training and education that they believed that this factor was considered as highly significant for Green IT/IS investments at APTH. Conversely, different people at APTH highlighted that the real action and engagement regarding training and education was insufficient as it had shown that the senior management team at APTH did not pay much attention to the training and education programs surrounding Green IT/IS and environmental knowledge. There was only a small CSR course running within the big organizations and some technical IT/IS programs such as how to use Microsoft Office and other programs. Therefore, this suggested that the senior management team ought to respond and be concerned more about training and education programs specifically for Green IT/IS or IT/IS for the environment in order to develop knowledge and better understanding for employees, if they seriously want the changes to stick and create value within APTH in the long run.

- Other significant factors that stand out from the interviewees for Green IT/IS investments within the aviation industry were ***positive image and leadership skills***.

5.8.5 Positive Image

It is undeniable that APTH is continuously striving to maintain a better and increase positive image. Hence, according to (Table 5.9), ***positive image*** is considered as a highly significant factor in terms of influencing Green IT/IS investments within the aviation industry. This supports what Daly and Butler (2009) that by introducing Green IT/IS as part of environmental effective program can boost organization’s image. The END revealed that the aviation industry is considered as being very competitive, with lots of processes and procedures surrounding safety issues. However, nowadays, attracting more passengers and airlines is not just a matter of good practice; doing good things for society, country, and the world is even more noteworthy, such as implementing rigorous environmental protection in order to achieve sustainable competitive advantages. For instance, Green IT/IS is a huge investment that builds and reinforces a positive image for APTH. Many activities and investments associated with

Green and environment initiatives and practices would lead to such an image becoming a long lasting one. Hence, the CSRD also highlighted that:

"APTH has done many CSR activities for a long time, e.g. activities with locals who received an impact from airport operations and activities, helping poor people, planting trees, which frankly has been to promote a better image. However, it is time we have to do what we called CSR in process, which basically means doing good from within; doing good from inside the company and then sharing with the outside. Thus, the company would have a better image in the long run. For example, according to the Global Reporting Initiative (GRI report, we have to emphasize three things: social, economic, and environment. However, we are now focused mainly on social (e.g. employees' wellbeing, security, etc.) and particularly environment (both inside and outside), our environment for a healthier world..." (CSRD).

The statement above implied that APTH tries to build up their image with the community as there are many external CSR activities and events for helping people and society in general. However, what APTH must promptly emphasize in their CSR is to try to develop good internal practices, that is, within the organization, e.g. good corporate governance and caring more about their employees, as then their positive image and reputation will be more sustainable and based on word of mouth from the inside. APTH is also greatly concerned about having a better public image, which supported what the literature highlighted the importance of positive image within the aviation industry (Smith and Grosbois, 2011). APTH has focused on and maintained their organization's image in order to reinforce the optimistic perception of all groups of stakeholders towards them and to be competitive.

5.8.6 Leadership Skills

Another significant factor indicated by the senior management team influencing Green IT/IS investments within the aviation industry was ***leadership skills***. As supported by Lynes and Dredge (2006), top management who have leadership skills could drive change and achieve goals regarding the establishment of and commitment to good environmental practices more successfully. For instance, Virgin Atlantic's Sir Richard

Branson is clearly a leader in this industry, with all his efforts to reduce CO2 emissions and its impact on global warming as he has devoted considerable time and energy to the struggle against global warming (Capoccitti *et al.*, 2010). Looking at another airline, Scandinavian Airlines (SAS), under the leadership of CEO Jan Stenberg, an environmental management scheme has become strategic level, with the establishment of Green vision and goals and a promise to publish environmental reports on an annual basis (Lynes and Dredge, 2006). Hence, it has won numerous awards for these annual environmental reports and is emerging as a leader in environmental management. Therefore, APTH is in need of a leader who can be trusted, inspired people, truly committed and made the changes stick in the long run. The ICTD responded accordingly that:

"*Any new project development that relates to Green initiatives and practices obviously need support from top management; however, what's more important is the capability of that top management to be able to direct, inspire, guide, these changes as well as influence and persuade employees to share the same belief, attitudes and behavior and in achieving the goals in the same ways throughout. Honestly, not every management team would have those skills, but if they did, it would drive a successful change very quickly and confidently…"* (ICTD).

The finding made by the ICTD concurs with the literature (Capoccitti *et al.*, 2010) in that organizations within the aviation industry need not only support from top management but also the emergence of leadership who lead, drive, persuade, and influence employees to move forward with the organization and assist throughout in the Green IT/IS adoption and implementation process. Leadership usually know how to delegate responsibility and empower the members accordingly to get things done effectively and efficiency. This will lead to goals being achieved quickly and confidently.

5.9 Internal Organizational Factors Influencing Management Practices

The previous section demonstrated the significance of each particular internal organizational factor influencing Green IT/IS investments within APTH, and how the interviewees elaborated their perspectives on each of the individual factors. The importance of these factors is that they should be recognized and examined during the adoption and implementation of a new system (i.e. Green IT/IS) as well as subsequently in assisting in the management of Green IT/IS indirect costs. The literature highlighted the significance of each of the key internal organizational factors, namely top management support/commitment, employee involvement, Green organizational culture, and resources development (training/education) for IT/IS and Green IT/IS investments. In addition, there are two factors, which stand out from the interviewees' statements; these are positive image and leadership skills as also being meaningful factors for assisting in the management of Green IT/IS indirect costs.

The rationale here is to present lists of the associated indirect costs of Green IT/IS investment and in what way each of the key internal organizational factors assist in managing and controlling the associated indirect costs so as to reduce the impact derived from them. Table 5.10 below illustrates the mapping factors between which key internal organizational factors assist in managing each of the indirect costs, and the following (section 5.9.1, Table 5.11) presents and provides a detailed management mechanism, strategies and policy in reducing the impact of each indirect costs by the assistance of key internal organizational factors associated with Green IT/IS investments within APTH. Interviewees' responses contribute in answering this question, with the exception of those interviewees who did not want to respond to this question, including the PBD, OCD, ITS, and ENO. Obviously, operational staffs such as the ITS and ENO did not want to answer this question due to lack of confidence and fear of giving a vague answer. Accordingly, the OCD wanted to opt out as he felt that he is not involved greatly in the evaluation process for these projects. However, in the case of the PBD, he was supposed to respond to this question as it provides a list of indirect costs, which are important for Green IT/IS evaluation processes, and he is involved in the evaluation process.

Internal Organizational Factors / **Green IT/IS Indirect Costs Factors**	**Employee Involvement**	**Resources Development Training/Education**	**Green Organizational Culture**	**Top management Support/ Commitment**	**Positive Image**	**Leadership Skills**
Indirect Environmental Costs						
• Upfront Environmental Costs *(Costs incurred prior to the operation or system e.g. site studies; design of environmentally products/designs/process, permitting, and procurement).*		√		√		
• Back-end Costs *(Costs related to future costs of closure, decommissioning, disposal of inventory that are not yet in effect but have been proclaimed). These costs will occur at more or less some points in the future).*		√		√		
• Regulatory Costs *(Costs related to planning, inspection, insurance, pollution control, taxes and fees, normally incurred in operation of a process or systems e.g. additional government impositions, if not comply).*		√		√		
• ~~Contingent Costs~~ ~~*(Costs of remedying and compensating for future accidental releases of contaminants into the environment, fines and penalties, property damages). It may or may not incurred at some point in the future.*~~						
• Image and Relationship Costs *(Costs related with corporate image and relationship with customers, investors, suppliers, communities, regulators and works and award/recognition programs).*	√		√	√	√	
Indirect Organizational Costs						
• Organization Re-structuring *(Costs involved with the change to the organization' hierarchy/structure).*	√			√		
• Productivity Loss			√	√		
• Business Process Re-engineering *(Costs involved with re-designing of functions and process of organizations).*	√			√		
• Hardware Disposal		√		√		
• Strain on Resources				√		
• Other: *Integration*	√			√		
• Other: *Downtime*		√				
Indirect Human Costs						
• Management (Time/Resources/Effort and Dedication)	√	√		√		

• Employee (Time/Training/Learning/Motivation)		√		√		√
• Belief, Feeling and Perception	√		√		√	
• Redefining Roles		√		√		
• ~~Staffs Turnover~~						
• Other: *Conflict of Interest*				√		
• Other: *Problems induced by users*		√				
• Other: *Insufficiency of communication*				√		√

Table 5.10: Internal Organizational Factors that assisting in managing the Associated Green IT/IS Indirect Costs

The mapping (Table 5.10) above illustrates how each of internal organizational factors affects how management would handle with each of Green IT/IS indirect costs, particularly focusing on ways to manage and control each of the indirect costs surrounding Green IT/IS investments within the aviation industry. It can be seen that of all key internal organizational factors, resource development (training/education) and top management support/commitment are the prominent ones and stand out in terms of providing assistance in managing and controlling the impacts resulting from associated indirect costs.

Correspondingly, the following section (Table 5.11) provides more specific details on the practical management strategies, policies, and mechanisms obtained from the interviewees on managing and controlling the associated indirect costs surrounding Green IT/IS investment within APTH. Thereby, these assist in reducing negative consequences and financial impacts, such as budget/cost overruns, under optimized-budget and increase the possibility of project's success, related to Green IT/IS investments within APTH.

5.9.1 Cost Management Strategies, Policies, and Mechanisms

The following Table (5.11) demonstrates in detail the cost management strategies, policies, and mechanisms derived from each of the interviewees when asked to provide their opinion on these and when each of the associated indirect costs is prone to occur within the stages of the IS life cycle. Prior to the presentation in a concluding table that contains the associated indirect costs factors, and management strategies, policies and mechanisms, the empirical findings derived from the interviews were compared and double-checked. A comprehensive (Table 5.11) would assist managers and decision-makers to identify and manage each indirect cost, understand when to expect the occurrence of each of them within IS life-cycle stages, and decide and prepare the management strategies that can be employed to reduce its impacts from Green IT/IS investments. This comprehensive (Table 5.11) finally can be used as a guideline for handing with indirect costs surrounding Green IT/IS investments and as an alternative method of addressing the identification, and management of such costs.

Green IT/IS Indirect Costs Factors	Incurred	Management Strategies, Policies, and Mechanisms to Reduce Impacts
Indirect Environmental Costs		
• Upfront Environmental Costs	Y	• Green procurement planning and inspecting e.g. supplier's evaluation. • Set up a Green evaluation team to study all relevant factors and ensure that the organization is doing so ecologically as part of Green procurement. • Set up a policy (Airport Environmental Management Policy) that relates to Green IT/IS. • Training related to Green procurement. • CSR and environmental handbook/manual produced annually. • Hire a consultant or specialist. • Follow the best practices of others, e.g. through SAA, whereby we can exchange know-how at no cost.
• Back-end Costs	Y	• Risk mitigation plan and management to minimize risk including preventive programs and internal control; for example, bird-striking control and to tackle danger from animals that could affect the aviation operations; control birds' food sources by setting a standard level of grass height as well as level of water within airside and filling in the bird strike reporting form in order to reduce this incident from happening as suggested by ICAO. • Management of risk for natural disaster and environment prevention e.g., prevention program. • Prepare a contingency plan including safety strategy, monitoring and reporting, occupational health and safety campaign, risk mitigation and control, minimizing and prevention of workplace accidents. • Adding knowledge of law team to keep updated on new regulations related to these issues. • Planning in advance and monitoring continuously
• Regulatory Costs	Y	• Risk mitigation plan to minimize risk and unpleasant events. • Law team to comply fully to the environmental related rules and regulations and laws as

		well as to study and update new rules and regulations to be in accordance with the Ministry of Information Communication and Technology and Ministry of Transport in Thailand.
• Contingent (Compensation) Costs	N	• Educate and train regarding safety policy. • Set up compensation plans, e.g. build noise protection wall and set up noise control station to measure the level of noise, where results can also be checked, and give feedback online. • CSR and environmental handbook/manual produced annually. • Plan and prepare a contingency plan. • Management of risk for natural disaster and environment prevention (e.g. prevention program). • Negotiation techniques to compromise with protesters. • Green funds to help compensate from stakeholders. • Get support from the government, e.g. incentives.
• Image and Relationship Costs	Y	• Stakeholders' participation and engagement, e.g. seminars, brainstorming, workshop sessions. • Employee engagement such as Green activities/workshops (public relations) to enhance positive image. • Plan activities with stakeholders, e.g. CSR days, Green communities, tree planting, Green ideas workshops, forest-planting project, and supporting the United Nations' work and airport environmental management program. • CSR in a process (practicing good things inside first and then outside). • Good corporate governance plans, e.g. won sustainability awards report from SET. • Green communities activities, e.g. forest-planting project, airport environmental management program. • Meeting for all shareholders once a month to keep them informed of the company's progress, good governance and so on. One of the channels to engage with stakeholders. • Investment for expanding business for a better image. • Communicate, promote, share information, inspire employees' awareness on environmental protection and preservation to go Green from the top to bottom. • Promote the scheme and work together with outside sectors. • Organize Green IT/IS initiatives and practices master plan's competitions.

Indirect Organizational Costs		
• Organization Re-Structuring	Y	• Plan and prepare the changing of structures and hierarchy in advance and communicate simultaneously, e.g. assigning relevant people to prepare and adjust to the new roles and responsibilities. • Employee empowerment. • Plan for this change gradually (start from the most to the least necessary), inform the impacts to employees at each level to avoid resistance. • Top management support and prepare action plans. • Create a roadmap for the short and long term.
• Productivity Loss	Y	• Offer some rewards and incentives schemes. • Create awareness, belief and stimulate the initiatives and practices gradually. • Top management focuses on long-term strategic decisions and manage effectively. • To management show true commitment and communicate simultaneously (e.g. counseling service to reduce stress level, anonymous feedback program).
• Business Process Re-engineering	Y	• Plan in advance and communicate simultaneously. • Support and encourage empowerment. • Create a roadmap for the short and long term, for example; APTH has reached Level 2 in the carbon footprint accreditation program. Try to think of new ways to reduce waste and pollution that result from IT/IS operations. • Get rid of unnecessary processes and improve overall process to be more efficient. • Organize an environmental competition for innovation and give awards to employees whose innovative idea could in fact be implemented with the least cost.
• Hardware Disposal	Y	• Sell to some to employees or donate. • Not our core business, so hire specialist/outsourcing company, e.g. annual bidding or at least renewal discussion with the current outsourcing company will result in lower costs. • Some can be transferred to other uses and some can be sold to a third party. • Educate and encourage employees to recycle, reuse, and dispose of items in environmentally friendly ways. • Plan to recycle and reuse some of the items. • Leasing for the future.
• Strain on Resources	Y	• Plan and allocate human resources in advance; put the right man on the right job.

• *Downtime*	Y	• Have the backup and recovery procedures in place at all times; IT monitoring tools to investigate systems before downtime. • Plan for regular updates and maintenance to prevent this from happening.
• *Integration*	Y	• Plan and schedule for data mitigation beforehand. • Get employees' involvement for better understanding.
Indirect Human Costs		
• Management (Time/Resources/Effort and Dedication)	Y	• Set up a short-term and long-term plan and prioritize them. • Employee empowerment. • Plan effectively to be in accordance with strategies and goals. • Provide a training program for employees (e.g. CSR Challenging training program). • Plan and double-check and possibly change plans if needed as the project grows. • KPI to evaluate performance. • Delegate responsibility and match the right skills with the right jobs.
• Employees (Time/Training/Learning/Motivation)	Y	• Remote support and learning for IT programs, e.g. learn through KM database. • Get support from the top as well as inspiration and guidance from leaders. • Awards, incentives, and recognition program. • CSR and environmental handbook/manual produced annually. • Plan and schedule training in advance in a small group of each first phase employees, and then communicate and share knowledge and ideas. • Build knowledge and encourage employees to learn new things and be open-minded to accept changes. Arrange more specific training and education that is suitable for Green IT/IS. • Educate employees well by inviting a guest speaker who has knowledge within this area. • KPI and rewards. Maintain the level of employees' interest in new systems.
• Belief, Feeling and Perception	Y	• Teamwork activities related to Green issues. • Employee participation in activities/events/workshop as routine. • Get employees to work together as team and share knowledge so as to develop positive attitudes to and perceptions of these initiatives. • Take into account employees' opinions and concerns. • Communicate and share Green knowledge and belief so as to create employees' awareness and perception on environmental protection and preservation.

		• Positive images of the organization gained after implementation might promote better feelings about and perceptions of the investment.
• Redefining Roles	Y	• Plan to let some key supervisors become involved in communicating truthfully to operational staff. • Training programs to suit new roles. • Plan in advance and communicate with the person who has to change roles and responsibilities before the changes take place. • Job rotation within a certain period for some positions.
• Staffs Turnover	N	• Rewards/incentives. • Get employees to become involved and participate in the development of projects. • Maintain the good working condition, safety. • Gain support from top management and a leader who can be trusted and can lead the organization in the long run.
• *Conflict of Interest*	Y	• Management must show and communicate a strong commitment for avoiding conflict of interest, e.g. rules and regulations. • Provide knowledge to employees, which can minimize conflict within the organization due to differences in the levels of workers' knowledge. • Develop guidelines (Practice Guidelines on Conflict of Interest) to ensure everyone is clear regarding the beneficiaries of the organization and transparent control system especially among management committee members.
• *Problems Induced by Users*	Y	• Train and educate users prior to implementation.
• *Insufficiencies of Communication*	Y	• Set up a group of champions who are responsible for communicating to each department within organizations. • Top management shows true support and act toward the initiatives and practices. • May need a trusted leader to facilitate an open discussion in order to let employees feel safe in sharing any problems.

Table 5.11: Cost Management Strategies, Policies and Mechanisms to Reduce Impacts from Green IT/IS Investments

Table 5.11 provides a practical set of guidelines or checklist for decision-makers (i.e. IT/Green IT/IS managers) to help in managing and controlling the associated indirect costs surrounding Green IT/IS investment within APTH or any typical aviation organization which is about to adopt and implement Green IT/IS. The key fact is that instead of managers trying to avoid or ignore the indirect costs, which tend to be up to four times greater than the direct costs as stated by Hochstrasser (1992); however, the (Table 5.11) are presented with an alternative method to deal with the these indirect costs. Nevertheless, new knowledge regarding the management strategies and mechanisms can be used as guidelines or checklists when managers embrace with such costs in order to assist in reducing the impacts associated with Green IT/IS investments, has emerged from the interviewees at APTH, and as a result the mechanisms and strategies suggested are considered to be very comprehensive and beneficial for organizations within the aviation industry as they have been proposed by experienced director and managers at APTH.

5.10 Implications of Management of Indirect Costs for the Success of Green IT/IS Projects

The empirical findings highlight that the IT team were in agreement with the view that understanding the identification and management of indirect costs would better influence their decision to adopt and implement Green IT/IS for APTH. The interviewees emphasized the implications of management of indirect costs for the success of Green IT/IS investments projects as follows:

"It helps the organization to understand beyond just the financial numbers or utilize just only the ineffective existing method. It is good to understand that these costs are hard to quantify but they affect our budget as a whole…and we never know, we could reduce these costs and make the projects more successful…" (ITISS).

"Some of the costs mentioned above, if our team is able to identify and understand the true meaning of them at the first place and right now!...I believe that it would reduce substantially overall costs of investments…" (FD).

"For CSR viewpoint, I believe that, for example, when we invest something for this case a new Green IT/IS system or any environmental initiatives and practices, we are thinking about our environment more or less and also our responsibility and our image; it always comes with costs for this investment. I can say the costs like indirect environment costs and it is obvious but what we are aware of but maybe not take them into account as we think; it is a complex process of including those indirect costs as you have explained to me. We have to take them into account! I mean, the factors and all the lists of indirect costs are helpful. So, I think, we will plan and think more carefully in terms of efficiency of our business process and evaluate of investment wisely for the next projects…" (CSRD).

"Indirect costs can make projects fail if we don't understand them and we would never know the reasons behind because sometimes we know the terms but don't know what they mean. If we understand before, when we make a decision regarding this investment, we are certain that we could be able to manage them to some extent…" (END).

"We have been dealing and involving with some of these costs but did not know they are indirect costs. If we can identify them before, we believe that we can reduce their impacts as they are costing to us! Frankly, I like the lists of indirect costs that incorporate all the costs together in categories…" (BDD).

All the statements imply that the investment in Green IT/IS or environmental project are a complex and huge one, and the promise of profits and projects being successful uncertain and take such a longer time to payoff for the standpoint of the organization, and it required lots of input and resources to make it a meaningful project. The above statements highlight that the identification and management of indirect costs for Green IT/IS projects are considered to be new knowledge enrichment for APTH particularly the evaluation process that truly based on traditional financial techniques and they considered ineffective and lead to projects' failure. Some of them responded that they have only just understood that indirect costs affect the overall investment, but henceforth, if they could identify and manage those associated indirect costs, it would make the projects more creditable and fruitful; they would be more cost-effective and strengthen the organization's financial position in the long run. More importantly, the lists of indirect costs are beneficial for future Green IT/IS or environmental evaluation projects and will assist the decision-makers such as the CIO, CFO, or IT/Environmental managers within APTH and any aviation organizations.

Those aforementioned statements made by interviewees concur the findings in the literature (Irani and Love, 2001; Love *et al.*, 2004; Ghoneim, 2007; Bernroider *et al.*, 2013; Bai and Sarkris, 2013) that the traditional financial methods alone is not anymore sufficient especially for strategic projects containing intangible and non-financial aspect such this case Green IT/IS. Also, costs of Green IT solutions comprise one of the most crucial impediments that prevent organizations from adopting them (Molla *et al.*, 2009). They also support Chen *et al.*'s (2011) claim that Green IT/IS create financial concerns since they may lead to either a reduction in costs or the incurrence of additional expenses as being Green is not necessarily cost-efficient. The fact is that there are some hidden costs that result from the implementation and continuation of sustainable practices (Butler *et al.*, 2011). Moreover, Okarfor *et al.* (2013) state that usually the environmental costs are hidden, so decision-makers have little or no information on such costs, as well as no incentive to manage and reduce them, but they can be a substantial component of an organization's overall costs structure. Consequently, the implications of the identification and management of indirect costs could have vastly contributed to the success of Green IT/IS investments as expressed by the interviewees above. Certain opinions expressed by the interviewees at APTH on the implications of management of indirect costs are summarized in (Table 5.12) below.

Implications of Management of Green IT/IS Indirect Costs	Positions
• Maintain and strengthen the position of the businesses and projects	FD, BDS
• Reduce the likelihood of failure of projects, while increase the possibility of success of projects	ICTD, BDD, ITISS, ITD
• Be a pilot project to include key factors and indirect costs for a more effective evaluation process	ICTD, END
• Decrease the possibility of budget/costs overruns and under-optimized budget	FD, BDD, ITISS
• Establishment of proper mechanisms/guidelines to reduce the impacts from indirect costs	ITD, CSRD

Table 5.12: Implications of Management of Indirect Costs

5.11 Overall Process for the Justification of Green IT/IS Investments Evaluation within the Aviation Industry

In accordance with the above discussions on the empirical evidence highlight, indirect costs associated with Green IT/IS investments can have a significant impact in shaping and transforming organizations within the aviation industry. Articulating the findings concerning the external pressures, internal organizational factors, and the implications of management of indirect costs surrounding Green IT/IS investment provides a better understanding of its effects on organizations within the aviation industry.

Specifically, the interviewees were asked to respond regarding the external pressures and internal organizational factors that contribute to a better understanding as well as the mechanisms and strategies to assist in the management of indirect costs implications when deciding to adopt and implement Green IT/IS within APTH. The management team agree that single use of traditional IS evaluation techniques including CBA, ROI, or PB is not enough for Green IT/IS investments especially with new and technological shift together with environmental considerations. The interviewees also highlight that the changes to global climate, the increasing use of energy and the development of superior technology nowadays triggers the need for more applicable and practical investments evaluation for projects, particularly for those that take environment aspects into consideration.

Hence, the aforementioned statement confirmed the view in the literature surrounding IT/IS and Green IT/IS investments evaluation that there is a need to take into account intangible and non-financial factors (Irani and Love, 2001; Mohamed and Irani, 2002; Ghoneim, 2007; Irani and Love, 2008; Molla *et al.*, 2009; Butler *et al.*, 2011; Beroider *et al.*, 2013; Okarfor *et al.*, 2013; Bai and Sarkis, 2013). Also, it concurs with the viewpoint that such hidden environmental costs cannot be entirely identified for particular transactions, thus managers must use other techniques to assess them (Joshi *et al.*, 2002).

Consequently, incorporating those factors from both the literature and empirical findings enhances a better understanding of the evaluation process and the implications of cost management particularly indirect costs so as to assist in reducing the impact of Green IT/IS investments and providing them with a comprehensive tool. As the interviewees indicated:

"Yes, it would be supportive and influence the evaluation process better for Green IT/IS investments. *It may seem complicated at the first glance, but when try to understand them step-by-step, it is more practical. Also the factors that we discussed helping us to think again for improvement…"* (ICTD).

"All the factors that we discussed are also useful as they are broadening new knowledge and perspectives for projects' investment at APTH especially I think; our total cost of Green IT/IS is somewhat underestimated. From now, I would be aware and try to manage the costs that we have been neglecting for so long especially when a project involves with environmental or Green practices…" (ITD).

The ICTD, who has more responsibility for Green IT/IS projects, and the IT management team highlight the usefulness of this compressive model and the view that incorporating both external factors and internal organizational factors together with the comprehensive lists of associated indirect costs would enhance a better understanding, widen their knowledge and assist in an effective cost management and Green IT/IS evaluation process within APTH. The statements above implied that both external and internal organizational factors are essential as they enable a better understanding of the decision-making process of Green IT/IS investments evaluation. Also, the identification and management of the indirect costs of Green IT/IS can assist in reducing the financial impacts. The BDD also reinforced that this comprehensive tool includes various helpful factors providing understanding and a clearer picture, and it had given them another perspective on how to carry out a more effective and efficient evaluation of projects, particularly exploiting the lists of indirect costs incurred, and they recognized that they can manage these costs conclusively.

Thereby, it supports the study's proposition concerning the usefulness of this proposed model. Nonetheless, this research study assist to tackle these issues by presenting a model with descriptive details to assist the justification process when taking a decision to adopt and implement Green IT/IS.

5.11.1 The Success of Green IT/IS Investments Evaluation

Following the discussion, the interviewees were asked whether the adopted Green IT/IS initiatives and practices were perceived to be a success within APTH. Most of the interviewees reacted in a positive way, and they were indicated that above all they believed that Green IT/IS investment is something they are willing to adopt and implement as it involves social responsibility; to do so is a moral obligation they must perform for society and for the country as a whole and improve overall operation performance and their image. For example, a Green IT/IS data center is powerful, faster, and more energy-efficient, but consumes less power and is less harmful to the environment.

Nevertheless, the FD's reaction was that in certain ways it would be a success, but it is a challenging process as it demands too much effort from everyone as well as massive investments from APTH compared to normal IT/IS projects. Moreover, if there were more Green IT/IS projects going on, it definitely would affect the organization's bonus and financial position; as a result, employees may react differently if they felt that no true effort and real commitment from top management was being made to drive changes. On the other hands, the END added that it would definitely be a success, along with the Green Airport campaign; what people from various departments have started to do are good signs, and it implies that they understand the reasons behind Green IT/IS investments for the sake of the environment as a whole.

5.12 Conclusions

This chapter analyzes and presents the findings of an in-depth case study of Green IT/IS investment conducted in the aviation industry in Thailand. The case study demonstrates the importance and accountability of Green IT/IS investments in organizations, especially within the aviation industry. The findings reported from this case study relate to the perceived importance of the external and internal organizational factors influencing Green IT/IS investments evaluation and the ways in which they affect management practices on how to manage and control the associated indirect costs of Green IT/IS investments in the case organization within an aviation industry. Empirical evidences are reported in this chapter, and the researcher is now able to draw conclusions from the inquiry. Consequently, the empirical conclusions from the case organization are presented and highlighted the fact that Green IT/IS within the aviation industry in Thailand is considered a new phenomenon, thus making organizations within APTH more enthusiastic to investigate and understand more about its investments evaluation. The reality is that Green IT/IS projects are very costly. Thus, management and managers are reluctant to invest, especially in light of the problems of cost overruns and under-optimized budgets due to the associated Green IT/IS indirect costs. This research contributes to both a theoretical and empirical level in providing a better understanding of the significant factors, including external factors, which are derived from the theoretical grounding – institutional theory – as well as the internal organizational factors drawn from the normative literature resulting in a comprehensive taxonomy. Those factors influence management practices and how the associated indirect costs can be managed and controlled in order to reduce the impacts and increase the project' success As a result, such management practices and mechanisms can assist in reducing the impacts associated with indirect costs from Green IT/IS investments within Thailand's aviation industry.

The main conclusions obtained from the empirical findings on Green IT/IS investments evaluation focusing on indirect costs implications are summarized below:

- The comprehensive lists of Green IT/IS investment projects and environmental initiatives and practices of APTH reflect the potential of Green IT/IS commitment at APTH that will eventually take place as a solid scheme in protecting the environment. This supports the literature in this domain in response to going Greener and reducing carbon footprints within the aviation industry and the world's emissions.

- The intention to save the environment, moral obligation/social responsibility, and being competitive are the prominent motives for adopting and implementing Green IT/IS as indicated in the literature; however, within the aviation industry, there are other factors that do not stand out in the literature including positive image, industry trends, strategic direction, cost savings, and improved IT/IS and business processes within the organization.

- It is interesting to note that a formal IS evaluation is used and conducted at APTH for IS or Green IT/IS investment projects as part of the evaluation process; however, the empirical findings showed that the evaluation is reported as time-consuming and has only been done because they are required to do so. More importantly, some of the interviewees implied that there are factors to be included for an effective IS evaluation process, but to some extent they do not know which factors should be included or excluded to assist in evaluating the projects, and the important thing is that top management does not support it and think it could delay a project's approval. The outcome indicated that this issue is still continuing a decade later, regardless of IT/IS or Green IT/IS investments evaluation.

- Costs identification within APTH is a significant consideration for every project. The empirical findings revealed that APTH appeared to be aware of indirect costs in general and interpreted the varying level of understanding, but indicated to the perception using dissimilar terms. This suggests that the case organization lacks awareness and knowledge of these indirect costs, which shows that cost identification and management are often difficult for them to understand and reinforces the literature regarding the problem of understanding, identifying, managing and controlling the indirect costs. However, when showing the interviewees comprehensive lists of indirect costs including human, organizational and environmental costs, it enhances understanding regarding the identification of indirect costs. The results obtained were compared and interviewees confirmed that most of the proposed indirect costs related to Green IT/IS investments. They were also given the significance level of each indirect cost associated with Green IT/IS investments. As a result, the proposed comprehensive lists of indirect costs were validated, and the original lists of the indirect costs were then extended and used as an extension of the comprehensive lists of indirect costs. There were five more indirect costs raised by interviewees that were not cited in the literature surrounding Green IT/IS investments evaluation. These were: *Downtime, Integration, Conflict of interest, Problems induced by users, and Insufficiency of communication*. Only two indirect cost – *contingent cost and staff turnover* – were dropped from Green IT/IS costs.

- Empirical findings supported the literature by advocating that predefined external pressures (coercive, normative and mimetic) within the aviation industry influence organizations to adopt and implement Green IT/IS, and *normative pressures* is considered one of the most influential factors within this industry. In addition, there were two more external organizational pressures raised by interviewees that were not cited in the literature: *government policy* and *trends of technology development*.

- The empirical findings highlighted the key internal organizational factors affecting Green IT/IS investments within the aviation industry as well as assisting in managing and control Green IT/IS indirect costs. There are two more factors that were considered as highly important in the literature: *positive image* and *leadership skills*. However, within the aviation industry, great emphasis has been discussed and placed on these new factors in terms of assisting in cost management. Moreover, some of the key internal organizational were reported and highlighted that APTH might need further development and improvement for any future Green or any environmental investments.

- In particular, the empirical findings identified in the literature and confirmed that decision-makers or managers are not aware of the availability of various type of non-traditional appraisal techniques. Some interviewees who have better clarification of indirect costs implied that such costs can have a great impact towards investments but they do not know how to handle them. This suggests that the case organization does not yet have a rigorous process for identifying and managing Green IT/IS indirect costs or any budget/process for costing Green IT/IS indirect costs. Apparently, the case organization is sensitive to cost issues or financial stability due to the increasing number of huge projects within the case organization. Therefore, the implications of the identification and management of indirect costs have contributed to the success of Green IT/IS investments, as expressed by the interviewees. The outcome corresponded with the literature by highlighting that indirect costs affect the overall investment, but if they know what they are, they can promptly identify and manage those associated indirect costs.

- It has been identified in the literature, and empirically confirmed in this study, that the incapability and insufficiency of management or decision-makers to identify and manage indirect cost factors allow management to simply use the traditional IS techniques alone, which is not enough for huge project investments, especially those involving many intangible and non-financial factors resulting in negative consequences. As a result, there is a need to find ways, guidelines or mechanisms to assist in identifying and managing indirect costs for a more effective evaluation process of Green IT/IS investments within the aviation industry.

- As empirically confirmed by all of the interviewees that this comprehensive model, which incorporates both external and internal organizational factors together with a comprehensive list of indirect costs into one model, provides a better understanding of Green IT/IS investments evaluation to justify this investment that relies on intangible aspects such as environmental, human, and organizational factors. Moreover, together with the proposed management strategies and mechanisms this would better assist the effective evaluation process, rather than a traditional technique alone, and lead to better cost management and effective decisions regarding the implications of indirect costs from Green IT/IS investments within the aviation industry. After these costs are managed, they can be controlled and reduced, particularly the financial impacts related to budget/cost overruns and under-optimized budget as well as the likelihood of project being successful in the long run.

The points presented above are in keeping with the research proposition of this research. The revisions to the proposed cost management model for Green IT/IS investments evaluation based on the empirical evidences presented in this chapter are to be carried through in the following chapter.

Chapter 6

Revised a Cost Management Model for Green IT/IS Investments Evaluation within the Aviation Industry

As previously discussed in Chapter 2, it is apparent that there is a need for a deeper understanding of Green IT/IS evaluation particularly on indirect cost implications within the aviation industry. The empirical findings of the research have been presented and discussed in alignment with the aim of testing the research propositions presented in Chapter 3. In this chapter, the researcher revises the model based on the empirical evidence in Chapter 5. The purpose for this is the identification of a range of new external and internal organisational factors as well as indirect costs surrounding Green IT/IS investments evaluation within the aviation industry.

The researcher affirms that this research work satisfies the aim and objectives of this thesis and that this is accomplished by enhancing the understanding and knowledge of the decision-makers, researchers, and practitioners for Green IT/IS investments evaluation, by focusing on indirect costs implications within the aviation industry, and results in a more effective Green IT/IS evaluation process.

6.1 Introduction

The evaluation process of whether or not Green IT/IS is worth the investment is inherently ambiguous due to cost overruns and under-optimized budget, both in theory and practice. This is complicated by Green IT/IS having to handle with altering organizational requirements, which are involved with human, organizational, and environmental aspects. Hence, this is considered as a complex interaction between the use of IT/IS with consideration for the environment, and its changing organizational setting as well as environmental demands, demands that organizations address in what way such Green IT/IS investments should be examined and evaluated. Especially critical is how the costs are considered and managed to reduce future financial impacts.

The absence of an appropriate cost management framework and tool, as well as mechanisms to recognize the extensive range of investment implications related to Green IT/IS, especially undefined costs, and payoffs, is discussed. Certainly, the review of literature in Chapter 2 has emphasized on this, alongside with the empirical findings reported in Chapter 5 exemplifying this further. Consequently, the thesis has presented management concerns on the implications, proposing the main factors both external and internal organizational surrounding Green IT/IS investments as well as the development of a cost management model that consists of comprehensive lists of indirect costs. Hence, the model contributes towards a better understanding of Green IT/IS adoption and implementation as well as broaden perspective regarding Green IT/IS investments evaluation, in particular with regard to indirect costs management. The development of a model happens to be well-timed, as the adoption of Green IT/IS is gaining pace, particularly in a fast-growing industry like the aviation industry.

As previously mentioned in Chapter 2 that there is a lack of theoretical frameworks/models for management as well as generic Green IT/IS evaluation tools or cost management models for Green IT/IS, many organizations are employing limited traditional appraisal techniques, and so the management has insufficient understanding and knowledge of those intangible, non-financial and strategic criteria associated with Green IT/IS investments. It is obvious that such issues present management with several concerns, as their consequences are extensive and they can have a great impact on the project's outcome, such as budget/cost overruns, causing the project to fail.

In particular, management might lost attention and drop out their support in case the level, nature, and implications of Green IT/IS indirect costs are uncertain and doubtful, and there is ambiguity regarding payoffs for such investments. The implementation of Green IT/IS involves significant expenditure in terms of costs, particularly the associated indirect costs of such investment; therefore, the lists of identified indirect costs associated with Green IT/IS are provided with the summary (Tables 5.11) of management strategies and mechanisms to reduce the financial impacts of these costs. As the proposed model developed, it became clear that it is now possible and considered to be more accurate to identify main factors, including both external and internal organizational ones, affecting Green IT/IS investments, and a comprehensive range of Green IT/IS indirect costs (human, organizational, and environmental) are presented.

In addition, Green IT/IS investments require a long-term commitment, in terms of various factors including external and internal organizational factors, as previously discussed in Chapter 5. It is apparent that there is a complexity of identifying the relevant factors within the model, which contributes towards the evaluation process surrounding Green IT/IS investments within aviation industry. Therefore, projects that underpin Green IT/IS are complex and need to take into account various factors and indirect cost factors to be carried out effectively and efficiently. Undoubtedly, any organizations that want to adopt and implement Green IT/IS is confronted with decisions, especially indirect costs issues. Firstly, it is whether to invest, or to focus resources on improving other features of the business. This model will also support the robust evaluation of Green IT/IS, through presenting an in-depth understanding of human, organizational, and environmental implications, beyond the traditional financial criteria used by management. Hence, the proposition for this model appears justified as it supports decision-making through pinpointing those issues correlated with Green IT/IS investments evaluation.

Accordingly, the revised model presented (Figure 6.1) is a synthesis of various potential factors to consider for Green IT/IS investments in the aviation industry. The chapter draws together the material presented in the proposition from Chapter 3, as well as the findings from Chapter 5, and frames them into a model based on an analysis and synthesis of the external and internal organizational factors surrounding Green IT/IS investments as well as an identification and management of the lists of indirect costs associated with this investment within the aviation industry. The proposition and the factors of the model are tested in contradiction of the responses of senior directors and supervisors/managers as well as operational staffs in the case study organization to examine if they are borne out by their experiences in the arena. This allows for the proposition and some factors to be effectively negated, especially for the proposition and factors to be revised, based on the particular experience of IT directors and supervisors and relevant managers. The entirety of this will develop the model presented in Chapter 3 from its theoretical underpinning to consideration of how such an evaluation might be attained in practice.

6.2 Revising Existing Green IT/IS Investments Factors Based on the Case Study Findings

Chapter 5 illustrated the data collected throughout this research, so as to test the model proposed in Chapter 3. This purpose of this section is to revise the existing factors based on the empirical research conducted in the case study. The intention of doing this was to identify factors that confirm or contradict with the research proposition, in respect to utilizing these factors in the aviation industry for Green IT/IS investments. Thus, data can be compared with the experiences of others with similar Green or environmental investments. During the development of this research, the researcher has developed a list of factors that are considered significant and drawn from the literature concerning Green IT/IS investments within the aviation industry as a comprehensive taxonomy of internal organizational factors, as well as a list of indirect costs categories surrounding Green IT/IS investments. The main objective of analyzing these factors through prioritizing was to increase the success of Green IT/IS investments in the organizations. The secondary data and responses from mangers of a case organization demonstrates that they have considered different factors and various opinions of indirect costs while adopting and implementing Green IT/IS. This, then, agrees for the comparison of the data.

Hence, the purpose of this section of the thesis is not to offer rigid guidelines on Green IT/IS investments evaluation within the aviation industry; however, it is intended to describe one very definite case study that allows others to compare their experiences to those reported. Consequently, the outcomes is to provide a broader understanding of this emerging phenomenon surrounding Green IT/IS investments evaluation particularly on indirect costs implication from an organizational viewpoint. Therefore, Figure 6.1 is presented as a revised model developed after validating the primary factors and the list of indirect costs factors that can be used as a comprehensive tool and guidelines evaluating indirect costs of Green IT/IS investments before its adoption within the aviation industry. The revised model included below has many implications, but before examining these, it is vital to understand the development of Figure 6.1, which performs the refinement to the proposed model, presented in Figure 3.3 in Chapter 3.

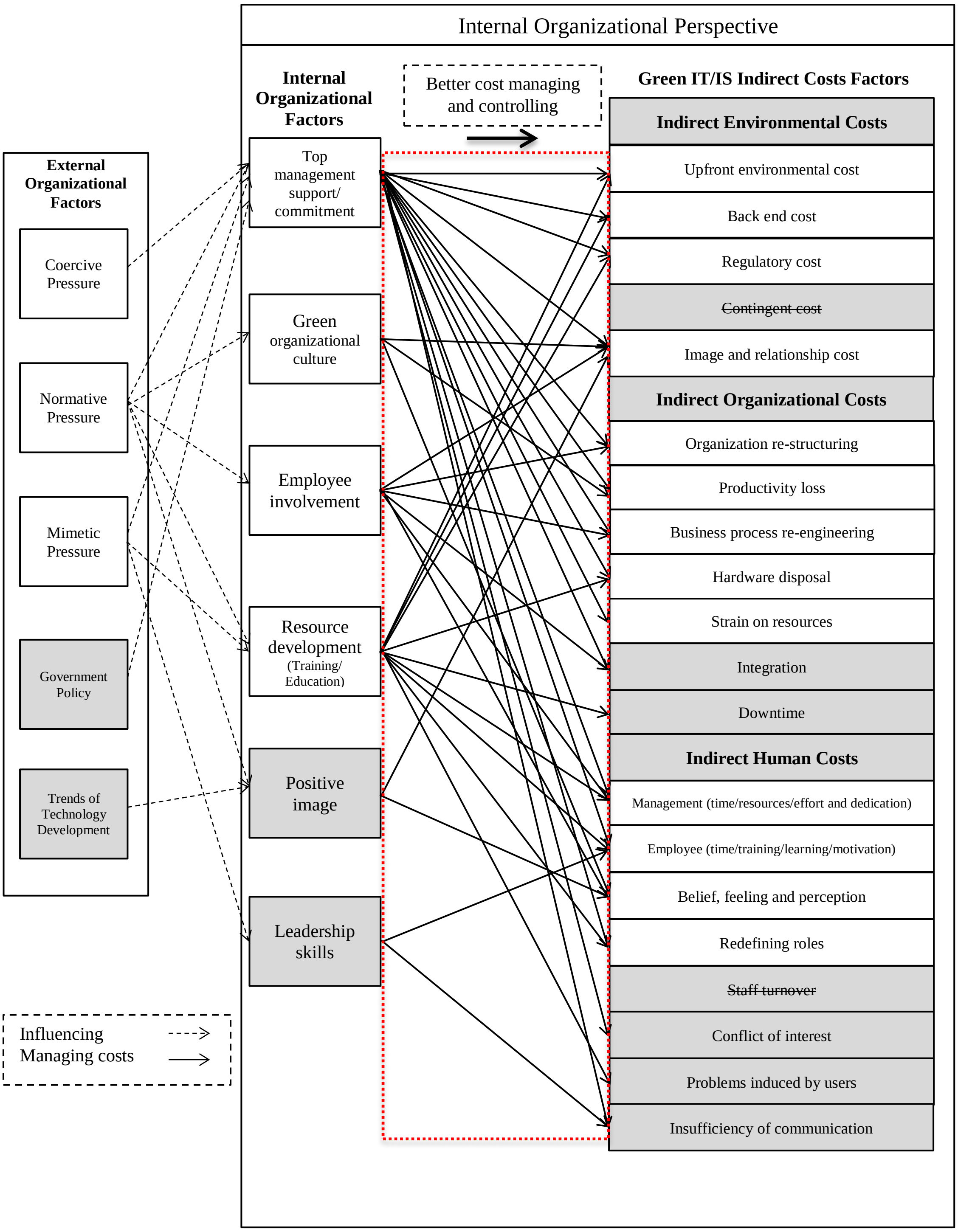

Figure 6.1: Revised Cost Management Model for Green IT/IS Investments Evaluation within the Aviation Industry

Chapter 5 specified the data collection and discussion that was used to develop the revised cost management model for Green IT/IS investments evaluation. The outcome of this is Figure 6.1, which denotes the revised model developed after the testing of each component and identification of distinctive human, organizational and environmental aspects within the model. Meanwhile, Green IT/IS is an emerging phenomenon particularly within aviation industry, thus it is likely to take this model as the solid foundation for future research.

In presenting the revised model, Figure 6.1 illustrated a number of issues, relationships, and their interaction from the data and identified as constructs; that should be taken account of during the evaluation process of Green IT/IS investments. This, then, has resulted in refinements being made to the initial model in chapter 3. For example, in case organizations want to adopt and implement Green IT/IS as well as to justify their investments, decision-makers can now establish whether or not they have the identified key factors and implications as well as indirect costs factors, understand the full costs implication, and are ready to embrace Green IT/IS investments. If, however, those identified factors are not in place or have not been considered, organizations might try to understand, identify and include them as well as consult with the proposed comprehensive model together with the mechanisms given to reduce costs in order to aid effective cost management surrounding Green IT/IS investments.

6.3 Revised IS Evaluation Techniques and Evaluation Process for Green IT/IS

The literature agrees on the view that IS evaluation is key to the successful implementation of a new system (Irani and Love, 2001; Stockdale and Standing, 2006; Piotrowicz and Irani, 2008; Yusof *et al*., 2008b; Bernroider *et al*., 2013), and Green IT/IS in no different (Bai and Sarkis, 2013; Lei and Ngai, 2013a). In this case, the case study organization, APTH, did employ a traditional IS evaluation technique with regard to IT/IS and Green IT/IS projects prior to implementation. However, the interesting point is that they aware that other factors should be included to make the IS or Green IT/IS evaluation process more credible and effective, but they did not actually know what and how factors should be included or excluded to assist in evaluating Green IT/IS investments. The most important things were that decision-makers are lack of knowledge and understanding, ignoring the associated indirect costs as well as top management perceived this as useless and time-consuming because they just wanted to see the typical financial number. Moreover, the senior managers contributed to the research in noting that incorporating external and internal organizational factors, and indirect costs implications for Green IT/IS investments evaluation process would improve the efficient of decision-making process as well as a more effective evaluation process, supporting the proposition of this research. The argument supporting this statement can be found in Chapter 5, Section (5.5, 5.7 and 5.8).

The literature review discovered a series of important factors affecting Green IT/IS investments that might be used to assist in a better understanding of the evaluation process; these are mapped against the case study findings in (Tables 6.1), 6.2, and 6.3 below and detailed in this section. This demonstrates the difference between some perceived circumstances within the case study organization and the literature. There is a strong agreement in the case study between the opinions of those interviewed in the case study and the literature. Thus, the majority of discussion is emphasized on where the literature and the case study do not somewhat match.

6.3.1 Identification of Green IT/IS Indirect Cost Factors

The literature illustrates the indirect costs, namely human and organizational (Irani and Love, 2001; Mohammed and Irani, 2002; Ghoneim *et al.*, 2003). Those are the ones to account for in IT/IS investments evaluation. Moreover, it is sufficient to take into account environmental costs (EPA, 1995; Okafor *et al*., 2013; Bai and Sarkis, 2013) and to include them in the lists of indirect costs in order to assist in evaluating Green IT/IS investments as Green projects heavily rely on environmental components. The following (Table 6.1) maps the potential lists of indirect costs against case study findings.

Green IT/IS Indirect Cost Factors	Demonstrated in the Literature	Case Study Findings
Indirect Environmental Costs		
• Upfront Environmental Costs	√	√
• Back-end Costs	√	√
• Regulatory Costs	√	√
• Contingent (Compensation) Costs	√	X
• Image and Relationship Costs	√	√
Indirect Organizational Costs		
• Organization Re-Structuring	√	√
• Productivity Loss	√	√
• Business Process Re-engineering	√	√
• Hardware Disposal	√	√
• Strain of Resources	√	√
• *Downtime*	X	√
• *Integration*	X	√
Indirect Human Costs		
• Management	√	√
(Time/Resources/Effort and Dedication)		
• Employees	√	√
(Time/Training/Learning/Motivation)		
• Belief, Feeling, and Perception	√	√
• Redefining Roles	√	√
• Staffs Turnover	√	X
• *Conflict of interest*	X	√
• *Problems induced by users*	X	√
• *Insufficiency of communication*	X	√

Table 6.1: Identification of Indirect Costs of Green IT/IS Mapped Against Findings of the Case Study Organization

The case study findings show that there are some factors newly identified in the literature or not identified in the case study. These are deliberated below to provide a better insight into the case concerns.

Indirect Environmental Costs

- **Contingent (Compensation) costs**

  In the existing literature, Okafor *et al.* (2013) revealed that these costs may or may not be incurred at some point in the future (EPA, 1995), for instance, costs of curing and compensating for future accidental releases of pollutants into the environment (e.g. oil spills), fines and penalties, property damage, legal expenses, and harm to natural resources (Okafor *et al.*, 2013). This cost can become dangerous to the environment, if sufficient attention is not paid to it. However, the practical experience of the IT manager went against this, remarking that these costs looked to be necessary in connection with other environmental projects but not for implementing Green IT/IS or IT related projects. The argument supporting this can be referred to in Section 5.5.1.1, Chapter 5.

Indirect Organizational Costs

- **Downtime**

  In addition to the indirect costs of Green IT/IS investments derived from the literature, Downtime was highlighted as an important factor that APTH believed was of significance considerations for the evaluation process of Green IT/IS investments. The fact is that the aviation industry is heavily operated by IT/IS, as this cost could take away valuable operational or routine work time, and it could cost a lot to the organization and the whole system Thus, by altering to Green IT/IS, undeniably there should be mechanisms to offer reassurance that these costs are less probable to occur, especially in this industry. If proper plans such as upgrades or maintenance have been prepared occasionally, the impacts could be significantly reduced.

- **Integration**

  Integration was considered to be another important factor that was not indicated in the existing literature of Green IT/IS investments. APTH noted that in the sense of integration within the organization, in order to achieve effective outcomes, not only should existing IT/IS hardware and infrastructure is integrated but also new systems (Green IT/IS) and people so that they would get used to and accept them. Thus, the likelihood of this cost to happen is reducing.

Indirect Human Costs

- **Staffs turnover**

  As referred to in the existing literature (Ghoneim, 2007), Staffs turnover as a result of IT/IS investment is considered to be one of the most significant indirect costs, mainly when teams do not understand or accept the reasons why organizations need to adopt or implement a new system such as some people leave to join the competitor. However, as applied to Green IT/IS investments at APTH, all interviewees agreed that this cost was not incurred at all. The reason behind this because Green IT/IS investment is a project involving social responsibility, and doing something ethical for organizations and society as a whole. Moreover, based on reviewing some documents and observation at APTH, it seems that salary, fringe benefits, employees' relationship and working conditions of APTH are above average once comparing with the similar position at other organizations in Thailand. That was the reason why this cost was not incurred for Green IT/IS investments within APTH. The argument supporting this can be referred to in Section 5.5.1.3, Chapter 5.

- **Conflict of interest**

  Another important factor that affected the evaluation for Green IT/IS investments at APTH was a conflict of interest. This cost could affect the existing roles and responsibilities of some staffs within the organization. For instance, some of the existing staff would have a decreased workload, but some would have to do more, which could lead to disputes within departments or the organization. Also, some interesting new projects, e.g. Green IT/IS, may have some benefits for certain groups of people involving a third party or personal interests.

- **Problems induced by users**

  Another important factor identified in the findings at APTH is problems induced by users. Along with Green IT/IS implementation, less knowledgeable users would accidentally delete critical files in the system and crash it, change the settings, accept anonymous files by accidentally introducing a virus to the system. This new cost would emerge as a result of some of the new features that users have not received training properly about yet or have less expertise in but are curious to explore on their own. Thus, this cost is considered significant and there is a need to prepare prior to the implementation of Green IT/IS as it consumes more of the IT team's time and energy.

- **Insufficiency of communication**

  Another important factor that affected the evaluation process of Green IT/IS investments at APTH was an insufficiency of communication as it could have a harmful effect when taking decisions and ongoing process of Green IT/IS investments. There might be a lack of communication from top to bottom level; managers might acknowledge that they have already sent messages but these have never reached the bottom line. The communication might have been lost somewhere, not been conveyed properly, or those who were supposed to pass it on to all operational staffs have failed to do so. To avoid the impact of this cost and ensure success in Green IT/IS investments evaluation, effective and efficient communication is fundamental for all party.

6.4 Revised External Pressures Associated with Green IT/IS

The findings of the case study and this research support the existence of some predefined external pressures considered significant within the aviation industry that influence organizations to adopt and implement Green IT/IS. Therefore, these findings support the research proposition in the following table.

External Pressures	**Demonstrated in the Literature**	**Case Study Findings**
• Coercive Pressure	√	√
• Normative Pressure	√	√
• Mimetic Pressure	√	√
• *Government Policy*	X	√
• *Trends of Technology development*	X	√

Table 6.2: External Pressures Mapped against Findings of the Case Study Organization

The case study findings that are not identified in the literature or newly identified in the case study are discussed below to provide a better comprehension into the case issues.

- **Government policy**

  Apart from the existing external pressures derived from the literature, the interviewees in the case study organization noted that Government policy is a significant external pressure influencing Green IT/IS investments within APTH.

This was mentioned because APTH is a state-owned enterprise, and thus some huge investment projects should be in alignment with the government policy and approved by the government or relevant authorities, which should also be provided with regular reports at each stage or as requested, in order to ensure its success in the long run.

- **Trends of technology development**

  Another important factor that should be considered for Green IT/IS investments is Trends of technology development. For instance, IT teams mentioned that the trends of technology development in the developed world, especially environmentally friendly or energy-efficiency technology and Green IT/IS system, are encouraging APTH to adopt and implement for the sake of society, and industry as a whole. It is beneficial to follow these Green trends and new technology that help in saving the environment and later, stimulating an investment on them. Hence, this can also influence APTH to adopt and implement Green IT/IS.

6.5 Revised Internal Organizational Factors Related to Green IT/IS

Equally important, the internal organizational factors identified in the normative literature including "*IS evaluation*", "*Green IT/IS adoption/initiatives*", and "*Green/Sustainable/CSR within the aviation industry*" are highlighted in many studies and have been applied to the case study. The findings in the following (Table 6.3) from the case study support the importance of internal organizational factors identified in the literature, and these will aid the organization in understanding whether they are prepared and ready to embrace the changes that occur in many ways as a result of the introduction of Green IT/IS APTH particularly in assisting the management of Green IT/IS indirect costs, and supporting the research proposition.

Internal Organizational Factors	Demonstrated in the Literature	Case Study Findings
• Top management support/commitment	√	√
• Employee involvement	√	√
• Green organizational culture	√	√
• Resources development (Training/Education)	√	√
• *Positive image*	√ (as sub-factors)	√
• *Leadership skills*	X	√

Table 6.3: Internal Organizational Factors Mapped Against the Findings of the Case Study Organization

The case study findings that are not identified in the literature or newly identified in the case study are discussed below to provide a better insight into the case issues.

- **Positive image**

  Apart from the existing internal organizational factors derived from the literature, the interviewees in the case study organization noted that positive image is a significant internal organizational factors influencing Green IT/IS investments with APTH. As referred to (Table 2.7), it can been seen that this factor might not apparent; however, it emerges mainly in the aviation context (Lynes and Dredge, 2006; Chen, 2012). However, the findings have confirmed that positive organizational image is a prominent factors within APTH surrounding Green IT/IS investments. There is evidence from these findings that it has affected the decision-making process of Green IT/IS evaluation immensely as well as assisting in reducing the impacts of the associated indirect costs within APTH. For instance, Green IT/IS investments can help in building and reinforcing a positive organizational image for APTH and stakeholder groups in the long run. The reason supporting this can be referred to in Section 5.8.5, Chapter 5.

- **Leadership skills**

  The existing literature has identified that leadership skills is also a significant factor within the aviation industry; however, it is not as apparent as other factors (see Table 2.7); however, the findings have confirmed that it is one of the outstanding factors within APTH for Green IT/IS investments to be a success, in that they inspire, drive, and persuade employees and all stakeholders to believe and trust, and act accordingly. However, there is evidence from these findings that it affected the decision-making process of Green IT/IS investments evaluation greatly as well as assisting in reducing the impact of indirect costs within APTH.

6.6 Revised External Pressures Affecting Internal Organizational Factors

Three external pressures derived from the normative literature, namely coercive, normative, and mimetic pressures, are all identified as significant factors which affect organizations in adopting and implementing Green IT/IS (DiMaggio and Powell, 1983; Scott, 2001). These dimensions are used as a theoretical lens to enhance a better understanding of Green IT/IS investments evaluation within APTH. They are all considered as significant elements affecting the evaluation process of Green IT/IS investments within APTH and supporting the research proposition. The case study findings show that there are some factors newly identified in the literature or not identified in the case study, as well as mapped against each other, and these are demonstrated in the following (Table 6.4) to give a better insight into the case issues.

External Pressures / **Internal Organizational Factors**	**Coercive Pressure (E.g. Law and Regulations)**		**Normative Pressure (E.g. Norm, Group/ Association)**		**Mimetic Pressure (E.g. Market Leader/ Competitor)**		***Government's policy***		***Trends of Technology development***	
Demonstrated in the literature (L) / **Case study Findings (C)**	L	C	L	C	L	C	L	C	L	C
• Top management support/ commitment	√	√	√	√	√	√	X	√		
• Employee involvement			√	√						
• Green organizational culture			√	√						
• Resource development (Training/ Education)			√	√	X	√				
• *Positive image*			X	√					X	√
• *Leadership skills*					X	√				

Table 6.4: External Pressures Affecting Internal Organizational Factors Mapped Against the Findings of the Case Study Organization

The case study findings that are not identified in the literature or newly identified in the case study are discussed below to give a better insight into the case issues.

- **Normative pressure influences positive image**

  The case study directors feel that industry standard and aviation association within aviation industry have played a crucial role in trying to protect and reduce carbon footprints into the environment as a whole. By following the industry practices and standards as have been discussed in Section 5.7 would yield many benefits particularly increasing a positive organizational image related to environmental and social responsibility, which are crucial aspects of good corporate governance practice.

- **Mimetic pressure influences resources development (training/education)**
  Pressure from marketing leaders and competitors can not only influence top management to support and implement Green initiatives and practices but also drive resources development such as training and education within the organization accordingly. The IT directors of APTH believed that in achieving sustainable competitive advantage, it is fundamental that employees are trained and educated about the importance of practicing environmental protection. The discussion on this subject can be retrieved in Section 5.7. For example, sharing insights into good practice and developing knowledge of new rules and regulations is essential for future human development if the organization wants to be competitive.

- **Mimetic pressure influences leadership skills**
  The findings have identified that what the existing literature does not focus on is mimetic pressure influencing leadership skills. Competitors and market leaders are significant players in the success of Green IT/IS investments evaluation, particularly in pushing other organizations especially their leaders to strive and imitate the best practices of them in achieving sustainable competitive advantages. According to ICTD as discussed in Section 5.7, APTH truly needs a true leader, who will lead, guide, inspire and be dedicated in motivating staffs constantly both the attitudes and behavior. That person needs to be somebody who can be trusted and will act quickly and know how to empower to team members and delegate responsibility accordingly in moving the organization towards the new Green perspective in the long run.

- **Government policy influences top management support/commitment**
  Government policy plays a vital role in influencing state-owned enterprises in Thailand and therefore APTH. One of the senior management reported that top management decisions whether to support or not, towards the massive investment projects such as Green IT/IS, rely on government policy as well. For example, if the government changes and a new political group comes in if that group does not

support investing in Green or environment initiatives and practices, APTH's projects have to be put on hold or even stopped.

- **Trends of technology influences positive image**

  The IT team at APTH emphasized that they have been updating with innovative, energy-efficiency and Green technology on the trends of new Green technology to invest further in them, which are notable for the industry as a whole to reduce the impact on the environment. As a result, this could increase APTH's positive image because APTH is exposing to the publicity that they are enthusiastic to do something for the environment.

6.7 Revised Internal Organizational Factors Influencing Management Practices

This thesis underlines the importance of a cost management model for Green IT/IS investments evaluation. However, since the evaluation of Green IT/IS investment is still only an emerging trend for this research domain, especially within the aviation industry, there was inadequate available data or research on Green IT/IS investments evaluation studies. Therefore, this research makes an important contributions with its initial summary of the analysis of the effect of external and internal organizational factors, comprehensive lists of indirect costs implications and management practices on how to manage and control the associated Green IT/IS indirect costs for this investment so as to assist in reducing its impacts and increasing the projects' success. The key evidence supporting this statement can be referred to in Chapter 5 (Section 5.9 and 5.9.1). The analysis taken from the literature review is mapped against those suggested by the case study, summarized in (Table 6.5). This forms the basis for the discussion that follows:

Internal Organizational Factors / Indirect Costs Components	Employee Involvement		Resources Development Training/Education		Green Organization Culture		Top management support/commit		Positive image		Leadership Skills	
Demonstrated in the literature (L) / Case study findings (C)	L	C	L	C	L	C	L	C	L	C	L	C
Indirect Environmental Costs												
• Upfront Environmental Costs *(Costs incurred prior to the operation or system e.g. site studies; design of environmentally products/designs/process, permitting, and procurement).*			√	√			√	√				
• Back-end Costs *(Costs related to future costs of closure, decommissioning, disposal of inventory that is not yet in effect but has been proclaimed). These costs will occur at more or less some points in the future).*			√	√			√	√				
• Regulatory Costs *(Costs related to planning, inspection, insurance, pollution control, taxes and fees, normally incurred in operation of a process or systems e.g. additional government impositions, if not comply).*			√	√			√	√				
• ~~Contingent Costs~~ ~~*(Costs of remedying and compensating for future accidental releases of contaminants into the environment, fines and penalties, property damages). It may or may not incurred at some point in the future*~~.												
• Image and Relationship Costs *(Costs related to corporate image and relationship with customers, investors, suppliers, communities, regulators and works and award/recognition programs).*	√	√			√	√	√	√	X	√		
Indirect Organizational Costs												
• Organization Restructuring *(Costs involved with the change to the organization' hierarchy/structure).*	√	√					√	√				
• Productivity Loss					√	√	√	√				
• Business Process Re-engineering *(Costs involved with re-designing of functions and process of organizations).*	X	√					√	√				
• Hardware Disposal			X	√			√	√				
• Strain on resources							√	√				
• Other: *Integration*	X	√					X	√				
• Other: *Downtime*			X	√								
Indirect Human Costs												
• Management (Time/Resources/Effort and Dedication)	√	√	X	√			X	√				
• Employee (Time/Training/Learning/Motivation)			√	√			√	√			X	√
• Belief, Feeling and Perception			X	√	√	√			X	√		
• Redefining Roles			X	√			√	√				
• ~~Staffs Turnover~~												
• Other: *Conflict of Interest*							X	√				
• Other: *Problems induced by users*			X	√								
• Other: *Insufficiency of communication*							X	√			X	√

Table 6.5: Internal Organizational Factors that Assist in managing the Associated Green IT/IS Indirect Costs Mapped Against the Case Study Finding

Table 6.5 shows the internal organizational factors identified in the literature that assists in managing the associated Green IT/IS indirect costs mapped against the case study findings that are not identified in the literature or newly identified in the case study. In addition, there are detailed guidelines consisting of mechanisms and management strategies (see Section, 5.9.1, Table 5.11) for the reduction of financial impacts such as budget overruns, under optimized-budget. Therefore, the implications of management of indirect costs for the success of Green IT/IS projects at APTH are provided for an effective cost management (see Chapter 5, Section 5.11).

6.8 Contribution of the Revised Model

There is considerable evidence that APTH's proposed technique and model for Green IT/IS investments evaluation is a close match to the proposed model originated from the literature in Chapter 3. Especially, there is evidence through identifying factors such as external and internal organizational ones, together with referring to the lists of categorized Green IT/IS indirect costs, including environmental, human, and organizational, is considered effective cost management surrounding Green IT/IS investments evaluation. The interviewees supported the mainstream of the specific factors that were identified in Chapter 3 (see for example, Tables 6.2, 6.3, 6.4, and 6.5), which gained support for the solid foundation of this model. Nevertheless, they support the development of the model. Fundamentally, the data gathered from APTH contributes to the normative literature by:

- Combining and extending existing research in Green IT/IS investments evaluation, Green IT/IS indirect costs in the context of aviation.
- Utilizing the existing theory (i.e. institutional theory) as a theoretical lens in understanding external pressures affecting internal organizational factors, together with a comprehensive list of indirect costs.
- Improving the effectiveness of Green IT/IS investments evaluation particularly on indirect cost implications.
- Providing guidelines for cost management for Green IT/IS investments projects.
- Reducing the likelihood of project failure and budget overrun, while increasing the possibility of the project to be successful.

- Offering better insight for decision-makers (i.e. IT, Green IT/IS, CSR or equivalent managers) and those who are involved in the evaluation of Green IT/IS investments projects.

In addition, the revised cost management model makes a significant contribution to the emerging literature of IS evaluation, and Green IT/IS investments evaluation on indirect costs within the aviation industry by presenting an incorporation of all factors from the existing literature which is now grounded on empirical data. Notably, this study confirms the validity of the existing research and that issues identified as an important for Green IT/IS investments in other settings are valid in the aviation industry. Thus, the model has been developed by:

- Incorporating a comprehensive variety of research studies and factors of Green IT/IS investments evaluation and indirect costs components into one model.
- Offering a comparative of evaluation concerning a comprehensive range of Green IT/IS factors and a set of indirect costs in accordance with management experiences, producing a more robust outcome.
- Presenting a new set of guidelines and mechanisms to reduce the financial impacts of Green IT/IS projects.
- Developing a new established of potential research directions for exploration in the future.

The revised model, therefore, is well-defined and detailed theoretical and practical implications for both the aviation industry and for researchers.

6.9 Summary

This chapter has offered and examined the significant findings from an in-depth case study of Green IT/IS investments evaluation by focusing on indirect costs within the aviation domain. The conclusions are in keeping with the research proposition specified in Chapter 3, whereas the amendments to the main model are presented in this chapter. The key conclusions stimulated from these findings on investigating Green IT/IS investments evaluation by focusing on indirect costs within the aviation industry are reviewed below:

- The chapter presented an analysis of the external pressures from theoretical grounding, internal organizational factors, and a comprehensive set of indirect costs (environmental, human, and organizational) in the context of the aviation industry.
- The outcome model is an incorporation of the factors validated against the experience of directors, supervisors, and operational staff from various departments such as IT, Financial, Environment, Human Resources, Business Development, and CSR in the case study organization.
- The model is a synthesis of various factors drawn from many other literature and disciplines, providing added credibility to the model.

The revised model presented in this chapter adds new criteria and negates some that were initially identified in Chapter 3. These can be usefully formulated, separated and used in understanding each aspect of Green IT/IS investments evaluation. They include, for instance, external organizational factors affecting Green IT/IS and internal organizational factors influencing management practices with regard to indirect costs implications. Guidelines and mechanisms on cost management are also included. In terms of Green IT/IS investments evaluation, drawing together (Tables 6.2, 6.3, 6.4 and 6.5), thus the revised findings are presented in the following (Table 6.6).

Classification	New Findings	Identified in Conceptual Model (Chapter 3)	Supported by Case Study Findings (Chapter 5)	Added by Case Study Findings (Chapter 5)
External Organizational Factors				
	Government's policy	No	Yes	Yes, large investment projects need to be relevant to government policy in order to get approval.
	Trends of technology development	No	Yes	Yes, new technology trends in reducing environmental impact may change the decision to adopt such technology.
Internal Organizational Factors				
	Positive image	Yes (as a sub-factor)	Yes	Yes, it becomes a prominent factor within aviation industry regarding Green IT/IS investments. APTH concerns so much about organizational image.
	Leadership skills	No	Yes	Yes, it is an outstanding factor to drive changes predominantly for Green IT/IS within the aviation industry.
Indirect Costs Factors				
	Contingent (Compensation) cost	Yes	No	APTH commented that this cost was incurred only for a common environmental related project but not for Green IT/IS or IT aspects.
	Integration	No	Yes	There must be the integration of and alignment between the system and people.
	Downtime	No	Yes	Proper plans such as upgrades and maintenances should be prepared in advance to reduce impacts

				gradually.
	Conflicts of interest	No	Yes	The introduction of new division/position might gain more authority leading to a limited power and better job opportunities for some roles.
	Problems induced by users	No	Yes	Unexpected behavior displayed by users in installing files or deleting important files due to lack of training or knowledge on the new system.
	Insufficiency of communication	No	Yes	The values of internal staff communication are significant. Insufficiency in communication could ruin the success of Green IT/IS investments.
	Staffs turnover	Yes	No	Employees have been treated well such as good working conditions, high pay and high level of satisfaction. Despite the huge investment in Green IT/IS, they believe that they can still get the same benefit and it is something good for the environment in general.

Table 6.6: Summary of the Revised Findings of External and Internal Organizational Factors and Indirect Costs of Green IT/IS Investments within the Aviation Industry

The key implication of the (Table 6.6) is a close match between the initial model and the empirical evidences in Chapter 5. This proposes two significant findings; for example, firstly, the fundamental cost management for Green IT/IS investments evolution model specifically on indirect costs are robust and extensively shared and secondly, it is valid to Green IT/IS evaluation. The interviews yielded two additional external organizational factors that might influence Green IT/IS investments within APTH, namely government policy and trends of technology development.

An organization such as APTH, which is a state-owned enterprise, undeniably needs to take into account an external factor such as government policy. The fact is that large investment projects affect the government authority, in this case the ministry as well as multiple stakeholders. This is the reason why government policy has an influence over the aviation industry in Thailand. Moreover, Green IT/IS investments is considered emerging environmental initiatives and practice that assists in reducing the extensive impacts that IT operations have on the environment. Thus, trends of technology development in terms of innovative and energy-efficient technologies that reduce those impacts must be followed continuously, and it is vital for organizations to adopt and implement them. The more up-to-date and energy-efficiency technology are used for the sake of the environment, the more likelihood there is of reducing the impact from IT operations.

Furthermore, there are some differences roles of internal organizational factors involving positive images, as it is prone to be apparent for Green IT/IS investments within APTH in the findings. Positive image is considered a crucial factor in the decision-making process surrounding Green IT/IS, in that while APTH were considering whether or not to adopt projects, they were aware of the need to boost their image in addressing matters of public concern. This again, may reflect how APTH value its organizational image immensely. However, leadership skills have appeared as an important factor within the aviation industry assisting in guide and drive organizations to achieve goals quickly and positively in the long run especially within this industry.

The only aspects of the original model in Chapter 3 in the comprehensive list of indirect costs that were not supported were staff turnover and contingent costs. In this respect, this may well reflect how APTH have been willing to adopt and implement Green IT/IS because they are a socially responsible organization following a Green path, and nobody wants to leave the organization for this investment. Employees have been treated satisfactory such as good working conditions, high pay and high level of contentment when comparing to the same position at other organizations in the same industry. Despite the huge investment in Green IT/IS, they still believe that they still get the same benefit and it is something good for the environment in general. Moreover, in the case of APTH, contingent (compensation) costs are reported, as they are not incurred within the boundaries of Green IT/IS as usually appears within environment-related projects. Also, downtime and integration are new indirect organizational costs incurred for this project due to lack of upgrade or consistency in maintenance. There is still an integration issue particularly due to a lack of communication to assist to the integration of existing systems and infrastructures with new systems and people with new systems.

Furthermore, new emerging indirect human costs, including conflict of interest, problems induced by users, and the insufficiency of communication are incurred; those costs are associated mainly with inadequacy of resources development (training/education), and also communication from top to bottom level is inconsistency and needs to be taken into considerations. There are reasons previously stated in Chapter 5 for the emerging of these new indirect costs associated with Green IT/IS investments at APTH. As a matter of fact, that various reasons would place on the nature of the organization as it is a formal and vertical integration and the problems occur because top management needs to support and truly commit to investments; staffs do not have enough training and knowledge on relevant and specific subjects, and also there is the lack of a framework or proper mechanisms to deal with and reduce the impacts of the associated indirect costs.

Consequently, the findings from the interviewees closely support the research proposition and the factors derived from the existing literature, and this contributes to the robustness of the proposed model. Although, there is a formal evaluation process before the implementation of Green IT/IS projects; however, the IT directors and supervisors accepted the fact that this traditional technique is not sufficient due to many intangible, non-financial and strategic aspects especially for Green and environmental projects for a more effective evaluation process. In addition, there was a lack of true understanding and knowledge about this and also it was believed to be time-consuming and wanted to get it done. More importantly, APTH has experienced overrun and failure of projects due to the lack of proper strategy and mechanism as well as the inability to identify and manage them. Therefore, the interviewees were clear now about the necessity for a more completed costs model focusing on indirect costs management are required because they are a significant criterion to the successful of Green IT/IS investments in particular projects that relate to environmental concerns. Finally, this comprehensive model can assist in reducing the financial consequences of Green IT/IS or environmental-related projects.

Chapter 7

Conclusions

This closing chapter of this thesis starts by presenting the way in which the research aims and objectives have been achieved. The main findings and conclusions obtained from the literature and empirical evidence reported in the thesis is demonstrated, together with an assessment of the study's implications and limitations. In this manner, the research novelty and contributions are examined and discussed in theory and practice. Lastly, recommendations for further research are presented.

7.1 Introduction

Green IT/IS is progressively being adopted and implemented within organizations, regardless of sectors, including the aviation industry, so as to help towards maintaining and protecting a sustainable environment. Regarding the unpredictability of climate change, global warming, and environment-related issues have emerged, so organizations within this industry are more concerned about attempting to reduce the impacts of their IT/IS operations on the environment.

This research highlights that Green IT/IS within the aviation industry is an emerging phenomenon and there are vital issues to be addressed in order to assist in better understanding, add to new knowledge, and support effective business processes in a sustainable way. Despite several benefits that Green IT/IS offers, indirect costs implications, are apparently critical issues for organizations within the aviation industry in taking a further step towards this huge investment (i.e. Green IT/IS). There are increasing financial pressures, including budget limitation and costs restriction, on organizations that want to adopt and implement Green initiatives and practices including Green IT/IS. This is due to the higher costs of environmentally friendly technologies, so there is a need to understand the indirect costs implications and payoffs of such technologies if organizations want to sustain business operations in the long run in particular decision makers do not have adequate knowledge and understanding to overcome and diminish the consequences from Green IT/IS investments.

Nevertheless, the evidence suggests that Green IT/IS indirect costs associated with such investments comprise much of the budget, hidden or otherwise. More importantly, it is apparent that organizations constantly seek a sustainable competitive advantage through effectively cost-managing Green IT/IS. Organizations try not only to reduce the associated costs of Green IT/IS but also to identify Green IT/IS related indirect costs and ways to manage them effectively and efficiently.

Essentially it is necessary for decision-makers to be able to explore and understand various factors, including external and internal organizational factors, as well as identify and manage associated indirect costs emerging from such investments, so as to achieve a more effective evaluation process for Green IT/IS investments, focusing on indirect costs. Therefore, the aim of this thesis is proposed to assist in a better understanding and a more effective evaluation process by emphasizing on cost management, while reducing financial impacts that are associated with this investment.

The literature indicates that a limited number of Green IT/IS evaluation models exist and there is a lack of a theoretical model for Green IT/IS model particularly for indirect costs implications; also, none of the Green IT/IS evaluation model exists within the context of aviation. It is apparent that the existing models/framework are not common, thus their validity and applicability is doubtful; nevertheless, some understanding about Green IT/IS investments evaluation can be taken out from them. Hence, the overall applicability of the existing Green IT/IS evaluation models cannot deliver the same results in the aviation context, especially any of the cost management models that have emerged to reduce the impact from indirect costs. As a result, it has been claimed that Green IT/IS evaluation particularly indirect costs within the aviation industry has been neglected in the research literature, resulting to a number of voids. Thus, this research addresses the increasing need to investigate Green IT/IS investments evaluation within the aviation industry by focusing on indirect costs implications.

The intention was to develop a model or a framework that would assist and broaden decision-makers in understanding of Green IT/IS investments evaluation as well as enhancing a more effective evaluation process within the organization due to the demand of environmental considerations, and enabling them to consider investing in such technologies that assist and sustain the business process, meanwhile taking out the issue of cost and budget overruns or under-optimized budget but reducing financial impacts associated from indirect costs. If the indirect costs can be identified, it means they can be managed; however, such management practices could then help to reduce and control the overall consequences of the costs of this investment. This would result in the effective and the efficient cost management of Green IT/IS investments within aviation industry. Therefore, this research assists in enhancing the understanding of the significance and management of the indirect costs of investing in Green IT/IS within the aviation industry, which contributes to both theoretical and empirical levels.

7.2 Meeting the Aim and Objectives

To achieve the aim of the thesis, there are a number of objectives were illustrated in Chapter 1. Chapters 2, 3, and 4 presented the literature review, model development, and research design respectively, and the findings were discussed and highlighted in Chapters 5, 6 and 7. The following (Table 7.1) below are summarized and analyzed how the objectives have been achieved.

Objectives	Chapters
1	Chapter 1 and 2
2	Chapter 2 and 3
3	Chapter 3 and 4
4	Chapter 5, 6 and 7

Table 7.1: Research Objectives Mapped Against the Thesis Chapters

Objective 1: To critically review the literature in the area of IS evaluation and the Green IT/IS research area including adoption, investments evaluation and indirect cost implications of the research areas with a particular focus on the aviation industry.

- Based on the literature review, several research gaps were identified and were further examined and investigated by the researcher (Chapters 1 and 2).

Objective 2: To identify factors influencing Green IT/IS investments including external factors, internal organizational factors and IS evaluation (i.e. indirect costs factors) associated with Green IT/IS investments.

- Based on the critical analysis of the literature, Chapter 2 presented a comprehensive literature review related to IS evaluation, Green IT/IS investments evaluation (i.e. indirect costs), Green IT/IS initiatives/adoption, and Green/sustainable/CSR issues within the aviation industry. Thus, this enabled the researcher to identify associated factors both external and internal organizational factors influencing Green IT/IS investments and create a comprehensive set of indirect costs factors. It was identified that there is an absence of theoretical models/frameworks surrounding with Green IT/IS evaluation, particularly indirect costs implications, within the aviation industry (Chapters 2 and 3).

Objective 3: To propose and develop a conceptual model for Green IT/IS investments evaluation focusing on indirect costs within the aviation industry.

- Based on the research issues identified in Chapters 1 and 2, in Chapter 3 the researcher proposed the conceptual model for Green IT/IS investments evaluation model, focusing on indirect costs in the aviation industry, that consists of IS evaluation (indirect costs factors), external factors derived from institutional theory, and internal organizational factors drawn from existing literature. In order to validate the proposed conceptual model, an appropriate research methodology was justified and clarified in Chapter 4.

Objective 4: To analyze the empirical results and validate the model to the proposition, for a revised cost management model for Green IT/IS investments, focusing on indirect costs.

- With the aim of justifying the research methodology and using it to validate the proposed conceptual model, Chapter 5 analyzed and presented the empirical data collection from an in-depth case analysis of an aviation organization in Thailand. In doing this, the conceptual model proposed in Chapter 3 was tested and validated. In Chapter 6, the research findings drawn from the case study were determined and used to revise the model so as to provide decision-makers with a revised cost management model for Green IT/IS investments evaluation within the aviation industry. Chapter 7 begins by summarizing the thesis and offering conclusions that are drawn from both the literature and the empirical evidence reported in this thesis. After this, the limitation of the research and the novel contribution it offers is discussed, and recommendations are provided for future work.

The achievement of the abovementioned objectives was made feasible through the development of a novel model for the analysis of issues surrounding Green IT/IS investments evaluation focusing on the indirect costs within the aviation industry. The establishment of the model has contributed to both theory and practice from the existing literature was one of the key developments. It extends the present research on Green IT/IS evaluation to a new perspective, and it presents a useful model for those adopting and implementing such emerging Green technologies within the boundaries of environmental considerations by focusing indirect costs. The evidence gathered from the case study indicates that it has a robust underpinning.

7.3 Research Findings

In drawing the findings from the research reported, there are two dimensions to the conclusions. Firstly, there is the literature review revealed in Chapter 2 and incorporated together in the model presented in Chapter 3. Secondly, there are the outcomes of the case study in an organization within the aviation industry in Thailand that was already adopted and implemented Green IT/IS; the empirical conclusions were drawn and presented in Chapter 5. Therefore, two contrasting views through which to interpret the findings are offered and can be used to present the conclusions. However, there is no claims for generalization is made for interview research of this type. It is not the intention of this thesis to offer prescriptive guidelines for Green IT/IS investments evaluation within the aviation industry, but rather to describe case organization perspectives that allow others to relate their experiences to those reported. Hence, this thesis offers a broader understanding other phenomenon of Green IT/IS evaluation within the aviation industry. The important findings obtained from this research are emphasized below:

- A number of organizations highlighted the need for environmental considerations so as to enhance and sustain their business processes in particular IT operations by adopting and implementing Green initiatives and practices, including Green IT/IS. The aviation industry is increasingly aware of and responding to environmental issues as the industry itself has a tremendous effect on the environment; undeniably, this industry depends heavily on IT/IS operations. Thus, APTH is considered as a pioneer and leading organization within the aviation industry in Asia, in that it is concerned about the environment and putting effort into Green investments (i.e. Green IT/IS), such as Green IT/IS data center upgrading, Green IT infrastructure consolidation, and more.

- This growth of Green IT/IS adoption and evaluation within the aviation industry has not been much in the attention of academic research, and a need obviously appears for a more theory-building (i.e. Green IT/IS evaluation) as there is a dearth of theory development/theoretical model and use in this research domain.

- The findings drawn from the literature on IS evaluation, Green IT/IS, and Green/Sustainable/CSR within an aviation context highlighted that Green IT/IS investment can have significant effects on organizations (i.e. APTH), particularly in terms of indirect costs implications associated with various factors, including human, organizational, and environmental. Therefore, this comprehensive tool evolving with Green IT/IS investment evaluation that focus on the understanding of various factors affecting Green IT/IS investments as well as the identification and management of costs implications (i.e. indirect costs) surrounding such investment are needed before its adoption, thus justifying the necessity for the proposed model.

- There is a dearth of a theoretical framework or model for understanding Green IT/IS evaluation within the aviation industry. Besides, there is also lack of a particular framework or model for identifying and managing costs associated with Green IT/IS investment. The proposed model focuses on incorporating various key factors, including external factors utilizing existing theory (i.e. institutional theory) and internal organizational factors derived from various different studies in the literature resulting in a comprehensive taxonomy of internal organizational factors. It then assists in facilitating the identification, management, and control of the indirect costs within the Green IT/IS budget through the suggested mechanisms and strategies, and helps decision-makers within the aviation industry in planning a more accurate financial plan for their cost evaluation of Green IT/IS system so as to reduce financial impacts associated with such investment.

- It has been identified in the literature and empirically confirmed that the single use of the traditional IS evaluation techniques alone such as CBA, ROI, or PB is no longer adequate to evaluate the investment, particularly for strategic projects that take into account environmental considerations. The limitations and concerns over the use of such techniques are apparent; however, decision-makers are incompetent to consider other factors to include, and are not aware of the availability of various range of non-traditional appraisal techniques. Also, they do not actually know what should be incorporated in order to make a more effective evaluation process.

- It has been empirically identified that although perceived cost savings are considered to stimulate Green IT/IS investments in the long run, in reality, Green IT/IS cost consideration is frequently biased and vague. Empirical findings show that these costs may not be financially quantifiable, as they are involved with human, organizational, and environmental dimensions. The acknowledgement of such factors has significant implications during decision-making, as it stimulates a more effective evaluation process. However, traditional appraisal techniques cannot accommodate the intangible and non-financial aspects as they may not be identified and managed. Consequently, this underlines the need for a more complete indirect costs implications model, which has resulted in the development of a cost management model that integrates human, organizational, and environmental cost factors together with key factors surrounding the investments evaluation into one model.

- The implications of the identification and management of indirect costs have contributed to the success of Green IT/IS investments. As the interviewees stated the costs management mechanisms and strategies table would be valuable for evaluation of Green IT/IS and environmental-related investments in future projects. It is evident to them that indirect costs affect the overall investment; previously the interviewees do not know what these are. However, if they know what these associated indirect costs are, and then they could promptly identify and manage them to reduce the consequences. This would make the projects more cost-effective and strengthen the financial position of the organization.

- The empirical findings highlight that this comprehensive tool, which incorporates both external and internal organizational factors together with a comprehensive list of indirect costs, assists in a better understanding of the evaluation process of Green

IT/IS investment than that gained from using than a traditional technique. This justifies the use of the tool in evaluating such investments in particular cost perspective, which relies on intangible aspects, such as indirect human, organizational, and environmental costs, as it would better assist the decision-making process, making a more effective in cost management, and takes into account the implications of indirect costs.

The findings presented are in alignment with this study's initial research proposition. One key conclusion from the support for the model in Chapter 5 is that traditional IS evaluation techniques do apply to Green IT/IS investments within the aviation industry, but non-financial or intangible factors are not included. Green IT/IS is clearly a significant means by which the aviation industry can sustain its business operations in the long run while taking responsibility for the environment and achieving its moral responsibilities towards society as a whole.

More importantly, the researcher has argued that the singular use of traditional investment appraisal techniques are narrow-minded and inappropriate for strategic investments, particularly for a large-scale investment including Green IT/IS investments. Due to the fact that such techniques are unable to accommodate the complexity of the factors that are associated with this investment. As a result, the researcher was proposed a more specific cost management model focusing on indirect costs should be developed in order to broaden perspectives during the evaluation process. Also, the development of a model that integrates those factors, including the external and internal organizational factors that enhance the understanding when organizations taking a decision to adopt and implement Green IT/IS as well as various indirect costs factors, indicates that this proposition has wider implications for the entire organization. In addition, it acknowledges that such factors have significant implications during decision-making as it promotes a more thorough and effective evaluation process. In doing so, the revised model provides decision-makers with a rigorous cost management model for Green IT/IS investment evaluation focusing on the management of indirect costs, which agrees with views in the existing literature and has some empirical validity.

7.4 Research Novelty and Contribution

The most vital purpose of any thesis is to provide a contribution to knowledge of specific issues or to both academics and practitioners community. In this case, the main contribution is to break down the process of Green IT/IS investments evaluation focusing on indirect costs by drawing on a wide range of existing literature within the research-related areas on factors affecting Green IT/IS investments within aviation industry. In particular, the cost management model is shown to be applicable but needs to be adapted and adjusted to reflect particular issues associated with Green IT/IS investments evaluation within the aviation industry. As a result, it is here that the theoretical and practical contributions that this thesis makes to extend the boundaries of knowledge is presented. The research novelty claimed is presented:

7.4.1 Theoretical Contributions

This research has allowed for the development of a comprehensive model that contributes to the existing knowledge within the literature of IS evaluation, Green IT/IS investments evaluation, and Green/Sustainable/CSR within the aviation industry. It achieves this by articulating IS evaluation techniques focusing on indirect costs and external and internal organizational factors that need to be considered when adopting Green IT/IS for organizations within this industry. The model presented can be justified by the results of an in-depth case study. Combining both the literature and the findings has created a useful model for investigating Green IT/IS investments evaluation focusing on indirect costs within the aviation industry. Therefore, this research extends the boundaries of knowledge as presented below:

- The first contribution of this research pertains to the development of a comprehensive taxonomy in three different areas including Green IT/IS adoption, IS evaluation and Green/Sustainable/CSR within the aviation industry (Table 2.7, Section 2.8). It does this by identifying, contrasting and mapping the relevant factors affecting Green IT/IS investments. This articulation assists in the identification of the key internal organizational factors for Green IT/IS investments within the aviation industry. The outcome of this comprehensive taxonomy can be useful for researchers aiming to adopt or adapt it to be used in other contexts of their studies, as it can provide a new perspective that can be extended for future research surrounding Green IT/IS evaluation.

- The second contribution is the development of theoretical model/frameworks of the cost management model for Green IT/IS investments evaluation. It has contributed to and extended the literature for the reasons that there is a lack of theoretical frameworks/model within Green IT/IS research studies particularly evaluation including calls for more academic research within the aviation industry. As a result, this research originally applies an institutional theory as a theoretical lens that has never been used before in this particular context. In addition, the novelty of this model is its incorporation of various organizational factors, both external and internal, together with a comprehensive list of indirect human, organizational, and environmental costs into one model. The model then assists in the identification and management of indirect costs, in particular by proposing management strategies and mechanisms to manage and control the impacts from indirect costs surrounding Green IT/IS investments within the aviation industry. This comprehensive model is then validated and revised with the identification of new costs and relevant factors. It is through the above that the model gains its novelty and contributes to knowledge.

- Thirdly, another contribution is the identification of an additional indirect costs category, which is *indirect environmental costs*. By incorporating them into the existing lists of indirect human and organizational costs of IT/IS investments evaluation, it can assist in broadening new viewpoints on costs evaluation, particularly on Green IT/IS. Hence, this indicates the more effective evaluation processes of Green IT/IS investments evaluation are due to the nature of this investments taking into account an environmental aspect. Therefore, this extends the existing knowledge.

- Lastly, the empirical evidence resulted in another contribution, which is the identification of new external and internal organizational factors as well as new indirect costs factors affecting Green IT/IS investments within the aviation industry. The outcome of these new factors can enhance a better understanding of the factors or can be further used by other researchers within this research domain.

7.4.2 Practical Contributions

This outcome of this research is highly important to the aviation industry, IS researchers, policy-makers, practitioners, organizations and decision-makers such as IT, Green IT/IS, Financial, CSR or equivalent managers or directors who are involved in the evaluation process within this industry, as it offers them with a more profound understanding of key factors (both external and internal organizational factors) that advocate or hinder Green IT/IS investments. This comprehensive tool will also help facilitate and formulate an organization's strategies with concern for the environment when taking a decision to adopt and implement Green IT/IS. Accordingly, this research offers rich insights when identifying and managing the indirect costs of Green IT/IS investments particularly the ways to manage and control the associated indirect costs. Thus, this study contributes practically as follows:

- At one level, this comprehensive model will be supportive for top management who finalize Green IT/IS projects' approval (such as CIO or CEO) to apprehend a bigger picture of the overall budgets (both financial and non-financial aspects). It will also act as a guideline when top management needs to make the important decision of whether or not to invest in these investments based on the accuracy of the comprehensive lists of cost factors and relevant factors to be considered surrounding Green IT/IS investments. This can yield more effective decision-making and increase the likelihood of projects being successful.

- Another level is when managers such as IT or Green IT/IS managers who are dealing with the day-to-day operation can make use of this comprehensive model as it assists them develop an understanding of the significant factors associated with the investments evaluation and the connection to cost management. For example, how the external factors influence the internal organizational factors, which then result in the management of each particular indirect costs surrounding the investment. Also, the outcome in this research offers cost management strategies/mechanisms and guidelines (see Table 5.11) to assist in managing and controlling such costs. For instance, organizations develop a deeper understanding of Green IT/IS indirect costs implications, and when each of the indirect costs is prone to occur within the IS life-cycle stages, those managers can prepare themselves to reduce its impacts. It can be useful for them because if they know what they are, they can manage and control them, resulting in the success of projects in the long run. This is due to the fact that it usually takes times to identify the indirect costs because of the complexity of the nature of the indirect costs, which can lead to the problems of costs and budget and time overruns. For example, when organizations and decision-makers need to make a decision on Green IT/IS investments, they can consult and check the comprehensive model and management strategies, especially on costs, and justify their investments.

Therefore, the revised model can be utilized to investigate whether or not such factors are significant in the success or otherwise of specific investments. Consequently, a comprehensive model has been developed to overcome the limitations of traditional appraisal techniques that often use to justify IT/IS or Green IT/IS investments. In particular, it assists in investigating and managing indirect costs of Green IT/IS investments within the aviation industry in preparing a more realistic financial plan that includes non-financial and intangible components in the future.

7.5 Research Limitations

Nevertheless, it is clear that there are some limitations within any research study below:

- The research context is limited only to Thailand. It may be challenging to generalize the results of this research to other countries. However, the main criteria was to compare and contrast the empirical findings with other aviation organizations that adopted and implemented Green IT/IS. Thus, this study provides substantial empirical evidence towards such limitations. For example, the case organization is in a strong and leading position in this industry such as being in the top 20 busiest airports in the world, fast-growing in its facilities and infrastructures and striving heavily to go Green and initiate sustainability in line with international standards.

- Some of the additional data cannot be accessed because of some restrictions to the confidential documents e.g. budget reports/proposals in the organization studied. Also, some appointments with key individuals such as IT directors were frequently postponed. Owing to the restrictions of time and resources, it does not affect the regular analysis and the outcome of this research in particular on costing; consequently, this research delivers and confirms the accuracy of the data collected during the interview and the importance of the empirical findings within in this research domain and its context.

7.6 Recommendations for Further Research

Despite the fact that the empirical evidence validated the model, there is an opportunity to develop this research domain further. Considering the reflections and the confinements of the study, it is advocated that further research could valuably be followed as presented below:

- As aviation organizations in other countries may be unique in their functioning actions and processes, it could be possible to adopt this Green IT/IS investments evaluation model that focuses on indirect costs by applying it to other countries. Along these lines, the outcomes of this research can also be extended in other industries as Green or environmental initiatives are increasingly being adopted and implemented by many organizations. For example, the oil and gas industry or the manufacturing industry would be worth focusing on as these industries impact greatly on the environment. Therefore, attaining an understanding of this research area in different sectors is suggested.

- The identification of Green IT/IS investments evaluation of key factors and indirect costs factors across the model's development have proven those concerns crucial within the aviation organization studied. Therefore, more case studies (i.e. multiple case study method) within this research domain within the aviation industry are recommended, as it would be compelling to compare and contrast the results with other cases.

- The number of researches on Green IT/IS evaluation is limited, and most of them paid more attention to benefits rather than costs. However, this research focuses on the costs and specifically investigates indirect cost implications associated with Green IT/IS investments. Therefore, it will be beneficial if a further research of this domain looks at the benefits realization of Green IT/IS investments.

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Appendices

Appendix A

Completed Research Ethics Forms

Brunel
UNIVERSITY
LONDON

Brunel Business School
Research Ethics Form
PhD Students and Staff

Any research that involves human participation, the collection or study of their data, organs and/or tissues, and that is carried out on Brunel University premises and/or by Brunel University staff or Brunel University students under the supervision of Brunel University staff requires ethical approval.

This document is designed to help you ensure that your research is conducted in an ethical manner. It is the "Ethical Clearance" part of your research (whether it requires funding or not). You need to submit this form with your research documents. In addition to this and other requirements for your project, you might need to submit three documents – see Ethics Submission Guidelines for PhD-Staff for consideration by BBS Research Ethics Committee:

1. A Participant Information Sheet (created by you)
2. A Participant Consent Form (created by you)
3. A Company Confidentiality Agreement Form (created by you, not always required)

Section A – Information About You and Your Research Project

This is used to identify you and to give us a brief overview of your project.

Name: Miss Salakjit Jongsaguan	**Contact email address:** cbpgssj1@brunel.ac.uk
Date: 20/10/2014	
Name of Supervisor (if PhD student): Dr. Ahmad Ghoneim	
Title of Research Project: Investigating Green IT/IS Evaluation – a focus on indirect costs.	
Describe the Data Collection Process (200 words): The author is to collect the empirical data by qualitative method (a single case study within an aviation industry in Thailand). In doing so, it seeks to gain new insights into the factors affecting Green IT/IS adoption and evaluation of the aviation industry and how both external pressures and internal organizaional factors influencing the management of Green IT/IS practices. Thus, it enhances a better decision-making process of adopting and implementing Green IT/IS. The empirical data is primarily to be gathered by conducting semi-structured interviews with (e.g. IT managers/staffs, Environmental and Financial managers) as well as doing participant and field observation. The interview process is to be digitally recorded and transcribed at a later stage. Moreover, the informal interviews or discussion with other employees involved with Green IT/IS initiatives/practices would be conducted to gain more insights of the aviation industry. Apart from this, further supporting evidence will be sought from secondary sources such as minutes from meetings, policy documents, internal memos, archival documents and business case reports.	

Section B – Identification of Ethical and Risk Issues

Most research projects involve a number of potential risks (either to participants or yourself). The more risk factors that can be identified at the start, the easier it will be to guard against them. Answer the questions below to identify potential risks in your project. Please refer to the guidelines if you are unsure about your answer to any of these questions. Please indicate your answer by selecting either "Yes" or "No" options.

1. Is it possible participants might have been told to co-operate rather than freely volunteering? Sometimes it is difficult to ensure interviewees do not feel "obligated" in some way. You will need gatekeeper consent for this.	Yes ○ No ◉
2. Is it possible that participants might be under eighteen years of age? Normally minors are not legally able to give their consent to participation.	Yes ○ No ◉
3. Is it possible that participants might be required to discuss sensitive issues (e.g. private or of criminal nature)? Such discussion could put yourself or the participants in danger.	Yes ○ No ◉
4. Is it possible that your research might cause clinical or psychological harm to participants or yourself? This may include discussion of topics of sensitive nature or prolonged strenuous psychological or physical pressure for participants and/or yourself.	Yes ○ No ◉
5. Are all or some of the participants unable to give their own consents Including organisations with gatekeepers (e.g. schools and prisons); or vulnerable participants (e.g., children, people with learning disabilities, your own students).	Yes ○ No ◉
6. Will you be recording the identity of any participants (e.g. their name or employee number)? Sometimes it is difficult to guarantee anonymity. If so, you will need explicit consent.	Yes ○ No ◉
7. Is it possible that identity of participants could be traced (e.g. their name or employee number)? Sometimes anonymity can be broken by combining information from more than one source. If so, you will need explicit consent.	Yes ○ No ◉
8. Will you be storing traceable participant data on a laptop or in a file at any point during and/or after the duration of your project? There is a risk if a laptop or file is lost or stolen.	Yes ○ No ◉
9. Is it possible that your company will want the research kept confidential? Some companies allow research only on condition that the results are not made public. If so, you will need to fill in Company Confidentiality Form.	Yes ◉ No ○
10. Is it possible that copyright material might be copied? It may be necessary to get permission to use it.	Yes ◉ No ○
11. Will the study involve recruitment of patients through the NHS? If you answered 'Yes', you will have to submit an application to the appropriate external health authority ethics committee, **after** you have received approval from the School Research Ethics Committee.	Yes ○ No ◉

- If you have answered 'No' to all questions, you may upload **the completed form to your supervisor via uLink** (see submission guidelines).
- If you have answered 'Yes' to ***any*** of the questions **1 – 5**, you will need to describe more fully how you plan to deal with the ethical issues raised by your research. You should use the University Ethics Application form by clicking on this link: Application Form for Research Ethics Approval. You will need to submit the form via uLink.
- If you have answered 'Yes' to ***any*** of the questions **6 – 10**, please tell us in the box below how you are planning to mitigate against these risks. On completions you may upload **the completed form to your supervisor via uLink** (see uLink submission guidelines).
- If you answered 'Yes' to ***question 11***, you will have to submit an application to the appropriate external health authority ethics committee, **after** you have received approval from the School Research Ethics Committee.

Describe which risks (6-10) you have said "Yes" to and your mitigation plans: 8) The laptop will be password protected at all time. Also, the interview data files will be encrypted and password protected. All necessary precautions will be taken to keep the data as safely as possible. 9) Please, refer to the attached company confidentiality form. 10) The author might be using copyright material in the future. However, the author might not be able to copy or take the material out but only allow to go through or read the relevant material that correlate with the findings at the organization's building (refer to the the attached company confidentiality form). Additional the author is fully awared that it is highly significant to get approval from the organization prior to the use of these copyright material as well as the acknowledgement to the organization will also be made, if these materials are likely to be used in this thesis.

Section C – Declaration

Please note that it is your responsibility to follow the University's Code of Research Ethics and any relevant academic or professional guidelines in the conduct of your study. **This includes providing appropriate information sheets and consent forms, and ensuring confidentiality in the storage and use of data.** We should be notified of any significant changes in the protocol over the course of the research and may require a new application for ethics approval.

You need to indicate that you have carried out various activities prior to submitting this form along with your proposal.

I have read through and understood the Brunel University Code of Ethics (available at: https://intranet.brunel.ac.uk/registry/minutes/researchethics/CoEv7.pdf).	Yes ◉ No ○
I have written and attached a Participant Information Sheet ONLY needed if your research involves direct data collection from people.	Yes ◉ No ○
I have written and attached a Participant Consent Form ONLY needed if your research requires *explicit* consent.	Yes ○ No ◉
I have written and attached a Company Confidentiality Agreement Form Only needed if your research involves a company that is concerned about information being made public.	Yes ◉ No ○

For PhD students ONLY

I confirm that the application submitted has been discussed with the supervisor mentioned in Section A, and that he/she fully supports the application submitted and confirm that the information entered is correct.	Yes ◉ No ○

Appendix B

Interview Agenda

(English and Thai Version)

Interview Agenda

Green IT/IS Investments Evaluation within the Aviation Industry - A Focus on Indirect Costs

The interview is divided into 6 parts.

The interview aims to address the following issues:

- To develop an understanding of factors affecting Green IT/IS adoption and evaluation within aviation industry.
- To identify the indirect costs associated with Green IT/IS investments within aviation industry.
- To establish the effective evaluation process particularly focusing on costs implications of Green IT/IS investments.
- To establish mechanisms/strategies for costs management (i.e. indirect costs) surrounding Green IT/IS investments.

Agenda Sections

Section A: General Participant Information

Section B: Green IT/IS Adoption and Evaluation

Section C: Identification and Management of Costs' Components

Section D: External Pressures related with Green IT/IS Adoption and Implementation

Section E: Internal Organizational Factors related with Green IT/IS Adoption and Implementation

Section F: Overall Justification Process of Green IT/IS Investments within Aviation Industry

Section A – General Participant Information

Position:

Organization/Department:

Length of experiences in organization:

Level of experiences in IT/IS project:

Section B – Green IT/IS Adoption and Evaluation
(Introduce Green IT/IS)

1. How long have you initiated Green IT/IS initiatives/practices in your organization?
   ☐ (A) < 1 year
   ☐ (B) 1-2 years
   ☐ (C) 2-5 year
   ☐ (D) > 5 years

2. What was/were the main motivation(s) for adopting Green IT/IS initiatives/practices within your organization?

___

3. In your view, what was the need for Green IT/IS initiatives/practices in your organization?

___

4. Did you evaluate your Green IT/IS project before its implementation?
   ☐ Yes
   ☐ No (go to Section C)

5. Do you think evaluating Green IT/IS investments prior to its implementation would influence your decision to adopt? Also, to what extent is the evaluation of Green IT/IS investments process significant in your organization? Please explain.
   ☐ Yes
   ☐ No
   If yes/no, please explain.

___

6. Which of the following evaluation techniques do you use to evaluate your IS or Green IT/IS in your organization? *(Can select more than one answer).*
   ☐ Cost Benefit Analysis (CBA)
   ☐ Return on Investment (ROI)
   ☐ Pay Back (PB)
   ☐ Discount Cash Flow (DCF)
   ☐ Other, please specify___________________________

7.Who is involved with this evaluation process?

___

8. In your view, is "Costs Evaluation" a significance criterion to be considered when adopting Green IT/IS in your organization? Please, explain.

___

Section C – Identification and Management of Costs' Components
(Introduce Direct and Indirect costs)

1. Are you and your organization aware of the term "Indirect costs"? If so, what are they? If not, are there any other meanings given to these types of costs?

---

2. Literature indicates that the indirect (environmental, organizational and human) costs are significant for IS and Green IT/IS evaluation process as illustrated in the following table. Do you recognize any of the following as indirect costs relate with Green IT/IS *(or as defined by the interviewee)* are incurred in your organization? (Please √).

Green IT/IS Indirect Costs Factors	**Is this cost incurred in your organization?**
Indirect Environmental Costs	
• Upfront Environmental Costs *(Costs incurred prior to the operation or system e.g. site studies; design of environmentally products/designs/process, permitting, and procurement).*	
• Back-end Costs *(Costs related to future costs of closure, decommissioning, disposal of inventory that are not yet in effect but have been proclaimed). These costs will occur at more or less some points in the future).*	
• Regulatory Costs *(Costs related to planning, inspection, insurance, pollution control, taxes and fees, normally incurred in operation of a process or systems e.g. additional government impositions, if not comply).*	
• Contingent Costs *(Costs of remedying and compensating for future accidental releases of contaminants into the environment, fines and penalties, property damages). It may or may not incurred at some point in the future.*	
• Image and Relationship Costs *(Costs related with corporate image and relationship with customers, investors, suppliers, communities, regulators and works and award/recognition programs).*	
• Other:	
Indirect Organizational Costs	
• Organization Re-structuring *(Costs involved with the change to the organization' hierarchy/structure).*	
Productivity Loss	
• Business Process Re-engineering *(Costs involved with re-designing of functions and process of organizations).*	
• Hardware Disposal	
• Strain on Resources	
• Other:	
Indirect Human Costs	
• Management (Time/Resources/Effort and Dedication)	
• Employee (Time/Training/Learning/Motivation)	
• Belief, Feeling and Perception	
• Redefining Roles	
• Staffs Turnover	
• Other:	

2.1 If you have listed any other indirect costs' component(s) in the above table, can you please elaborate this factor(s)?

____

Section D – External Pressures related with Green IT/IS Adoption and Implementation

1. Literature indicates that there are some predefined external pressures (coercive, normative and mimetic) influencing organizations to evaluate the adoption of Green IT/IS initiatives/practices. Could you please *describe* each of the following external organizational factors in your organization?

   1.1 If you think that there is/are other external pressure(s) influence the adoption of Green IT/IS initiatives/practices in your organization, could you please specify and elaborate?

____

2. Which of the following external pressures could affect internal organizational factors related with Green IT/IS adoption or implementation in your organization? (Please √, can *select more than one answer)*

External Pressures / **Internal Organizational Factors**	**Coercive Pressure (e.g. Law and Regulation) Law and Regulations)**	**Normative Pressure (e.g. Norm, Group/ Association)**	**Mimetic Pressure (e.g. Market Leader/ Competitor)**	**Other(s), Please, specify.**
• Top management support/commit				
• Employee involvement				
• Organization culture				
• Resource development (Training/Education)				
• Others				

2.1 If you have listed any other external pressure(s) or/and internal organizational factors in the above table, can you please elaborate this factor(s)?

____

Section E – Internal organizational factors related to Green IT/IS adoption and Implementation

1. Literature indicates that the significance of internal organizational factors influence Green IT/IS adoption and evaluation within aviation industry. Could you please *describe* each of the following internal organizational factors in your organization?

    - Employee involvement
    - Top management support/commitment
    - Organization culture
    - Resource development (Training/Education)
    - Others

    1.1 If you think that there is/are other internal organizational factor(s) influencing the adoption of Green IT/IS initiatives/practices in your organization, could you please specify and elaborate?

2. Do you think which of the following internal organizational factor(s) could affect the management and control of the following Green IT/IS indirect costs in your organization? (Please √, *can select more than one answer*).

Internal Organizational Factors / **Green IT/IS Indirect Costs**	**Employee Involvement**	**Resources Development Training/Education**	**Green Organizational Culture**	**Top management Support/ Commitment**	**Other, Please specify.**
Indirect Environmental Costs					
• Upfront Environmental Costs *(Costs incurred prior to the operation or system e.g. site studies; design of environmentally products/designs/process, permitting, and procurement).*					
• Back-end Costs *(Costs related to future costs of closure, decommissioning, disposal of inventory that are not yet in effect but have been proclaimed). These costs will occur at more or less some points in the future).*					
• Regulatory Costs *(Costs related to planning, inspection, insurance, pollution control, taxes and fees, normally incurred in operation of a process or systems e.g. additional government impositions, if not comply).*					
• Contingent Costs *(Costs of remedying and compensating for future accidental releases of contaminants into the environment, fines and penalties, property damages). It may or may not incurred at some point in the future.*					
• Image and Relationship Costs *(Costs related with corporate image and relationship with customers, investors, suppliers, communities, regulators and works and award/recognition programs).*					
• Other:					
• Other:					
Indirect Organizational Costs					
• Organization Re-structuring *(Costs involved with the change to the organization' hierarchy/structure).*					
• Productivity Loss					
• Business Process Re-engineering *(Costs involved with re-designing of functions and process of organizations).*					
• Hardware Disposal					
• Covert Resistance *(Costs related to resistance to change).*					
• Other:					
• Other:					
Indirect Human Costs					
• Management (Time/Resources/Effort and Dedication)					
• Employee (Time/Training/Learning/Motivation)					
• Belief, Feeling and Perception					
• Redefining Roles					
• Staffs Turnover					
• Other:					
• Other:					

3. If you have listed any other indirect costs' component(s) and/or internal organizational factor(s) in the above table, could you please elaborate this factor(s)?

---

4. How your organization manages these indirect costs? What might be your management' strategies or policies or mechanism for managing and controlling these costs?

Green IT/IS Indirect Costs Components	**Management Strategies/Policies/Mechanisms to reduce impact**
Indirect Environmental Costs	
• Upfront Environmental Costs *(Costs incurred prior to the operation or system e.g. site studies; design of environmentally products/designs/process, permitting, and procurement).*	
• Back-end Costs *(Costs related to future costs of closure, decommissioning, disposal of inventory that are not yet in effect but have been proclaimed). These costs will occur at more or less some points in the future).*	
• Regulatory Costs *(Costs related to planning, inspection, insurance, pollution control, taxes and fees, normally incurred in operation of a process or systems e.g. additional government impositions, if not comply).*	
• Contingent Costs\ *(Costs of remedying and compensating for future accidental releases of contaminants into the environment, fines and penalties, property damages). It may or may not incurred at some point in the future.*	
• Image and Relationship Costs *(Costs related with corporate image and relationship with customers, investors, suppliers, communities, regulators and works and award/recognition programs).*	
• Other:	
Indirect Organizational Costs	
• Organization Re-structuring *(Costs involved with the change to the organization' hierarchy/structure).*	
• Productivity Loss	
• Business Process Re-engineering *(Costs involved with re-designing of functions and process of organizations).*	
• Hardware Disposal	
• Covert Resistance *(Costs related to resistance to change).*	
• Other:	
Indirect Human Costs	
• Management (Time/Resources/Effort and Dedication)	
• Employee (Time/Training/Learning/Motivation)	
• Belief, Feeling and Perception	
• Redefining Roles	
• Staffs Turnover	
• Other:	

5. What might be the implication (if any) of indirect costs' management on the success of the adoption and implementations of Green IT/IS projects?

Section F – Overall Justification Process of Green IT/IS Investments within Aviation Industry

1. Do you think that by incorporating both external pressures and internal organizational factors would make a better understanding on the decision-making process of costs' implications when deciding to adopt or implement Green IT/IS in your organization? Please, explain.

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2. Referred to the above question (Q.1F), are there any other major components/factors that you consider important? Please, explain.

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3. In the light of what we have discussed, do you perceive the adopted Green IT/IS initiatives/practices to be a success within your organization? Please, explain.

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4. Do you have any other comment(s) to add regarding your Green IT/IS initiatives/practices within your organization?

ขั้นตอนการสัมภาษณ์

การตรวจสอบแนวทางประเมิน Green IT/IS Evaluation โดยมุ่งเน้นเรื่องต้นทุนทางอ้อม (Indirect Costs)

การสัมภาษณ์แบ่งเป็น 6 ส่วน

จุดประสงค์ของการสัมภาษณ์เกี่ยวกับเรื่องต่อไปนี้:

- เพื่อทำความเข้าใจปัจจัยที่มีผลต่อการปรับใช้ Green IT/IS และการประเมินผล ในอุตสาหกรรมการบิน
- เพื่อระบุค่าใช้จ่ายทางอ้อมที่เกิดจากการคิดริเริ่ม/โครงการด้าน Green IT/IS ในอุตสาหกรรมการบิน
- เพื่อสร้างกรอบแนวทางในการประเมินผลที่มีประสิทธิภาพในโครงการด้าน Green IT/IS
- เพื่อสร้างกรอบแนวทางให้องค์กรมีความเข้าใจเรื่องการบริหารจัดการและการควบคุมต้นทุนทางอ้อม

ขั้นตอน
ส่วน **A:** ข้อมูลทั่วไปของผู้ให้สัมภาษณ์
ส่วน **B:** การปรับใช้ **Green IT/IS** และการประเมินผล
ส่วน **C:** การกำหนดองค์ประกอบต้นทุนและการบริหารจัดการ
ส่วน **D:** ปัจจัยภายนอกที่เกี่ยวข้องกับการปรับใช้ **Green IT/IS** และการนำไปปฏิบัติจริง
ส่วน **E:** ปัจจัยภายในองค์กรที่เกี่ยวข้องกับการปรับใช้ **Green IT/IS** และการนำไปปฏิบัติจริง
ส่วน **F:** ขั้นตอนการตรวจสอบโดยรวมของการลงทุนด้าน **Green IT/IS** ในอุตสาหกรรมการบิน

ส่วน A – ข้อมูลทั่วไปของผู้ให้สัมภาษณ์

ตำแหน่ง:

องค์กร/แผนก:

ระยะเวลาที่ทำงานในองค์กร:

ประสบการณ์เกี่ยวกับโครงการด้าน IT/IS:

ส่วน B: การปรับใช้ Green IT/IS และการประเมินผล

(แนะนำเรื่อง Green IT/IS)

1. คุณได้ริเริ่ม/ลงมือปฏิบัติงานด้าน Green IT/IS ในองค์กรของคุณเป็นระยะเวลาเท่าใด

☐ (A) < 1 ปี

☐ (B) 1-2 ปี

☐ (C) 2-5 ปี

☐ (D) > 5 ปี

2. แรงผลักดันที่สำคัญในการริเริ่ม/ลงมือปฏิบัติงานด้าน Green IT/IS ภายในองค์กรของคุณ

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3. ในความคิดเห็นของคุณ การริเริ่ม/ลงมือปฏิบัติงานด้าน Green IT/IS จำเป็นต้องมีสิ่งใดบ้าง

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4. คุณได้ประเมินโครงการด้าน Green IT/IS ก่อนจะลงมือปฏิบัติจริงหรือไม่

☐ ใช่

☐ ไม่ใช่ (ข้ามไปส่วน C)

5. คุณคิดว่าการประเมินเรื่องการลงทุนด้าน Green IT/IS
ก่อนที่จะลงมือปฏิบัติจริงนั้นมีอิทธิพลต่อการตัดสินใจที่จะปรับใช้หรือไม่ การประเมินการลงทุนด้าน Green IT/IS มีความสำคัญกับองค์กรของคุณในระดับใด กรุณาอธิบาย

☐ ใช่

☐ ไม่ใช่

ใช่/ไม่ใช่ กรุณาอธิบาย

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6. คุณใช้เทคนิคในการประเมินข้อใดต่อไปนี้ในการประเมิน IS หรือ Green IT/IS ในองค์กรของคุณ *(เลือกได้มากกว่าหนึ่งข้อ)*

- ☐ การวิเคราะห์ต้นทุนและผลประโยชน์ (Cost Benefit Analysis - CBA)
- ☐ ผลตอบแทนจากการลงทุน (Return on Investment - ROI)
- ☐ ความคุ้มทุน (Pay Back - PB)
- ☐ การคิดลดกระแสเงินสด (Discount Cash Flow - DCF)
- ☐ อื่นๆ โปรดระบุ ________________________

7. ผู้ที่เกี่ยวข้องกับขั้นตอนการประเมินมีใครบ้าง

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8. ในความคิดของคุณ "การประเมินต้นทุน" เป็นปัจจัยสำคัญที่ใช้ในพิจารณาการปรับใช้ Green IT/IS ในองค์กรของคุณ กรุณาอธิบาย

ส่วน C – การกำหนดองค์ประกอบต้นทุนและการบริหารจัดการ

(แนะนำต้นทุนทางตรงและทางอ้อม)

1. คุณและองค์กรรู้จักคำว่า "ต้นทุนทางอ้อม" ถ้ารู้จัก คืออะไร ถ้าไม่รู้จัก
คุณจะให้ความหมายเกี่ยวกับต้นทุนนี้อย่างไรได้บ้าง

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2. มีข้อมูลที่ระบุว่าต้นทุนทางอ้อม (ด้านสิ่งแวดล้อม องค์กรและมนุษย์) มีความสำคัญต่อขั้นตอนการประเมิน IS และ Green IT/IS ดังที่แสดงในตารางต่อไปนี้
คุณทราบหรือไม่ว่าองค์กรของคุณต้องเสียค่าใช้จ่ายในเรื่องต้นทุนทางอ้อมที่เกี่ยวข้องกับ Green IT/IS เหล่านี้ *(หรือตามนิยามที่ผู้ให้สัมภาษณ์ระบุ)* (กรุณาทำเครื่องหมาย √).
และต้นทุนเหล่านั้นมีอิทธิพลต่อการตัดสินใจของคุณในการปรับใช้ Green IT/IS ในองค์กรมากเท่าใด

องค์ประกอบต้นทุนทางอ้อม	ต้นทุนที่เกิดขึ้น ภายในองค์กร
ต้นทุนทางอ้อมด้านสิ่งแวดล้อม	
• ต้นทุนด้านสิ่งแวดล้อมเบื้องต้น *(ต้นทุนที่เกิดขึ้นก่อนการปฏิบัติงานหรือใช้ระบบ เช่น การศึกษาพื้นที่ทำงาน การออกแบบผลิตภัณฑ์/โครงการ/ขั้นตอนที่ดีต่อสิ่งแวดล้อม การขออนุญาต และการจัดซื้อจัดจ้าง)*	
• ต้นทุนภายหลัง *(ต้นทุนที่เกิดขึ้นจากการปิดโครงการในอนาคต การยกเลิกรื้อถอนโครงการ การกำจัดสินค้าคงคลังที่มีอยู่แต่ไม่ได้ใช้งาน)* ต้นทุนเหล่านี้จะเกิดขึ้น ไม่มากก็น้อยในอนาคต*)*	
• ต้นทุนที่เกี่ยวข้องกับกฎเกณฑ์ *(ต้นทุนที่เกี่ยวข้องกับการวางแผน การตรวจสอบ ประกันภัย การควบคุมเรื่องสิ่งแวดล้อม ภาษีและค่าธรรมเนียม ซึ่งจะเกิดขึ้นในกระบวนการทำงานหรือระบบ เช่น ข้อกำหนดเพิ่มเติมของรัฐบาล ในกรณีที่สิ่งที่มีอยู่ไม่สอดคล้อง)*	
• ต้นทุนเฉพาะหน้า *(ต้นทุนในการเยียวยาหรือชดเชยกรณีที่อาจจะมีการรั่วไหลของ สารพิษสู่สิ่งแวดล้อม ค่าปรับและบทลงโทษ ความเสียหายต่อทรัพย์สิน)* ต้นทุนเหล่านี้อาจจะเกิดหรือไม่เกิดก็ได้ในอนาคต	
• ต้นทุนด้านภาพลักษณ์และความสัมพันธ์ *(ต้นทุนที่เกี่ยวข้องกับภาพลักษณ์ขององค์กรและความสัมพันธ์ กับลูกค้า นักลงทุน ซัพพลายเออร์ สังคม ผู้ออกกฎเกณฑ์ การให้รางวัลและให้ความสำคัญกับผลงาน)*	
• อื่นๆ:	
ต้นทุนทางอ้อมด้านองค์กร	
• การปรับโครงสร้างองค์กร *(ต้นทุนที่เกี่ยวข้องกับการเปลี่ยนแปลงลำดับขั้น/โครงสร้างองค์กร)*	

• อัตราผลผลิตที่ลดลง	
• การปรับระบบทางธุรกิจ *(ต้นทุนที่เกี่ยวข้องกับการออกแบบแผนกและขั้นตอนการทำงานในองค์กร)*	
• การกำจัดทิ้งฮาร์ดแวร์	
• การต่อต้านภายใน *(ต้นทุนที่เกี่ยวข้องกับการต่อต้านความเปลี่ยนแปลง)*	
อื่นๆ:	
ต้นทุนทางอ้อมที่เกี่ยวกับบุคคล	
• การบริหารจัดการ (เวลา/ทรัพยากร/ความพยายามและความทุ่มเท)	
• พนักงาน (เวลา/การฝึกอบรม/การเรียนรู้/การสร้างแรงกระตุ้น)	
• ความเชื่อ ความรู้สึกและแนวคิด	
• การปรับเปลี่ยนบทบาท	
• การลาออกของพนักงาน	
• อื่นๆ:	

2.1 ในกรณีที่คุณได้ระบุต้นทุนทางอ้อมด้านอื่นๆในตารางด้านบน กรุณาขยายความถึงปัจจัยเหล่านั้น

ส่วน D – ปัจจัยภายนอกที่เกี่ยวข้องกับการปรับใช้ Green IT/IS **และการนำไปปฏิบัติจริง**

1. มีข้อมูลที่ระบุว่าปัจจัยภายนอก เช่น (ปัจจัยเชิงบังคับ, ปัจจัยด้านธรรมเนียมปฏิบัติ, ปัจจัยในธุรกิจเดียวกัน) มีความสำคัญต่อขั้นตอนการประเมินการปรับใช้/ลงมือปฏิบัติโครงการ Green IT/IS ปัจจัยภายนอกเหล่านั้นมีอิทธิพลต่อการตัดสินใจของคุณในการปรับใช้หรือลงมือปฏิบัติ Green IT/IS ในองค์กรมากเท่าใด (กรุณาทำเครื่องหมาย √)

1.1 ในกรณีที่คุณคิดว่ามีปัจจัยภายนอกอื่นๆที่มีอิทธิพลต่อการริเริ่ม/การลงมือปฏิบัติด้าน Green IT/IS ในองค์กรของคุณ กรุณาระบุและขยายความ

2.ปัจจัยภายนอกเรื่องใดต่อไปนี้จะมีผลกระทบต่อปัจจัยภายในองค์กรของคุณที่เกี่ยวข้องกับการปรับใช้หรือลงมือปฏิบัติ Green IT/IS ในองค์กร (กรุณาทำเครื่องหมาย √ *เลือกได้มากกว่าหนึ่งข้อ)*

ปัจจัยภายนอก / **ปัจจัยภายในองค์กร**	**ปัจจัยเชิงบังคับ (เช่น รัฐบาล กฎหมาย กฎเกณฑ์)**	**ปัจจัยด้านธรรมเนียมปฏิบัติ (เช่น บรรทัดฐาน มาตรฐานอุตสาหกรรม/กลุ่มสังคม)**	**ปัจจัยในธุรกิจเดียวกัน (เช่น ผู้นำตลาด คู่แข่ง)**	**อื่นๆ โปรดระบุ**
• การสนับสนุน/ความมุ่งมั่นของฝ่ายบริหารระดับสูง				
• การมีส่วนร่วมของพนักงาน				
• วัฒนธรรมองค์กร				
• การพัฒนาทรัพยากร (การฝึกอบรม/การศึกษา)				
• อื่นๆ				

2.1 ในกรณีที่คุณคิดว่ามีปัจจัยภายนอกหรือปัจจัยภายในอื่นๆในองค์กรของคุณ กรุณาระบุและขยายความ

ส่วน E: ปัจจัยภายในองค์กรที่เกี่ยวข้องกับการปรับใช้ Green IT/IS และการนำไปปฏิบัติจริง

1. มีข้อมูลที่ระบุว่าปัจจัยภายในองค์กรมีความสำคัญต่อการปรับใช้ Green IT/IS และการประเมินในอุตสาหกรรมการบิน กรุณา*อธิบาย*แต่ละปัจจัยเหล่านั้นในองค์กรของคุณ

- การมีส่วนร่วมของพนักงาน
- การสนับสนุน/ความมุ่งมั่นของฝ่ายบริหารระดับสูง
- วัฒนธรรมองค์กร
- การพัฒนาทรัพยากร (การฝึกอบรม/การศึกษา)
- อื่นๆ

1.1 ในกรณีที่คุณคิดว่ามีปัจจัยอื่นๆภายในองค์กรที่มีอิทธิพลต่อการปรับใช้ Green IT/IS และการลงมือปฏิบัติ กรุณาระบุและขยายความ

2. คุณคิดว่าปัจจัยภายในองค์กรเรื่องใดที่มีอิทธิพลต่อการบริหารจัดการและการควบคุมต้นทุนทางอ้อมเกี่ยวกับเรื่อง Green IT/IS ในองค์กรของคุณ (กรุณาทำเครื่องหมาย √ *สามารถเลือกได้มากกว่าหนึ่งข้อ*)

ปัจจัยภายในองค์กร / **องค์ประกอบต้นทุนทางอ้อม**	**การมีส่วนร่วมของพนักงาน**	**การพัฒนาทรัพยากร (การฝึกอบรม/การศึกษา)**	**วัฒนธรรมองค์กร**	**การสนับสนุน/ความมุ่งมั่นของผู้บริหารระดับสูง**	**อื่นๆ โปรดระบุ**
ต้นทุนทางอ้อมด้านสิ่งแวดล้อม					
• ต้นทุนด้านสิ่งแวดล้อมเบื้องต้น *(ต้นทุนที่เกิดขึ้นก่อนการปฏิบัติงานหรือใช้ระบบ เช่น การศึกษาพื้นที่ทำงาน การออกแบบผลิตภัณฑ์/โครงการ/ขั้นตอนที่ดีต่อสิ่งแวดล้อม การขออนุญาต และการจัดซื้อจัดจ้าง)*					
• ต้นทุนภายหลัง *(ต้นทุนที่เกิดขึ้นจากการปิดโครงการในอนาคต การยกเลิกรื้อถอน โครงการ การกำจัดสินค้าคงคลังที่มีอยู่แต่ไม่ได้ใช้งาน)* ต้นทุนเหล่านี้จะเกิดขึ้น ไม่มากก็น้อยในอนาคต*)*					
• ต้นทุนที่เกี่ยวข้องกับกฎเกณฑ์ *(ต้นทุนที่เกี่ยวข้องกับการวางแผน การตรวจสอบ ประกันภัย การควบคุมเรื่องสิ่งแวดล้อม ภาษีและค่าธรรมเนียม ซึ่งจะเกิดขึ้นในกระบวนการทำงานหรือระบบ เช่น ข้อกำหนดเพิ่มเติมของรัฐบาล ในกรณีที่สิ่งที่มีอยู่ไม่สอดคล้อง)*					
• ต้นทุนเฉพาะหน้า *(ต้นทุนในการเยียวยาหรือชดเชยกรณีที่อาจจะมีการรั่วไหลของสารพิษสู่สิ่งแวดล้อม ค่าปรับและบทลงโทษ*					

ความเสียหายต่อทรัพย์สิน) ต้นทุนเหล่านี้อาจจะเกิดหรือไม่เกิดก็ได้ในอนาคต					
• ต้นทุนด้านภาพลักษณ์และความสัมพันธ์ *(ต้นทุนที่เกี่ยวข้องกับภาพลักษณ์ขององค์กรและความสัมพันธ์กับลูกค้า นักลงทุน ซัพพลายเออร์ สังคม ผู้ออกกฎเกณฑ์ การให้รางวัลและให้ความสำคัญกับผลงาน)*					
• อื่นๆ:					
• อื่นๆ:					
ต้นทุนทางอ้อมด้านองค์กร					
• การปรับโครงสร้างองค์กร *(ต้นทุนที่เกี่ยวข้องกับการเปลี่ยนแปลงลำดับขั้น/โครงสร้างองค์กร)*					
• อัตราผลผลิตที่ลดลง					
• การปรับระบบทางธุรกิจ *(ต้นทุนที่เกี่ยวข้องกับการออกแบบแผนกและขั้นตอนการทำงานในองค์กร)*					
• การกำจัดทิ้งฮาร์ดแวร์					
• การต่อต้านภายใน *(ต้นทุนที่เกี่ยวข้องกับการต่อต้านความเปลี่ยนแปลง)*					
• อื่นๆ:					
• อื่นๆ:					
ต้นทุนทางอ้อมที่เกี่ยวกับบุคคล					
• การบริหารจัดการ (เวลา/ทรัพยากร/ความพยายามและความทุ่มเท)					
• พนักงาน (เวลา/การฝึกอบรม/การเรียนรู้/การสร้างแรงกระตุ้น)					
• ความเชื่อ ความรู้สึกและแนวคิด					
• การปรับเปลี่ยนบทบาท					
• การลาออกของพนักงาน					
• อื่นๆ:					
• อื่นๆ:					

3 ในกรณีที่คุณได้ระบุต้นทุนทางอ้อม และ/หรือปัจจัยภายในองค์กรด้านอื่นๆในตารางด้านบน กรุณาขยายความถึงปัจจัยเหล่านั้น

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4. องค์กรของคุณบริหารต้นทุนทางอ้อมอย่างไร ฝ่ายบริหารของคุณใช้กลยุทธ์ นโยบาย หรือกลไกใดในการบริหารและควบคุมต้นทุน

องค์ประกอบต้นทุนทางอ้อม	**กลยุทธ์/นโยบายของฝ่ายบริหารในการลดผลกระทบ**
ต้นทุนทางอ้อมด้านสิ่งแวดล้อม	
• ต้นทุนด้านสิ่งแวดล้อมเบื้องต้น *(ต้นทุนที่เกิดขึ้นก่อนการปฏิบัติงานหรือใช้ระบบ เช่น การศึกษาพื้นที่ทำงาน การออกแบบผลิตภัณฑ์/โครงการ/ขั้นตอนที่ดีต่อสิ่งแวดล้อม การขออนุญาต และการจัดซื้อจัดจ้าง)*	
• ต้นทุนภายหลัง *(ต้นทุนที่เกิดขึ้นจากการปิดโครงการในอนาคต การยกเลิกรื้อถอนโครงการ การกำจัดสินค้าคงคลังที่มีอยู่แต่ไม่ได้ใช้งาน)* ต้นทุนเหล่านี้จะเกิดขึ้น ไม่มากก็น้อยในอนาคต*)*	
• ต้นทุนที่เกี่ยวข้องกับกฎเกณฑ์ *(ต้นทุนที่เกี่ยวข้องกับการวางแผน การตรวจสอบ ประกันภัย การควบคุมเรื่องสิ่งแวดล้อม ภาษีและค่าธรรมเนียม ซึ่งจะเกิดขึ้นในกระบวนการทำงานหรือระบบ เช่น ข้อกำหนดเพิ่มเติมของรัฐบาล ในกรณีที่สิ่งที่มีอยู่ไม่สอดคล้อง)*	
• ต้นทุนเฉพาะหน้า *(ต้นทุนในการเยียวยาหรือชดเชยกรณีที่อาจจะมีการรั่วไหลของสารพิษสู่สิ่งแวดล้อม ค่าปรับและบทลงโทษ ความเสียหายต่อทรัพย์สิน)* ต้นทุนเหล่านี้อาจจะเกิดหรือไม่เกิดก็ได้ในอนาคต	
• ต้นทุนด้านภาพลักษณ์และความสัมพันธ์ *(ต้นทุนที่เกี่ยวข้องกับภาพลักษณ์ขององค์กรและความสัม*	

พันธ์กับลูกค้า นักลงทุน ซัพพลายเออร์ สังคม ผู้ออกกฎเกณฑ์ การให้รางวัลและให้ความสำคัญกับผลงาน)	
• อื่นๆ:	
• อื่นๆ:	
ต้นทุนทางอ้อมด้านองค์กร	
• การปรับโครงสร้างองค์กร *(ต้นทุนที่เกี่ยวข้องกับการเปลี่ยนแปลงลำดับขั้น/โครงสร้างองค์กร)*	
• อัตราผลผลิตที่ลดลง	
• การปรับระบบทางธุรกิจ *(ต้นทุนที่เกี่ยวข้องกับการออกแบบแผนกและขั้นตอนการทำงานในองค์กร)*	
• การกำจัดทิ้งฮาร์ดแวร์	
• การต่อต้านภายใน *(ต้นทุนที่เกี่ยวข้องกับการต่อต้านความเปลี่ยนแปลง)*	
• อื่นๆ:	
• อื่นๆ:	
ต้นทุนทางอ้อมที่เกี่ยวกับบุคคล	
• การบริหารจัดการ (เวลา/ทรัพยากร/ความพยายามและความทุ่มเท)	
• พนักงาน (เวลา/การฝึกอบรม/การเรียนรู้/การสร้างแรงกระตุ้น)	
• ความเชื่อ ความรู้สึกและแนวคิด	
• การปรับเปลี่ยนบทบาท	
• การลาออกของพนักงาน	
• อื่นๆ:	
• อื่นๆ:	

5. การบริหารจัดการต้นทุนทางอ้อมจะมีส่วนทำให้การปรับใช้และลงมือปฏิบัติโครงการ Green IT/IS ประสบความสำเร็จได้อย่างไร

ส่วน F: ขั้นตอนการตรวจสอบโดยรวมของการลงทุนด้าน Green IT/IS ในอุตสาหกรรมการบิน

1.คุณคิดว่าการคำนึงถึงปัจจัยภายนอกและปัจจัยภายในองค์กรจะช่วยให้เกิดความเข้าใจดีขึ้นในเรื่องการตัดสินใจปรับใช้หรือลงมือปฏิบัติโครงการ Green IT/IS ในองค์กรของคุณหรือไม่ กรุณาอธิบาย

2. จากคำถามข้างต้น (Q.1F) มีองค์ประกอบ/ปัจจัยหลักข้อใดที่คุณคิดว่าสำคัญ กรุณาอธิบาย

3. จากสิ่งที่เราได้พูดคุยกัน คุณคิดว่าการริเริ่ม/ลงมือปฏิบัติโครงการ Green IT/IS จะประสบความสำเร็จในองค์กรของคุณ กรุณาอธิบาย

4. คุณมีข้อคิดเห็นเพิ่มเติมเกี่ยวกับการริเริ่ม/ลงมือปฏิบัติโครงการ Green IT/IS ในองค์กรของคุณหรือไม่

Appendix C

Interpretation of Empirical Data

External Pressures / **Internal Organizational Factors**	**Coercive Pressure (E.g. Law and Regulations)**	**Normative Pressure (E.g. Norm, Group/ Association)**	**Mimetic Pressure (E.g. Market Leader/ Competitor)**	***Government's policy***	***Trends of Technology development***
Top management support/ commitment	√√√√√√√√√√	√√√√√√√√√	√√√√√√√	√√√√√√√√	√
Employee involvement		√√√√√√	√√		
Green organizational culture		√√√√√			
Resource development (Training/ Education)	√√	√√√√√√√√	√√√√√√√√√		
• *Positive image*		√√√√√√√		√	√√√√√√√√√
• *Leadership skills*		√	√√√√√√√		

Table A1: The Response from Interviewees regarding External Pressures Influencing Internal Organizational Factors to Adopt and Implement Green IT/IS within Aviation Industry

Internal Organizational Factors / **Green IT/IS Indirect Costs Factors**	**Employee Involvement**	**Resources Development Training/Education**	**Green Organizational Culture**	**Top management Support/Commit**	**Positive Image**	**Leadership Skills**
Indirect Environmental Costs						
• Upfront Environmental Costs *(Costs incurred prior to the operation or system e.g. site studies; design of environmentally products/designs/process, permitting, and procurement).*	√	√√√√ √√		√√√√ √√		
• Back-end Costs *(Costs related to future costs of closure, decommissioning, disposal of inventory that are not yet in effect but have been proclaimed). These costs will occur at more or less some points in the future).*	√√	√√√√ √√√√		√√√√ √√√		
• Regulatory Costs *(Costs related to planning, inspection, insurance, pollution control, taxes and fees, normally incurred in operation of a process or systems e.g. additional government impositions, if not comply).*		√√√√ √√		√√√√ √√√√		
• ~~Contingent Costs~~ ~~*(Costs of remedying and compensating for future accidental releases of contaminants into the environment, fines and penalties, property damages). It may or may not incurred at some point in the future.*~~						
• Image and Relationship Costs *(Costs related with corporate image and relationship with customers, investors, suppliers, communities, regulators and works and award/recognition programs).*	√√√√ √√√		√√√√ √√	√√√√ √√√	√√√√ √	
Indirect Organizational Costs						
• Organization Re-structuring *(Costs involved with the change to the organization' hierarchy/structure).*	√√√√ √	√	√	√√√√ √√√√		
• Productivity Loss	√		√√√√	√√√√ √√√√		√√
• Business Process Re-engineering *(Costs involved with re-designing of functions and process of organizations).*	√√√√ √√√			√√√√ √√√		
• Hardware Disposal	√√	√√√√ √√√√	√	√√√√ √√√	√	
• Strain on Resources				√√√√ √√√√ √		√

• Other: *Integration*	√√√√ √√√	√		√√√√ √√		
• Other: *Downtime*		√√√√ √√√√ √		√		
Indirect Human Costs						
• Management (Time/Resources/Effort and Dedication)	√√√√ √√√	√√√√ √√		√√√√ √√√		
• Employee (Time/Training/Learning/Motivation)	√√	√√√√ √√√√		√√√√ √√√		√√√√ √
• Belief, Feeling and Perception	√√√√ √√√		√√√√ √√	√	√√√√ √	√
• Redefining Roles	√√	√√√√ √√√√		√√√√ √√√		
~~• Staffs Turnover~~						
• Other: *Conflict of Interest*	√√	√√		√√√√ √√√√ √		
• Other: *Problems induced by users*	√	√√√√ √√√√ √		√		
• Other: Insufficiency of communication	√√			√√√√ √√√√		√√√√ √√

Table A2: The Response from Interviewees Internal Organizational Factors Assists in Managing the Associated Green IT/IS Indirect Costs.